

1.0 DESCRIPTION

StudioDrive is a professional stereo audio system that can be installed in the drive bay of a personal computer (PC). StudioDrive provides the source control, mixing, and monitoring functions of a professional broadcast audio console to create a complete self-contained studio that is ideal for live broadcasting and audio production tasks.

StudioDrive accepts up to 6 audio sources via 4 mixing channels. There are inputs for a studio microphone, three stereo line level sources, a dedicated input for the PC soundcard, and the built-in telecoupler for recording audio (news feeds, actualities) from a standard POTS line.

StudioDrive has two pair of stereo outputs for live broadcasting and recording to the PC soundcard or other recording device. Accurate LED VU meters monitor the Program output level. A monaural Mix-Minus output is provided for use with any external telephone hybrid.

The Monitor and Headphone system allows StudioDrive to monitor (a) the Program output, (b) playback *from* the soundcard or (c) the off-the-air signal from the station demodulator.

StudioDrive consists of the main control unit which is installed in the PC's drive bay, and the Audio Interface unit that contains the power supply and all I/O connections. The Audio Interface unit can be attached to the back of the computer case or mounted to a tabletop or wall. The two units are interconnected with a flat cable, which is routed through the back of the computer. An optional Desk Mounting Kit allows StudioDrive to be desk-mounted, for use with a laptop computer (or for non-PC applications) or if it is not possible to mount the main control unit in the PC.

Any soundcard with either balanced (professional) or unbalanced (consumer) analog I/O can be used with StudioDrive to create an integrated and self-contained broadcast and production facility.

2.0 INSTALLATION *StudioDrive should be installed by a qualified engineer or technician.*

StudioDrive can be installed in the drive bay of a PC or desk mounted using the optional Desk Mounting Kit.

Before installing StudioDrive in the PC, the complete system should be programmed, connected, and calibrated to all peripheral studio equipment. Only after proper operation is verified should StudioDrive be installed in the PC.

2.1 USER PROGRAMMING

Before StudioDrive is installed, the user must set some internal jumpers to optimize the unit for the peripheral equipment with which it will be used. **JP1 thru JP9** are located on the StudioDrive circuit board.

JP1 and JP2 set the *input sensitivity* for Line Input #2. Set them to HI if the source equipment is balanced and operates at about 0 dBu. Set them to LO if the source is unbalanced and operates at -10 dBv.

JP3 and JP4 set the *input sensitivity* for the PC soundcard (playback) inputs. Set them to HI if the PC soundcard is balanced and operates at about 0 dBu. Set them to LO if the soundcard is unbalanced and operates at -10 dBv.

JP8 and JP9 set the *input sensitivity* for the Air monitor inputs. Set them to HI if the Air monitor signal is balanced and operates at about 0 dBu. Set them to LO if the Air monitor signal is unbalanced at -10 dBv.

JP5 sets the *Monitor Muting* function. Set it ON if the Monitor system should mute when the mic is on. Set it OFF to defeat the muting feature. (Use this mode only if mic is in an acoustically isolated "announce booth" or studio.)

JP6 and JP7 determine what the Monitor system “hears” when the unit is in the PC-Record mode. Most soundcards provide an audio output when the card is in the Record mode. When StudioDrive is in the PC-Record mode, the Monitor system monitors the *output of the PC soundcard* so the operator can hear the effects of mixing or editing on the PC. Set JP6 and JP7 to **COMP** for this mode of operation.

If the PC soundcard *does not* provide audio when the soundcard is in the Record mode, JP6 and JP7 should be set to **REC**. This will allow the operator to monitor the RECORD output, which feeds the soundcard input.

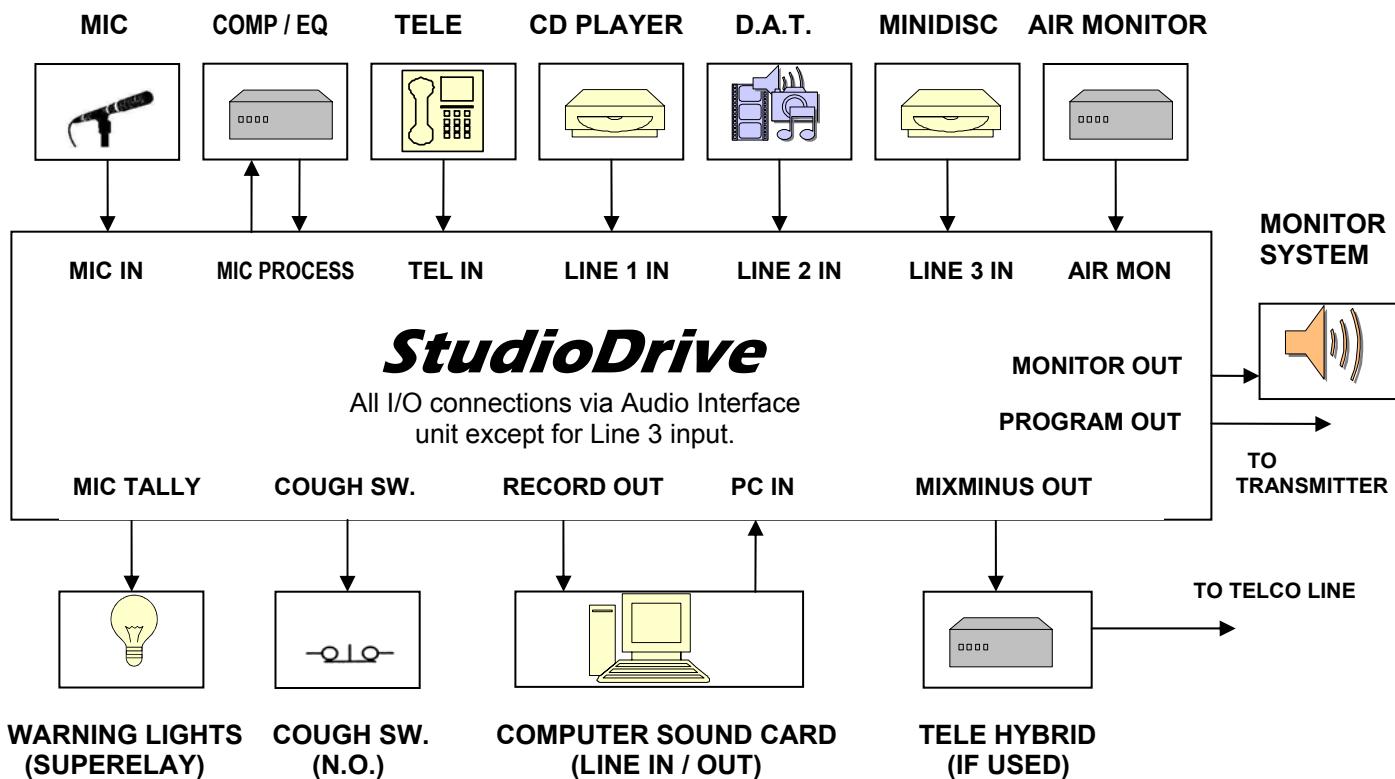
There are also two jumpers located in the Audio Interface unit.

JP1 enables the Mic Process Insert function. If external mic processing equipment will be used (via PROC INSERT jack on Audio Interface unit), set the jumper to ON. If mic processing will not be used, set it OFF. (This is the factory default setting.)

JP2 enables remote on/off control of the mic. If a remote mic on/off or “cough switch” will be used, set the jumper to ON. If no remote mic control will be used, set it OFF. (This is the factory default setting.)

2.2 CONNECTING TO PERIPHERAL STUDIO EQUIPMENT

StudioDrive audio connections are made via the Audio Interface unit. The block diagram below shows a typical installation. All connections, except the Mic input, use T-R-S (“stereo”) ¼” phone plugs.



MIC INPUT Input for professional microphone. XLR: Pin 1 = GND, Pin 2 = HI, Pin 3 = LO.

MIC PROCESS Insert point (unbalanced) for external mic processing equipment, e.g., limiter, EQ, etc. TIP = Output *from* processor to mic chan. input, RING = mic preamp output *to* processor, S = GND. Levels to / from mic processor should be -5 dBu. **Note: JP1 in Audio Interface unit must be ON.**

LINE 1 L+R Line input #1 is for an unbalanced stereo source @ -10 dBv (levels up to 0 dBv are OK). TIP = LEFT, RING = RIGHT, SLEEVE = GROUND

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The following line level *inputs* should be wired as follows: **TIP = HI, RING = LO, SLEEVE = GND.**
For *unbalanced* sources connect the **RING** and **SLEEVE** together.

LINE 2 LEFT	Line input #2, left channel.	Input sensitivity set by JP1.
LINE 2 RIGHT	Line input #2, right channel.	Input sensitivity set by JP2.
P.C. LEFT	Input for PC soundcard playback, left channel.	Input sensitivity set by JP3.
P.C. RIGHT	Input for PC soundcard playback, right channel.	Input sensitivity set by JP4.
AIR MON LEFT	Input for Air monitor, left channel	Input sensitivity set by JP8.
AIR MON RIGHT	Input for Air monitor, right channel	Input sensitivity set by JP9.

TEL Connect to POTS line to record caller audio. TIP = RED, RING = GREEN, SLEEVE N/C
Note: the telecoupler bridges the telephone line. A standard telephone should also be connected to the line to seize (terminate) the line while recordings are made (for recording caller audio only).
Note: A telephone hybrid must be used if *both the caller and host are to be recorded or broadcast*, e.g., for a “talk show”. In this case, the hybrid’s caller audio output may be fed to the TEL input.

MONI L+R *Unbalanced* output to studio monitor system. TIP = LEFT, RING = RIGHT, SLEEVE = GND.

MIX MINUS *Unbalanced* output to feed “send” input of hybrid, if used. TIP = HI, SLEEVE = GND.

The following *balanced outputs* should be wired as follows: **TIP = HI, RING = LO, SLEEVE = GROUND.**
For *unbalanced loads*, connect to **TIP** and **SLEEVE ONLY**. **DO NOT SHORT RING TO GROUND!**

PGM LEFT	Main Program output, left channel, on-air feed. (0 VU = +4 dBu)	
PGM RIGHT	Main Program output, right channel, on-air feed.	“
REC LEFT	Record bus output, left channel, to input of PC soundcard. (Output level adjustable.)	
REC RIGHT	Record bus output, right channel, to input of PC soundcard.	“

TALLY/COUGH Logic circuits for mic control and *On The Air* warning light control:
TALLY: Provides +12 volts between TIP and SLEEVE when Mic is on. Connect to Henry Engineering Superelay DC control inputs to activate warning lights when Mic is on.
COUGH: Connect an external N.C. switch or pushbutton between the RING and SLEEVE to control Mic. Opening the circuit turn Mic off; closing circuit turns mic on.
Note: JP2 in Audio Interface unit must be ON to enable remote Mic on/off control.

2.3 RECORD OUTPUT LEVEL CALIBRATION

Plug the flat cable from the Audio Interface unit into the header on the StudioDrive chassis. Be sure that the RED STRIPE on the cable is at the **right** end of the header, as viewed from the rear of the StudioDrive chassis.
After all audio connections have been made the system can be powered up. Calibration consists of adjusting the StudioDrive RECORD OUTPUT level to match in input sensitivity of the PC soundcard.

Average vs. peak levels

All PC recording/editing software has some type of on-screen audio level meter. Some meters read average levels, while others read peak levels. The purpose of the meter *should be* to show *average perceived level*, so that all recordings will play back at a *consistent perceived level*. Unfortunately, some on-screen level meters actually read absolute *peak levels*. While this is useful to prevent system overloads, peak-reading meters are of little use in determining average perceived level. Check the manual for the software being used to determine what the on-screen meter indicates.

The best way to calibrate a PC soundcard recording system is to determine the maximum operating level (“clipping point”) for the system, then establish **0-VU at 15 to 20 db below the clipping point**. This will ensure adequate headroom above 0-V U for distortion-free audio peaks. **Note:** StudioDrive’s clipping point is 20 dB above 0-VU.

To calibrate record levels, feed a test tone (about 400 Hz) into any StudioDrive line input. Carefully set the level so that the amber “0-VU” LED is lit. (This produces exactly +4 dBu at the Program outputs.)

Now put the soundcard into the RECORD mode. Adjust StudioDrive’s REC CAL trimmers to produce the appropriate level into the soundcard. The REC CAL trimmers are at the back of the StudioDrive PC board.

2.4 MOUNTING STUDIO DRIVE INTO THE PC

After proper operation is verified, StudioDrive can be installed in the PC case. **For best performance, StudioDrive should be installed at the top of the drive bay.**

Disconnect the PC from AC power and remove the outside cover. Carefully unplug the ribbon cable from the main StudioDrive chassis. Route the ribbon cable through any open slot in the PC chassis, preferably a slot that is close to the top end of the PC chassis. Route the cable to the drive bay area of the PC, keeping it away from other data cables and PC boards. (Do NOT bundle it with other data cables in the PC!)

Now slide the StudioDrive chassis into the drive bay. Re-connect the ribbon cable, *then* install two #4 screws on each side to firmly secure the StudioDrive chassis to the PC frame. Replace the PC cover; installation is complete.

3.0 OPERATION

StudioDrive operates like any other broadcast audio console. A description of controls is below:

MIC ON/OFF BUTTON	Switches the Mic on or off. When the button is IN, mic is on. The Monitor is normally muted when the mic is on, unless this feature has been defeated.
MIC ON LED	Illuminates when Mic is on.
MIC LEVEL POT	Mix level for Mic channel. The normal range is between -20 and -10 dB.
L1 / TEL BUTTON	Selects either LINE source #1 (out) or the TEL coupler (in) for mix channel. If TEL is selected, audio may be recorded from a phone line. Note that this feature is for recording caller audio only. It is <i>not</i> for doing a "talk show" where both caller and host are recorded or broadcast. A regular telephone must also be connected to the phone line so the call can be initiated (or answered) and the line "held" while caller audio is being recorded. The telephone should have a <i>mute button</i> so that ambient noise is not picked up by the telephone handset while recording.
TEL ON LED	Illuminates when TEL is selected with button above.
L1 / TEL LEVEL POT	Mix level for L1 / Tel channel. The normal range is -20 to -10 dB.
L2 / L3 SELECT BUTTON	Selects either LINE source #2 (out) or LINE source #3 (in) for mix channel. If this button is IN, the L3 INPUT JACK is active.
L3 INPUT JACK	Input jack for Line source #3: unbalanced, -10 dBv, stereo mini-jack.
L2/ L3 LEVEL POT	Mix level for L2 / L3 channel. The normal range is -20 to -10 dB.
PC PLAY / RECORD BUTTON	Selects PC-Monitor mode. When this button is out (PLAY), Monitor system will monitor either Program bus <i>or</i> Air monitor signal, depending upon MONITOR PGM/AIR button. If PC PLAY/RECORD button is in (RECORD), Monitor system will monitor the <i>output of the PC soundcard</i> . This permits the operator to listen "through" the soundcard, to hear the effects of mixing or editing on the PC.
PC LED	Indicates PC-Monitor mode selected above. GREEN = PLAY, RED = RECORD.
PC LEVEL POT	Mix level for PC soundcard output. The normal range is -10 to -20 dB. Note: The soundcard output is mixed to the Program (on air) output <i>only</i> . <u>It is not mixed to the Record output.</u> When recording to the PC, this pot should be set to OFF (CCW).

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MONITOR PGM/AIR BUTTON	When the PC PLAY/REC button is out (PLAY) this button is active. It selects either the Program bus audio or Air monitor audio for the Monitor system. If the PC PLAY/REC button is in (REC), this function is overridden.
MONITOR LED	Indicates Monitor audio selection: GREEN = PROGRAM, RED = AIR, OFF = PC-REC function is engaged (soundcard output is fed to Monitor system.)
MONITOR LEVEL POT	Controls level of Monitor system. (Monitor system mutes when Mic is on.)
PHONES LEVEL POT	Controls level of Headphones.
PHONES JACK	For stereo headphones. Use medium or high impedance headphones only.
VU METER LEDS	Indicates Program output level. 0-VU = +4 dBu.

3.0 OPERATION

StudioDrive has two distinct modes of use: "On Air" for live broadcasting, and "Production" for recording and editing on the PC.

When StudioDrive is used for live broadcasting, the Monitor system should be set to AIR, so the operator can monitor the stations off-air signal. The PC PLAY/REC button should be out, and the MONITOR PGM/AIR button should be in.

In this mode, ALL audio sources are mixed to the main Program output. Set the level pots so that most peaks cause the amber 0-VU LED to flash. The VU meter LEDs are calibrated to match the averaging ballistics of a standard VU meter. There is an additional 20 dB of headroom above 0-VU. Adjust the Headphone and Monitor levels as needed. The Monitor system will mute when the Mic is on, if this feature is enabled.

When StudioDrive is used for recording or editing with the PC, the Monitor system should be set to PC-RECORD. The PC PLAY/REC button should be in, to allow monitoring the *output* of the soundcard. In this mode, all audio sources *except the PC soundcard audio* are mixed to the Record output. To prevent erroneous readings on the StudioDrive VU meter, **the PC level pot should be set to OFF (CCW)**. If the Record output levels have been properly calibrated, the StudioDrive VU meter will indicate correct recording levels for the soundcard in use. Adjust mix levels so that most peaks cause the amber 0-VU led to flash.

3.1 MIC PREAMP GAIN CALIBRATION

The gain of the mic preamp should be optimized for the microphone in use. The mic preamp gain is adjusted via a small hole labeled MIC GAIN on the Audio Interface unit. To set mic preamp gain, turn the Mic channel on, and set the Mic Level pot to **-15 dB**. Speak into the mic, and adjust the gain trimmer so that the amber 0-VU LED flashes on most audio peaks.

4.0 SPECIFICATIONS

INPUTS

MIC	Bal, 10K, gain adj. 40-60 dB
LINE 1	Unbal, stereo, 10K x 2, -10 dBv nom
LINE 2	Bal stereo, 10K x 2, 0 dBu / unbal, 5K x 2, -10 dBv
LINE 3	Unbal, stereo, 10K x 2, -10 dBv
PC	Bal stereo, 10K x 2, 0 dBu / unbal, 5K x 2, -10 dBv
TEL	Bal, 5K, transformer isolated input for tel line
AIR	Bal stereo, 10K x 2, 0 dBu / unbal, 10K x 2, -10 dBv

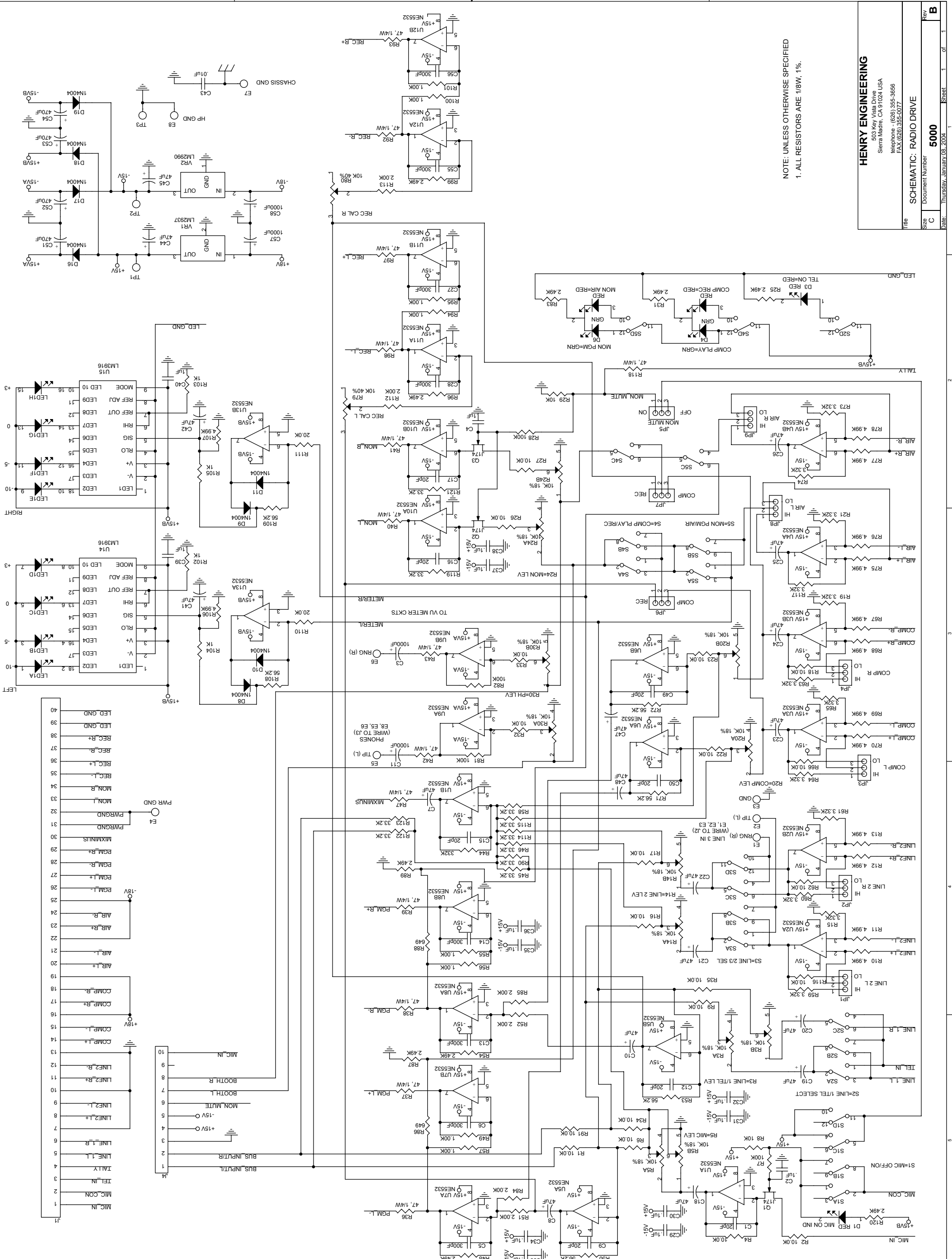
OUTPUTS

PGM	Bal, stereo, 600 ohm load, +4 dBu nom, +24 dBu max
REC	Bal, stereo, 600 ohm load, +4 dBu nom, +24 dBu max
MIXMINUS	Unbal, 2k ohm load, -2 dBu nom, +20 dBu max
MONITOR	Unbal, 600 ohm load, 0 dBu nom, +20 dBu max
MIC PROC	Unbal, -5 dBv I/O

AUDIO PERFORMANCE

FREQ RESP	0 – 20 kHz, +/- 0.25 dB
DISTORTION	0.01% THD or IM
NOISE, Pgm, Rec	85 dB below nom output
HEADROOM	20 dB
DYNAMIC RANGE	105 dB
VU METER CAL	0 VU = +4 dBu

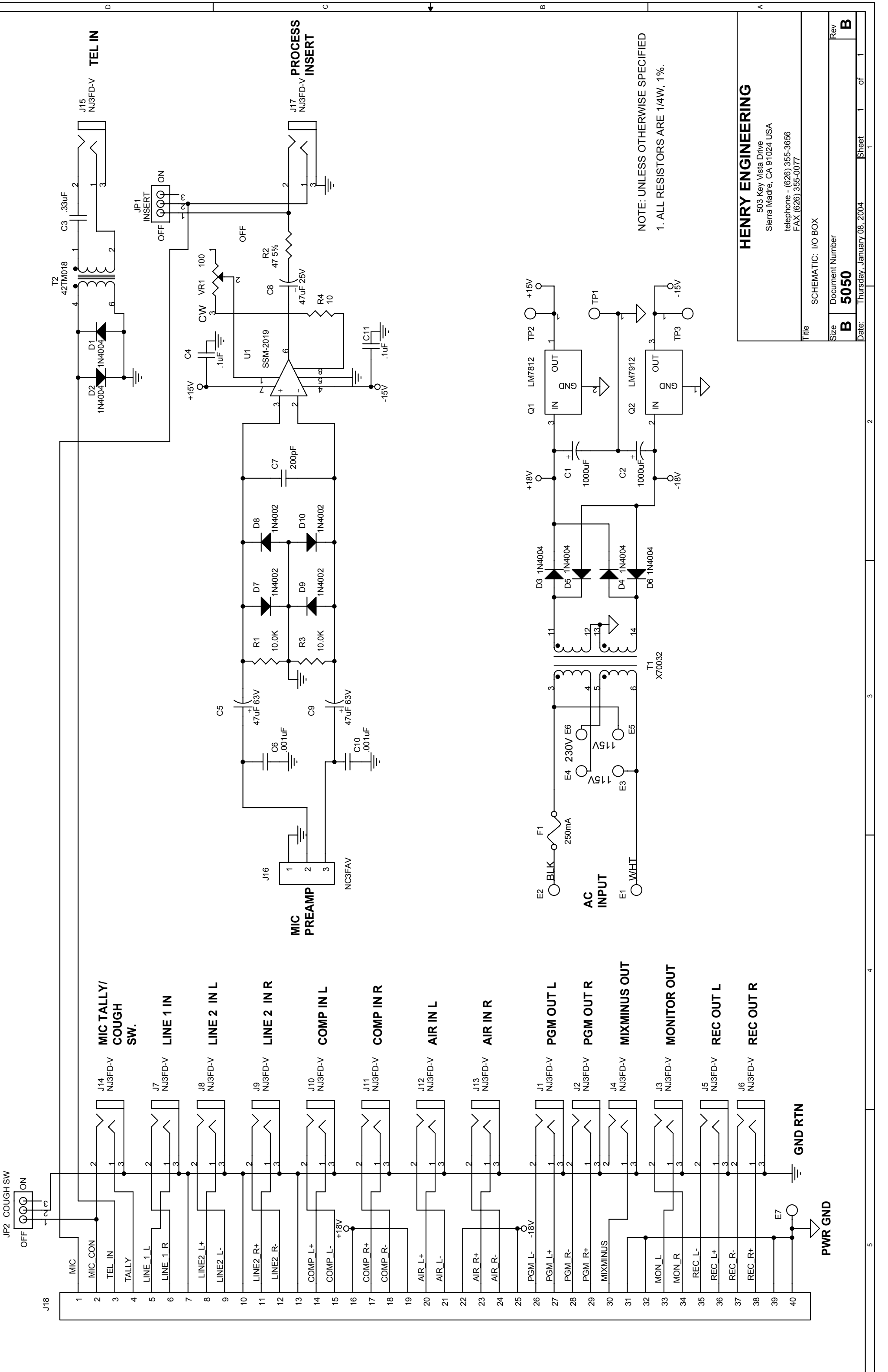
Specifications subject to change without notice.



NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 1/8W, 1%.

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NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 1/4W, 1%.

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Date: Thursday, January 08, 2004 Sheet 1 of 1

Rev

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JP2 COUGH SW

MIC TALLY/
COUGH
SW.

LINE 1 IN

LINE 2 IN L

LINE 2 IN R

COMP IN L

COMP IN R

AIR IN L

AIR IN R

PGM OUT L

PGM OUT R

MIXMINUS OUT

MONITOR OUT

REC OUT L

REC OUT R

GND RTN

PWR GND

TEL IN

PROCESS
INSERT

MIC
PREAMP

AC
INPUT

J18

J14

J7

J8

J9

J10

J11

J12

J13

J1

J2

J4

J3

J5

J6

E7

J15

J17

J16

F1

E4

E5

E6

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E1

TP2

TP1

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T2

C8

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C6

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C10

C11

U1

VR1

C3

D1

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T1

E3

E4

E5

E6

E7

C1

C2

Q1

Q2