

INSIDE THE 1B22

The 1B22 produces an isolated 4 to 20 mA or 0 to 20 mA output current which is proportional to the input voltage and independent of the output load resistance (Figure 1). The input stage is configured as an inverting amplifier with a resistor network to provide pin-strappable input ranges of 0 V to +5 V and 0 V to +10 V and output ranges of 0 to 20 mA and 4 to 20 mA. The conditioned signal is modulated to generate a square wave that drives transformer T1. The peak-to-peak amplitude of the signal is proportional to V_{IN} . An internal, high stability reference with a nominal output voltage of +6.4 V is used to develop a 4 mA offset for the 4 to 20 mA current loop output.

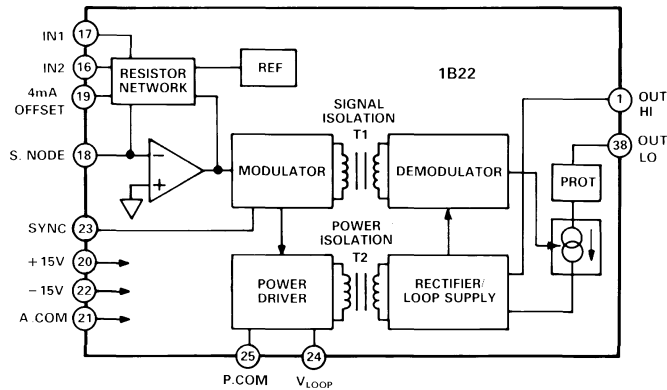


Figure 1. 1B22 Functional Block Diagram

After passing through signal transformer T1, the amplitude modulated signal is demodulated and filtered by a single pole filter. This filtered output is the control signal for the voltage-to-current converter stage. Timing information for the demodulator is derived from the power transformer T2. The 1B22 outputs are protected from accidental shorts to ac line voltages up to 240 V rms. Combined with 1500 V input to output isolation, the 1B22 provides unbeatable protection against transients, wiring errors and current loop short circuits to power lines.

The dc-dc converter consists of a power driver, power transformer T2, a full wave rectifier and a filter. The dc-dc converter provides the power for the output circuitry as well as the isolated compliance voltage for the loop. This voltage is proportional to V_{LOOP} on the input side. The 1B22 requires ± 15 V supplies to power the input side circuitry and a +14 V to +30 V supply for the dc-dc converter.

USING THE 1B22

Basic Interconnections: The 1B22 may be applied to achieve rated performance as shown in Figure 2. For 0 V to 10 V signals either IN1 or IN2 can be used for input; for 0 V to +5 V signals jumper IN1 to IN2. Similarly, for 4 to 20 mA operation the 4 mA OFFSET node should be jumpered to the S. NODE, while for 0 to 20 mA it should be tied to COM. Figure 3 shows the functional diagram of the resistor network used in the 1B22.

For applications where a separate loop supply is not available, the ± 15 V supplies can be used by connecting +15 V to V_{LOOP} (Pin 24) and COM to P.COM (Pin 25). For additional compliance voltage, P.COM can be connected to -15 V to drive higher loads.

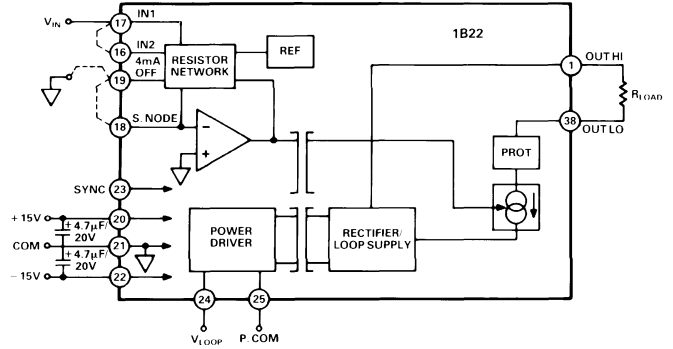


Figure 2. Basic Interconnections

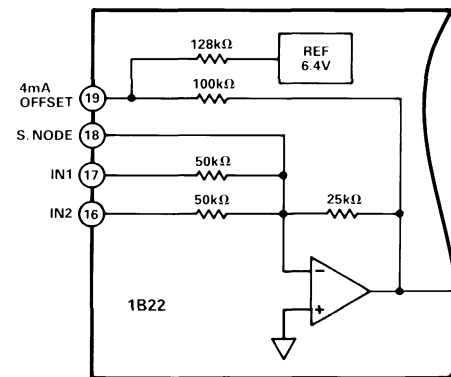


Figure 3. Internal Resistor Network

Optional Trim Adjustments: Figure 4 is an example of using potentiometers for trimming gain and offset for a 0 V to +10 V input and 4 to 20 mA output. The network for offset adjustment keeps the resistors relatively small to minimize noise effects while giving a sensitivity of $\pm 1\%$ of span. The value of R1 should be 5 M Ω for the 0 V to +10 V range (for 0 V to +5 V configurations, a 1.2 M Ω resistor should be used). For more adjustment range, resistors smaller than 274 k Ω can be used.

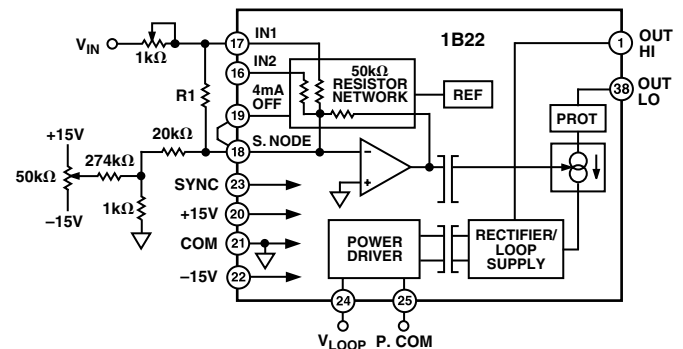


Figure 4. Optional Offset and Span Adjustment

1B22

Synchronizing Multiple 1B22s: In applications where multiple 1B22s are used in close proximity, radiated individual oscillator frequencies may cause “beat frequency” related output errors. These errors can be eliminated by driving the SYNC pins of all the units with a 40 kHz clock circuit at 50% duty cycle (Figure 5). The SYNC input typically has an input impedance of 150 kΩ||180 pF.

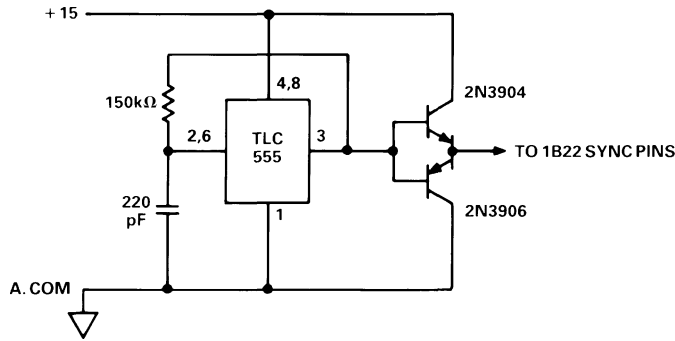


Figure 5. Multiple 1B22s' Synchronization

Loop Supply Requirements: The 1B22 design allows flexible loop supply options. The loop supply voltage required for any value of load resistance can be calculated from the following equation:

$$V_{LOOP} = \frac{2R_L + 780}{106}$$

This value allows for approximately 10% overrange capability. The graph in Figure 6 shows the relationship between supply voltage and load resistance.

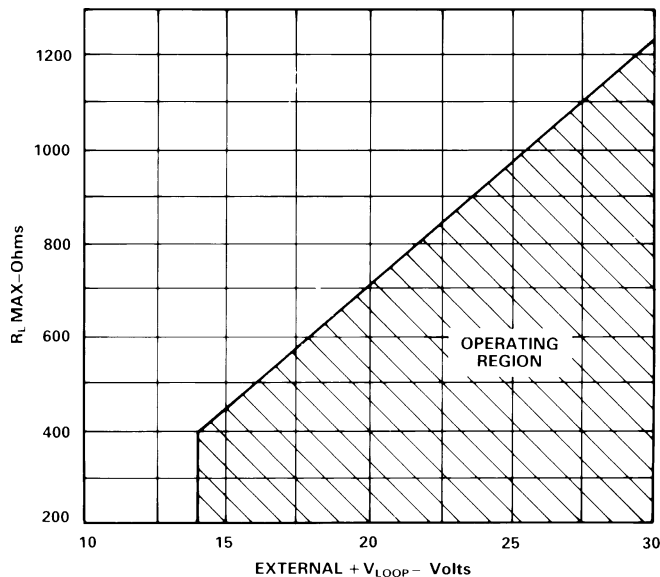


Figure 6. Loop Supply vs. Load

APPLICATIONS

Isolated D/A Converter: The 1B22 offers total ground isolation and protection from high voltage transients in interfacing D/A converters to standard 4 to 20 mA current loops. The D/A converter, such as the Analog Devices' 12-bit AD7245 DACPORT®, should be connected for operation on the unipolar 0 V to +10 V output range. This is shown in Figure 7.

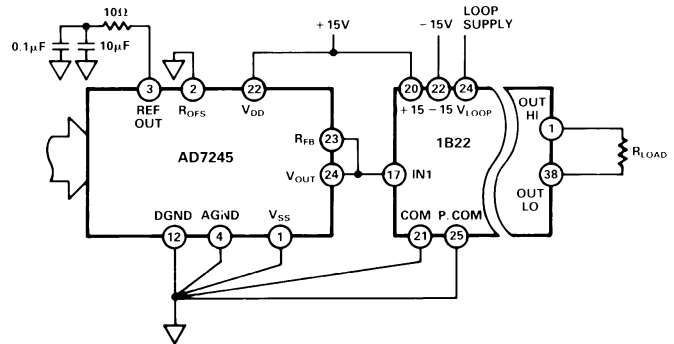


Figure 7. D/A Converter-Isolated 4-20 mA Interface

Pressure Transmitter: In Figure 8, the 1B22 is used in a pressure transmitter application to provide complete input-output isolation and avoid signal errors due to ground loop currents. The process pressure is monitored with a strain gage type pressure transducer interfaced by the Analog Devices' 1B32 transducer signal conditioner. The high level voltage output of the 1B32 is converted to the isolated 4 to 20 mA current for transmission to a remote recorder or indicator.

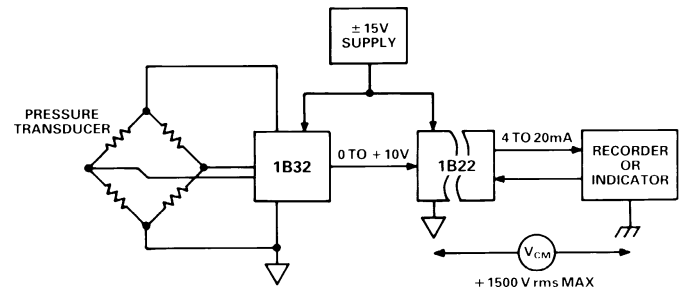


Figure 8. Isolated Pressure Transmitter

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