

SSH-16 manual: cio-ssh16.pdf CIO-DAS1602/16 manual: CIO-DAS160x-1x.pdf P4SCA specs: P4SCA.pdf USB-3112 specs: USB-3112.pdf driver library: sm-ul-functions.pdf

INPUTS TO SSH-16

- 1. RF power forward (directional coupler output)
- 2. RF power reflected (directional coupler output)
- 3. RF current, loop sensor (AD8361 output)
- 4. Electrolytic current (voltage across Rsense)
- 5. Electrolytic voltage (voltage across cell)
- 6. Magnet current (voltage across Rsense)
- 7. Magnetic field (AD22151 output)

OUTPUTS FROM USB-3112

- 1. Voltage Controlled Oscillator control
- 2. Variable Attenuator control
- 3. Electrolytic Cell Voltage control
- 4. DC magnet Current control

For slow changing data such as temperature or supply voltage drift, an additional USB input module can be used and correlated with other data by use of a time stamp using data array indices and or system clock read into data array.

USB-3112 manual: USB-3112.pdf

SSH-16 manual: cio-ssh16.pdf

VCO:			
	0V	5V	10V
ZX95-400+, +10dBm, \$39.95, 12V, 21mA	173	231	297
ZX95-535-S+, +6dBm \$39.95, 12V, 21mA	241	343	445
ZX95-765+, +8dBm \$40.95, 12V, 22mA	364	522	683
ZX95-1700W+, +10dBm \$49.95, 12V, 35mA	620	899	1172
specification files: ZX95-400+.pdf, ZX95-535+.pdf, ZX95-765.pdf, ZX95-1700W+.pdf			

Fixed Attenuator keeps amplifier input below maximum allowable. Works in conjunction with variable attenuator.

Fixded Attenuator specs: VAT-10+.pdf

Voltage Variable Attenuator Provides for control of output power and current from RF amplifier.

Voltage Variable Attenuator specs: ZX73-2500.pdf

Power Amplifier provides magnetic pumping current to Electrolytic Cell

Power Amplifier specs: ZHL-20W-13.pdf

Power for the RF amplifier is provided by the dedicated 24 volt supply through filter/choke

Dual Coupler used to measure forward and reflected power in conjunction with power meters

Dual Coupler specs: ZFBDC20-13HP.pdf

Power Detector used to determine forward and reflected power at electrolytic cell interface

Power Detector specs: ZX47-40.pdf

RF Current Detector

used to determine magnetic pumping current

The AD8361 detector will be used to sense the voltage generated in a coupled wire loop. The loop area and number of turns will be adjusted to match the output voltage level with the input of the AD8361.

The wire sense loop will be located between the top conductor trace and the ground plane. A conductor trace with a width of .100" and a gap space of .011" will allow for a rectangular loop with a height and width of .010" passing through the ground plane. The nominal output of the loop at 100MHz and 1 amp is .015 volts. Due to the range of frequency and current, a smaller loop may be used at higher frequencies. The loop will be silver, copper, or tungsten.

The inductance of the sensor segment is 2.5 nH/inch. for a length of .10 inches, the inductance will be about .25 nH. A small parasitic capacitance will also be present.

AD8361 specs: AD8361.pdf

A series of calibration boards will be used to correlate the oscilloscope probe or a standard resistor with the current sense loop. The Vishay TNPW080510ROBT9 part is a 10 ohm, .125W resistor. A single board using one resistor in series with group of four in parallel will be used to establish the I-V characteristic for the group of four over frequency. The group of four will be used in a board with the loop to establish the loop behavior. The group of four will also be used in series with a .050 ohm 1W resistor. The .050 ohm resistor will then be used with the loop.

one resistor in series with 4||resistors
4||resistors in series with loop
4||resistors in series with .050 ohm resistor
.050 resistor in series with loop

RF_detector_03.dip

The electrolytic cell will be based upon a transmission line cathode segment with a width of .060" and an exposed length of .400". The dielectric thickness will be .001" PFA and the electrolyte gap will be .002".

The tank L and C values may range up to 5nH and 400pF. The series C value may range from 10pF to 50pF. In general, larger component values are associated with lower resonant frequencies. Tuning will be done to find the input current minimum versus frequency, or to provide a match to the amplifier output. AVX SQCA capacitors will be used for tank and series capacitors.

Package is .055" x .055" x .057".

The capacitor will be fixed with a tunable series inductance in the tank circuit. To provide flexibility the drive circuit will be assembled using .001" PFA over a copper ground plane. The capacitor assemblies will be pre-soldered with copper foil and epoxied in place.

Electrolytic Cell voltage will be provided by the USB-3112 with a current of up to 40mA.

A single LT1210 (LT1210.pdf) with an input RC network used to ramp the magnet current over a period of 10-30 seconds.

DC electromagnet uses two coils in series. Each coil has 200 turns (480") 22 ga. wire (17 milliohms/ft) wound an a .75" core giving .68 ohms per coil, and 1.3 ohms total resistance. A current of .25 amps (100 A-t) gives a field of about 4.5 millitesla. A current of 1 amp gives a field of about 18 millitesla or 180 Gauss.

A 1 volt signal into the DAS-1602/16 with a 0-1.25 volt range setting provides a resolution of 1.25/2**16 or 19 microvolts/bit. For current sensing at .5 amps (~280MHz) a 2 ohm resistor gives an output voltage of 1 volt and a power dissipation of .5 watts. For current sensing at 1.0 amps (~560MHz) a 1 ohm resistor gives an output voltage of 1 volt and a power dissipation of 0.5, 1.0, 1.5, and 2.0 ohms may be used.

AD22151 Hall Effect Sensor (AD22151.pdf) using 5V,20mA. Since the sense circuit is relatively inexpensive, a sense circuit will be assembled for each of a number of frequencies so that resolution is improved for magnetic field sweeping about a center value.

At 280 MHz, The DC field is 10 mT (100G). With a gain of 50 and an offset of -1.5 volts (1.0 volts at 0 Gauss), the AD22151 output will be: 1 volt + $50^{*}.0004^{*}100 = 3.0$ volts. Since the linear range for the output is from 10% to 90% of Vcc, 1 to 4.5 volts corresponds to a resonant frequency range of 0- 490MHz, For a gain of 50 (20mV/Gauss), Offset of -1.5 volts (1.0 volts at 0 Gauss) R3 = 50k, R2 = 1037, and R4 = 62.5k.

For a center frequency of 560MHz at 3.0 Volts output, the gain is reduced to 25. This gives a resonant frequency range of 0-980MHz. For a gain of 50 (20mV/Gauss), Offset of -1.5 volts (1.0 volts at 0 Gauss) R3 = 50k, R2 = 2155, and R4 = 62.5k.

TO-220_regulator_adjustable_magnet.dip LT1210_magnet_driver.dip TO-220_regulator_fixed_magnet.dip for 5V magnet current source and 12V magnet current source Hall_Effect_Sensor_01.dip

Power for the LT1210 is provided by the +12,-12 supply from PJMA. Power for the AD2251 is provided by the instrumentation 5V supply, through filter.