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While incorporating many of the features of the previous I/F design; the new I/F Converter has a number of enhancements that will allow it to run with greater stability. The first feature is an upgrade of the V/F Converter on the card. The previous version was an Analog Devices AD-650 (asynchronous). The maximum conversion frequency was 1 MHZ for a 10 volt full scale input. Operation of this device depended on an external one-shot capacitor which was susceptible to temperature drift. The new V/F Converter is an Analog Devices AD-652 (synchronous). The AD-652 uses a variation of the popular charge-balancing technique to perform the conversion function. The AD-652 uses an external clock to define the full scale output frequency, rather than relying on the stability of an external capacitor. The result is a more stable, more linear transfer function.

Front End Amplifier

The front end amplifier has been changed to incorporate two amplifiers. The amplifiers are as follows:

- Analog Devices - AD549KH extremely low input bias current (100 fA max). Low offset drift (5 uV/deg. C). This is used for the two lower gain settings. The input pins are placed on teflon standoffs so that no current leakage paths exist through the pc card. This opamp is packaged in a TO-99 metal can. The can is tied to analog ground. All resistors used for gain settings are extremely low temperature drift resistors.

- Burr-Brown - OPA627BM extremely low offset drift (.8uV/deg. C). This amplifier was chosen for the high gain setting because of the low offset drift associated with the device. Input bias current is a very low 20 pA max. The input pins are placed on teflon standoffs so that no current leakage paths exist through the pc card. This opamp is packaged in a TO-99 metal can. The can is tied to analog ground. All resistors used for gain settings are extremely low temperature drift resistors.

Selecting The Input Amplifier

There is a pc card mounted dpdt dip switch that is used to select between either of the two amplifiers. Since the amplifiers have different gain functions they will have different applications. But in the event of a failure the backup amplifier can be switched in, albeit at a different gain.

The V/F Converter

As mentioned above the V/F Converter is the AD652. Since this is a synchronous V/F Converter it requires an external clock. The stability of this external clock will for the most part determine the stability of the V/F Converter. The clock selected for this function is a 4 MHz Temperature Compensated Crystal Oscillator. The temperature drift for this device is $\pm$ .2 ppm over the full temperature range from 0 to 50 deg. C. This implies a maximum clock drift of less than 1 count over a 50 degree C temperature range. This frequency selected will give the maximum resolution since the maximum input frequency allowed is 4 MHz. The relation between the clock frequency and the output frequency is as follows:

$$F_{out} = (Fclk/2)*(Vin/10v)$$

So a 2 MHz output will be obtained for a 4 MHz clock and a 10 volt full scale input signal. This will probably be different from the scaling of the current I/F converters.

The Resistors And Trimpots

The resistors and trimpots used on the front end are of the highest quality. Temperature drift of these resistors is typically 5 ppm/deg. C. This will keep any temperature drift effects to a minimum.

The Pad Heaters

The NIM module now incorporates 2 Silicone pad heaters (6 x 8 inches). These are mounted on the NIM module side panels. The goal of these heaters is to temperature stabilize the I/F converter at approximately 38 deg. C (100 deg. F). With this function operational we should be able to replace the temperature stable resistors with resistors that are not as expensive in future cards. These pad heaters will require 24 volts dc @ 350 mA each. A separate power supply chassis will be manufactured in house. The power will be supplied to the heaters through a BNC connector mounted on the front of the NIM module. The on/off cycling of the heaters will be controlled by a pc card mounted solid state thermostat manufactured by Analog Devices (AD592). Temperature on/off cycling will be approximately 1.5 degree F.

The Output Section

Since there was no apparent problems with the output sections, these were not redesigned and will appear as they were on the old design.

Circuit Card Layout

The circuit card will incorporate 2 major ground planes (analog and digital). The component side of the card will contain both ground planes. These two ground planes can be tied together via jumpers.

Front Panel Displays

The front panel will contain all components directly connected to the card (right angle components) except for J9 (BNC connector). There will be no flying leads to the front panel components except for two wires to the BNC connector (24 volts). The following components will be on the front panel side of the pc card:

- pulse output k-loc connector. (J5)
- green leads to indicate heaters are on/off.
- BNC connector for 24 volts. (J9) Front Panel Mounted.
- Reset button.

Connections To Circuit Card

There are 7 connectors mounted directly on the pc card to bring signals in. Two are 15 contact Dsub connectors (1 male and 1 female). There are also 4 SMB connectors and 1 KLOC connector. These connectors will be used as follows:

- J2 - Signal A input (SMB)
- J3 - Signal B input (SMB)
- J4 - Auto reset pulse (SMB)
- J5 - Pulse out (K-LOC) Front Panel Side of PC Card.
- J6 - Analog out (SMB)
- J7 - Output pulses to rear panel K-LOC connectors (DSUB)
- J8 - Power to card and to connect heaters to temperature control circuit (DSUB)

Rear Panel NIM Module Connectors

There are 11 K-LOC connectors and 1 NIM power supply connector on the rear panel of the NIM module:

- J1- NIM connector contains 5 volt and ± 15 volt power. Also contains the analog buffer output signal. Pinouts are as follows:

  J1-3 +5 volts
  J1-14 +15 volts
  J1-18 -15 volts
  J1-32 ± 15 volt return
  J1-40 analog buffer out
  J1-42 +5 volt return

- J10 A-input (connects to J2 on pc card)
- J11 B-input (connects to J3 on pc card)
- J12 Auto Reset input (connects to J4 on pc card)
- J13 analog output (connects to J6 on pc card)
- J14 output pulses channel 1 (connects to J7-9,1 on pc card)
- J15 output pulses channel 2 (connects to J7-10,2 on pc card)
- J16 output pulses channel 3 (connects to J7-11,3 on pc card)
- J17 output pulses channel 4 (connects to J7-12,4 on pc card)
- J18 output pulses channel 5 (connects to J7-13,5 on pc card)
- J19 output pulses channel 6 (connects to J7-14,6 on pc card)
- J20 output pulses channel 7 (connects to J7-15,7 on pc card)

Disassembling The NIM Module

Since there are heater pads attached to the inside walls of the NIM module, the side panels cannot slide off as easily as on other NIM modules. The top rail will have to be removed so the side panel can be removed when work is required on the pc card.

Autozeroing Circuit

This I/F converter has an Autozeroing circuit (az). This az circuit includes an external autozero reset pulse. The purpose of this circuit is to periodically autozero the input section of the I/F when no signal is present. If the input signal has a dead time around T-zero then during this dead time the I/F can be autozeroed with the t-zero pulse. This will prevent any front end offset voltages from becoming too large and inducing errors in the output count. This circuit is jumper selectable so it can be removed or included at any time.