1398-SR3AF Active Shunt Module

The ULTRA 100 drives do not have an internal shunt circuit to dissipate any excess energy and overvoltage faults could result. To ensure the smooth braking of large inertial loads, the use of a shunt-regulator is recommended. The Active Shunt Module (1398-SR3AF) is meant to be used in systems that see significant DC voltage regeneration from large inertial load applications. What the 1398-SR3AF does is monitor the DC bus voltage of the drive and, if the voltage reaches the activation level, the 1398-SR3AF drops the DC bus voltage and dissipates the energy as heat. Figure 1, depicts this drop in DC bus voltage.

Figure 1: Shunt activation on DC bus voltage

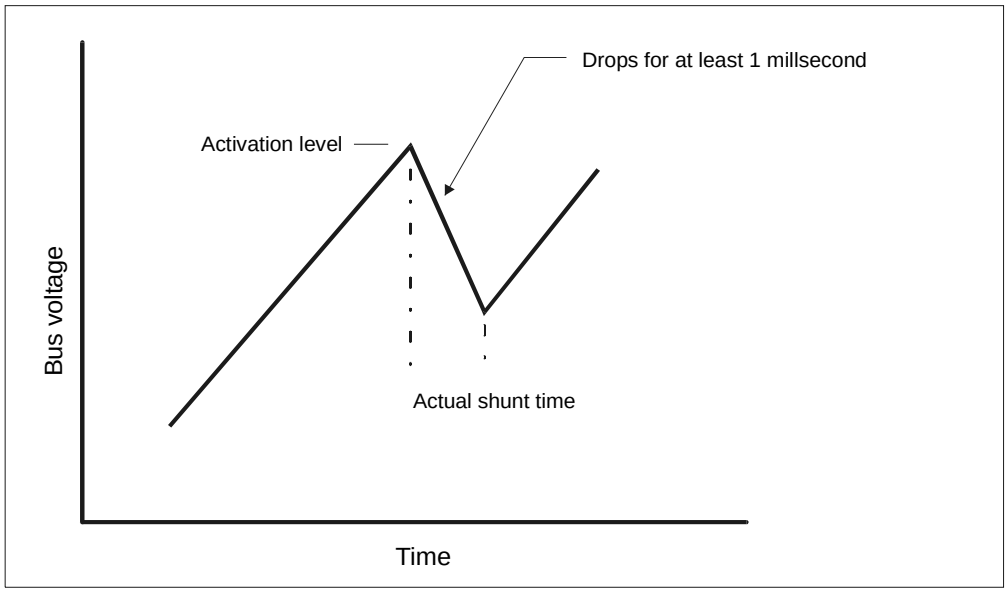
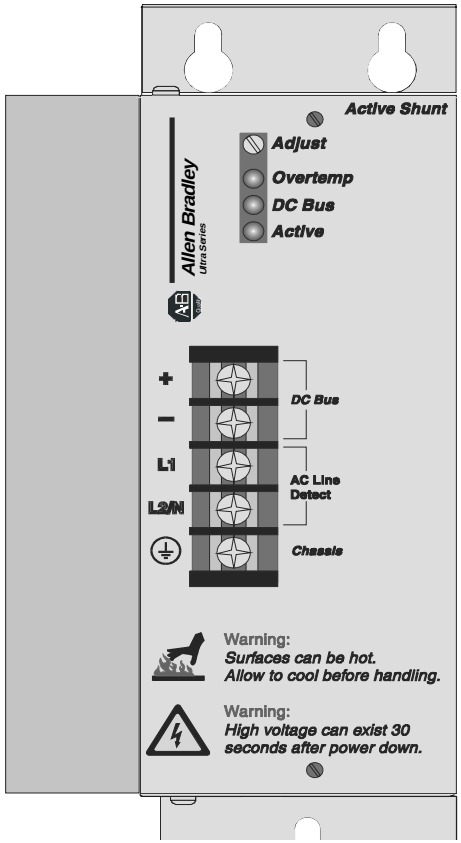


Figure 2, lists information relating to the adjust screw and the LED's that show shunt activity. See also Figure 7 on page 10 for more information.

Figure 2: Shunt module adjustment screw and LEDs



Adjust (screw)

The Adjust screw is used to set the activation level of the Shunt. It is set at the factory and will not ordinarily need any further adjustment.

Overtemp (LED)

The Overtemp yellow LED will illuminate when the unit's thermostat has tripped. While the thermostat is tripped, the unit will not shunt excess voltage (the bus-drop feature will still work) and this will usually cause the host drive to fault on overvoltage. Once the LED turns on, only removing power will shut it off, even if the active shunt unit has cooled and is functioning again.

DC Bus (LED)

The DC Bus green LED will be on when there is sufficient bus voltage. The higher the bus voltage, the brighter the LED will glow.

Active (LED)

The Active green LED will be on while the Active Shunt is actually shunting. This LED indicates not only that the Active Shunt is functioning, but can also be used to quickly see how much the shunt is running.

Performance Specifications

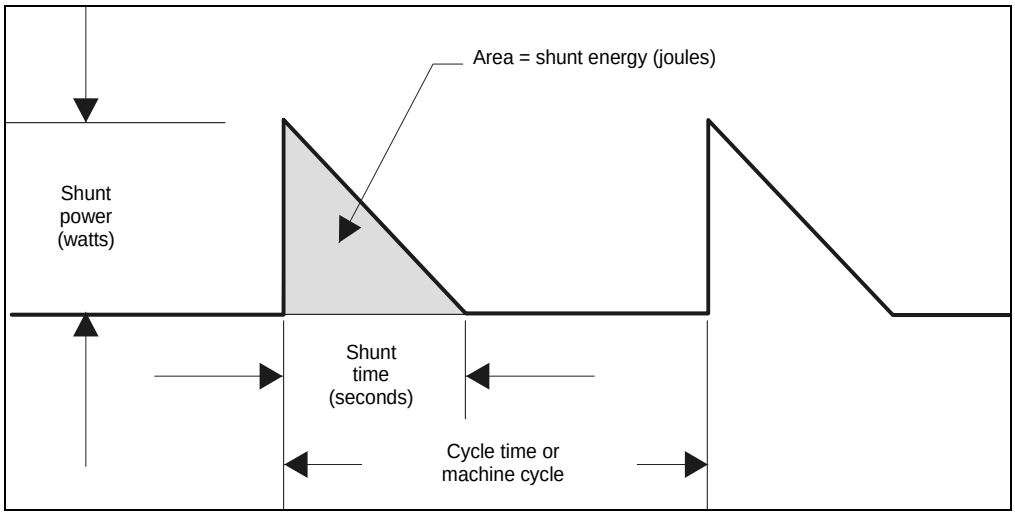
The peak shunting capability is a direct result of using a 36 ohm shunt resistor. The peak shunt power can be calculated by dividing bus voltage squared, by 36. For example, if the bus voltage is 380 when the shunt comes on, the shunt power at that time is 4,011 watts.

$$\frac{380 \text{ volts}^2}{36 \text{ ohms}} = 4011 \text{watts}$$

Continuous Shunt Capability

A shunt regeneration profile is defined by shunt time, cycle time, and peak power level. Figure 3 depicts a profile of regeneration during a machine cycle.

Figure 3: Shunt Regeneration Profile

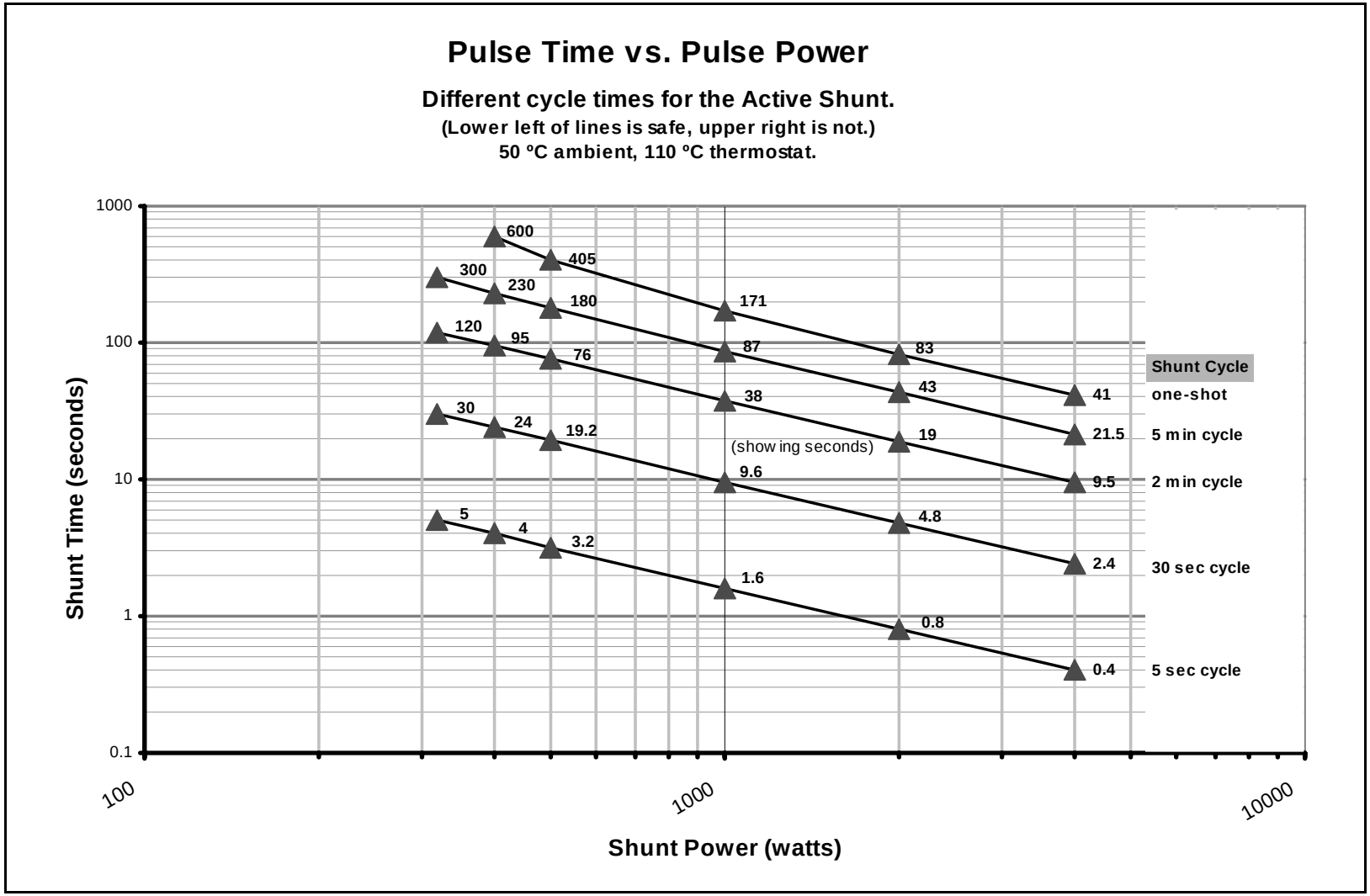


Shunt power is the peak shunt power during the shunt time. Shunt time is the time the power pulse is dissipated by the shunt. The cycle time is the time from the beginning of one shunt time to the beginning of the next shunt time.

If the required average shunt power over the machine cycle is ≤ 300W and the cycle time is ≤ 300 seconds the 1398-SR3AF can handle the application. Figure 4 on page 5 depicts the capability of a 1398-SR3AF at 50ºC ambient. The different lines represent different cycle times (rates). The X-axis is the shunt power during the shunt time and the Y-axis is the maximum shunt time for that power and cycle time. For example, the bottom line is a 5 second cycle time (meaning the shunt pulse comes every 5 seconds) and it intersects the 800 watt pulse for 2 seconds every five seconds in a 50ºC or less ambient. This means that the shunt can handle an 800 watt pulse lasting for two seconds, every 5 seconds if the ambient is not above 50ºC.

Note: The limiting factor on how much average power can be dissipated is temperature.The shunt power capability increases about 5.5 watts for every 1ºC drop in ambient temperature (3.1 watts/ºF). Increasing the air flow across the heat sink can increase the continuous shunt capability significantly (while obstructing air flow can decrease it significantly).

Figure 4: Active Shunt Module thermal capacity



Installation

Mechanical Installation Requirements

Mount the unit in an enclosure providing IP54 protection (protected against dust and splashing water), or IP65 protection (dust free and protected against water jets) as the work environment dictates.

ATTENTION: Avoid contaminating electronic components.

Provide a quality air source to cabinets; free of debris, oil, corrosives, or electrically conductive contaminates. All cabinets should have scheduled inspections and be cleaned as needed.

Failure to observe these safety procedures could result in breakdown and damage to equipment.

Many NEMA (National Electrical Manufacturers Association) Type 4 cabinets provide this level of protection.

Provide adequate clearance and ventilation to dissipate heat generated by the shunt module. The minimum recommended space surrounding the shunt module for cooling air intake and fan exhaust is:

- 5 cm (2 in) above,
- 5 cm (2 in) below,
- 1.25 cm (0.5 in) sides, and
- 2.5 cm (1.0 in) in front which includes additional cable clearance

Position the shunt module on a flat, solid, grounded surface. Bolt the unit to the cabinet using the mounting slots in the case. Mounting dimensions are shown in Figure 5 on page 8. The surface and mounting hardware should meet or exceed the specified requirements for vibration and shock, altitude and humidity, air flow clearance, temperature, and size (see the following tables).

Table 1: Vibration and shock, altitude, humidity, temperature, and air flow limits

Environmental Condition	Value
Vibration	2g at 10 to 2000 Hz
Shock	15g 11 msec half sine
Altitude	1500 m (5000 ft)
Humidity	5% to 95% non-condensing
Ambient operating temperature[1]	0 ° to 50° C (32° to 140° F)
Air flow clearances	50 mm (2 in) above and below unit for air flow

1. Power performance increases about 5.5 W for every 1°C drop in ambient temperature.

Table 2: Recommended mounting hardware

Mounting Hardware	Size
Metal Screws	#10
Hex Cap Screws	1/4”-20
Hex Cap Screws (Metric)	M5

Table 3: Wiring

Wiring	Size
75°C copper wire	12 AWG (4.0mm^2) or 14 AWG (2.5mm^2)

Table 4: Terminal Block

Screws	Torque
Chrome plated brass	11 in-lbs (1.2 Nm)

Table 5: Unit Weight 1398-SR3AF

Product	Unit Weights
1398-SR3AF	1.23 kg (3.3 lbs)

Table 6: Ferrites for CE radiated emissions compliance

Mfg. Part/No.	D	E	Impedance
SS28B2034	0.250	0.120	125 Ω
SS28B2037	0.350	0.200	154 Ω
SS28B2032	0.500	0.200	230 Ω

Box shaped ferrite assembly in fully enclosed nylon case. End ports are surrounded with flexible spring flutes to grip a range of cable diameters from.125 to.500” (3.2 to 12.7mm).

FerriShield, Inc.
350 Fifth Avenue, Suite 7310
New York, NY 10118-7591

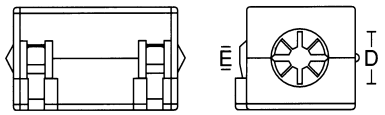
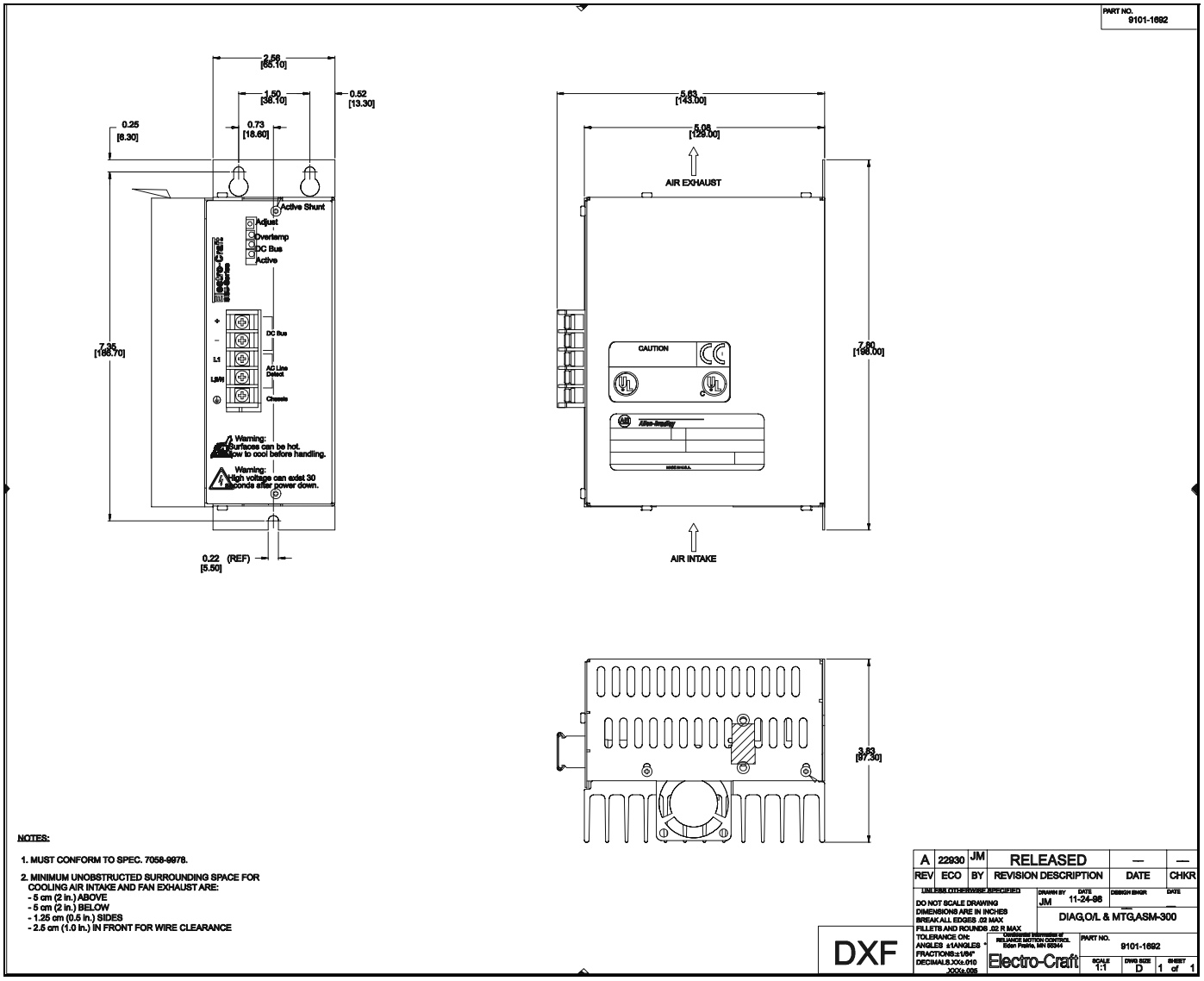


Figure 5: **1398-SR3AF Mounting Dimensions**



Wiring

The Bus (+) connection on the SR3AF must be connected to the Bus (+) connection of the ULTRA 100 drive. Likewise, the Bus (-) connection must be connected to the Bus (-) connection of the ULTRA 100. Use 12 AWG (4.0mm^2) or 14 AWG (2.5mm^2) twisted 75°C, copper wire for wiring and tighten the terminal block screws to 11 in-lbs (1.2 Nm). The wire should not be longer than 10 feet (3m).

The AC inputs can be wired to the AC terminals of the ULTRA 100 or the same AC power source. If used, the shunt module will sense when the AC is lost to the drive and, after 0.25/sec, will drop the bus. Use 12 AWG (4.0mm^2) or 14 AWG (2.5mm^2) twisted 75°C, copper wire for wiring and tighten the terminal block screws to 11 in-lbs (1.2 Nm).

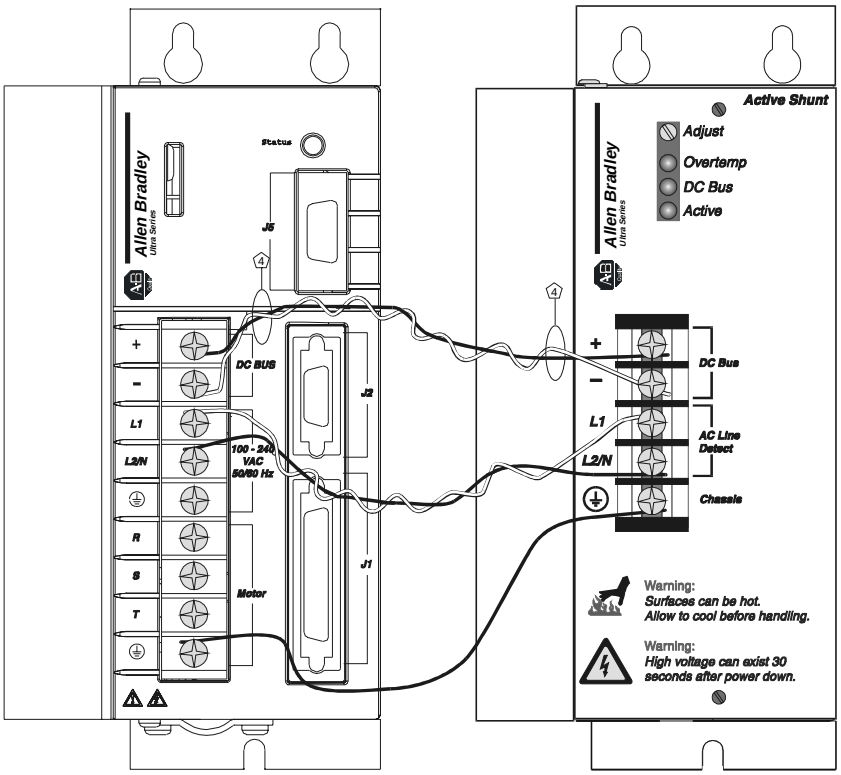
The chassis ground should be connected to earth ground.

To comply with the CE radiated emissions standards, ferrites must be added to the ends of the DC bus wires. Route both twisted wires through the ferrites. Ferrites with an impedance at 100 MHz between 100 Ω to 200 Ω were found to be effective. Table 6 on page 7 lists some readily available ferrites with effective impedance ratings.

Figure 6: 1398-SR3AF Wiring Layout

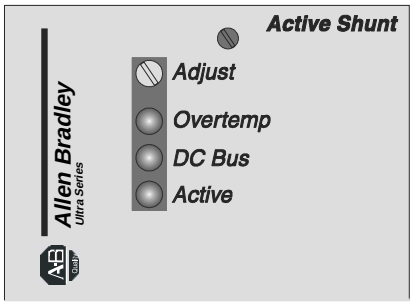
NOTE:

1. ALLOW 1.0” (2.5 cm) CLEARANCE IN FRONT OF UNIT FOR CABLES.
2. ALLOW .50” (1.25 cm) ON BOTH SIDES OF UNITS
3. ALLOW 2.0” (5 cm) ABOVE AND BELOW
4. INSTALL A 100Ω–200ΩFERRITE RFI SUPPRESSOR AT BOTH ENDS OF DC BUS WIRES TO COMPLY WITH CE RADIATED EMISSIONS STANDARD



Troubleshooting the Active Shunt

Figure 7: Troubleshooting Symptoms, Diagnosis, and Solution



Symptom	Diagnosis and solution
Overtemp light is on	The internal thermostat in the shunt unit is getting too hot. To fix this problem: • Reduce the average shunt power, • Reduce the ambient temperature of the air around the shunt, or • Increase the amount of air passing over the heat-sink fins. Once the LED turns on, only removing power will shut it off, even if the active shunt unit has cooled and is functioning again.
Bus Overvoltage faults from the drive with the Active Shunt functioning and the Overtemp light off	There are two situations where this can happen. 1. First, if the Bus Overvoltage trip level on the drive is too low. Since this is not adjustable the solution is to reduce the “activate” level on the Active Shunt. This is done be turning the Adjust pot counter-clockwise. 2. Second, if the regeneration power exceeds the shunt power for too long. It is possible for the drive to generate more power than the Active Shunt can handle. There are two possible solutions to this situation. • The first is to adjust the regeneration profile so that the drive generates less power for a longer time. The drive current limit parameters may be useful here. • The second is to reduce the shunt “activate” level. This turns on the shunt earlier in the regeneration profile and may help.

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