

## Remote Sensing

### General Description

The remote sense feature provides excellent regulation at the load rather than at the converter's output terminals. It does this by sensing and regulating voltage at the load, compensating for load current IR drops across output connectors, traces and cables as well as or'ing diode forward voltage drops.

The remote sense feature will compensate for voltage drops up to 0.5V or 10% of nominal output voltage, whichever is greater. If the total voltage drop between output terminals and load exceeds this amount, other design changes, such as increasing conductor size or decreasing connector resistance, must be taken.

Astrodyne has also recommended diodes for or'ing applications that minimize forward voltage drop. Please see AP13 for details.

Voltage drops across output series resistance ("IR drops") vary with output current. If the load current stays relatively constant, Astrodyne recommends using output voltage trim instead of remote sensing. (See AP5)

(Output voltage trim increases the output voltage by a fixed amount to compensate for IR drops between the module and the load; remote sense increases the output voltage dynamically to compensate for variable IR drops due to load current changes.)

Voltage drops across or'ing diodes (diodes that isolate one converter's output from another paralleled converter's) tend to stay

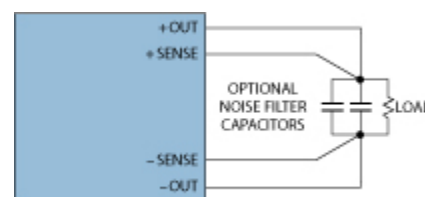
relatively constant with load current variations, but change with diode temperature. Astrodyne recommends using remote sense when using or'ing diodes if precise regulation is needed.

### Implementation

The remote sense terminals must always be connected, either to the output terminals or to the load. Connect -SENSE to -OUT at the load and +SENSE to +OUT at the load as shown in *Figure 6a*.

To reduce noise susceptibility, parallel an electrolytic capacitor and small ceramic capacitor across the remote sense terminals where they are connected to the load as shown in *Figure 6a*. (Tantalum may be used in lieu of electrolytic capacitors) Please refer to *Table 6-1* for recommended values.

Noise filter capacitors are especially helpful when the remote sense leads are over one foot long.



**Figure 6a** Remote sense implementation showing the remote sense leads and filter capacitors connected at the point of load.

When using traces for the remote sense connection, shield the traces by using a ground plane. (See AP18)

When using wires (rather than traces) for remote sense connections, twist the wires

together to reduce noise pickup, or better, use coax.

Suggested filter capacitor values			
V <sub>out</sub>	Electrolytic capacitor	Tantalum in lieu of electrolytic	Ceramic capacitor
2.1V, 3.3V	4700µF, 6V	330µF, 6V	0.47µF, Z5U
5.0V	2200µF, 10V	220µF, 10V	0.47µF, Z5U
8.0V	1500µF, 16V	150µF, 15V	0.47µF, Z5U
12V, 15V	1000µF, 35V	68µF, 25V	0.47µF, Z5U
24V, 28V	470µF, 50V	22µF, 50V	0.47µF, Z5U

Table 6-1 Recommended capacitor values for reducing remote sense noise susceptibility

Although available on all models, remote sense is most useful for high current (low voltage) models, where the potential IR drops are higher.

## Precautions

Improper use of the remote sense feature can introduce noise into the module's feedback loop, resulting in output noise or oscillations. There are several ways to minimize remote sense lead noise pickup.

- (a) Use shielded and/or twisted leads for remote sensing. Also consider using coax cable.
- (b) Use noise filter capacitors connected across the remote sense leads at the load. See Figure 6a and Table 6-1 for further information.
- (c) Use output voltage trim to make up for IR drops instead of remote sense if the load current does not change appreciably. (See AP5)

If the sense leads fail open circuit, the module output voltage will rise to the OVP set point. If there is any possibility of this

situation, connect a 100Ω resistor from +OUT to +SENSE, and from -OUT to -SENSE.

Be careful not to reverse the sense leads. If reversed, the module will be damaged. Astrodyne recommends using keyed connectors.

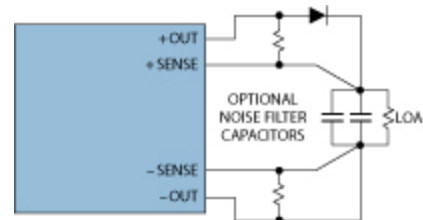


Figure 6b -When there is a possibility of remote sense leads failing open, connect a 100Ω resistor from each SENSE terminal to its respective OUT terminal at the converter. Also shown is an optional or'ing diode used when paralleling two or more converters.

## Related Topics

- AP-5 Output Voltage Trimming
- AP-7 Measuring Line and Load Regulation
- AP-13 Paralleling with Current Sharing and n+m Redundancy
- AP-18 Board Layout Considerations and Recommendations



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