# Application Note

# USING THE CS5460A AUTO-BOOT MODE

## 1. Which EEPROMs Can Be Used?

Several industry-standard serial EEPROMs that will successfully run auto-boot with the CS5460A are listed below:

- Atmel

  AT25010
  AT25020
  AT25040

- National Semiconductor

  NM25C040M8
  NM25020M8

- Xicor

  X25040SI

These types of serial EEPROMs expect a specific 8-bit command word (00000011) in order to perform a memory download. The CS5460A has been hardware programmed to transmit this 8-bit command word to the EEPROM at the beginning of the auto-boot sequence.

### 1.1 Further Explanation of the Auto-Boot Sequence

The auto-boot sequence is terminated by writing a '1' to the STOP bit in the CS5460A's Control Register. This action is performed as the last command in the EEPROM command sequence. At the completion of the write to the Control Register (provided STOP bit = "1"), SCLK stops, and $\overline{CS}$ rises, thereby reducing power consumed by the EEPROM. At completion of the Auto-Boot sequence, the serial port will revert to functioning as a *slave*-mode interface. Therefore, if desired, the CS5460A registers can still be read by an external device, such as a central office controller, connected to the meter assembly by a bus interface.

### 1.2 Sample Auto-Boot Sequence

The serial data for such a sample sequence is shown below in single-byte hexidecimal notation:

| | |
|---|---|
| 40 00 00 61 | ;In Configuration Register, turn high-pass filters on, set K = 1. |
| 44 7F C4 A9 | ;Write value of 0x7FC4A9 to Current Channel Gain Register. |
| 46 7F B2 53 | ;Write value of 0x7FB253 to Voltage Channel DC Offset Register. |
| 4C 00 00 14 | ;Set Pulse Rate Register to 0.625 Hz. |
| 74 00 00 04 | ;Unmask bit #2 ("LSD" bit in the Mask Register). |
| E8 | ;Start performing continuous computation cycles. |
| 78 00 01 40 | ;Write STOP bit to Control Register, to terminate auto-boot initialization sequence, and also set the $\overline{EOUT}$ pulse output to Mechanical Counter Format. |

When the CS5460A is commanded by the EEPROM to perform a certain operation, the operation will not be pre-maturely terminated by the assertion of the Control Register's STOP bit. In the above example, the 'Start Conversions' command (0xE8) is issued from the EEPROM, and therefore the CS5460A will continue to perform continuous A/D conversions even after the STOP bit is asserted.

### 1.3 How do I reset the CS5460A in Auto-Boot Mode during Brown-Out/Black-Out conditions?

The power line that is to be metered may enter a black-out or brown-out condition at certain times, due to problems at the power plant or other environmental conditions (ground fault, electrical storms, etc.) In such conditions, it is important for the meter assembly to accomplish a proper reset,


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so that it can continue normal metering operations once the line power is restored. When the CS5460A is controlled by a microcontroller, the microcontroller is typically programmed (by the user) to handle these power-fail-reset situations. In the case of auto-boot, the CS5460A may be expected to reset itself (by re-executing the Auto-Boot sequence) whenever the line-power is restored. Figure 1 shows a reasonably reliable way to configure the CS5460A's $\overline{\text{RESET}}$ and $\overline{\text{INT}}$ pins of the CS5460A to restart the Auto-Boot sequence after a brown-out or black-out condition. This configuration employs a diode, a resistor, and a capacitor on the $\overline{\text{RESET}}$ pin in an attempt to allow the CS5460A to reboot after a sudden loss of power, followed by a reinstatement of power.

Note that in the above auto-boot example code set (see Section 1.2) the LSD bit is un-masked, in order to cause a high-to-low transition on the $\overline{\text{INT}}$ pin whenever the PFMON low-supply threshold is reached on the PFMON pin. If a power supply loss condition is sensed on PFMON, then the $\overline{\text{INT}}$ pin is asserted to low (because LSD is un-masked), which allows the BAT85 diode to quickly drain the charge on $C_{BOOT}$. But whenever the +5V power is restored, the resistor-capacitor network will force $\overline{\text{RESET}}$ to recharge slowly. The slow rise-time on the $\overline{\text{RESET}}$ pin can help to allow the oscillator circuitry and the CS5460A's internal reference circuitry enough time to stabilize before the device attempts to re-execute with the Auto-Boot sequence. This will allow the CS5460A to resume its normal metering operations after power is restored. (User must provide suitable resistor divider configuration on the PFMON pin, see Figure 1.) Use of this configuration does not guarantee that the CS5460A will reset properly, when exposed to *any* sudden disturbance in power.

In addition to the configuration described above, the designer should include sizeable common-mode capacitors to the VA+/VD+ pins (see Figure 1). Such capacitance on the analog/digital power supply pins will increase the amount of time over which the CS5460A will remain operational after power is lost, which therefore increases the chances that the CS5460A will successfully re-execute a proper reboot upon restoration of power. Suggested values are >47 µF (per pin) or >100 µF (total).

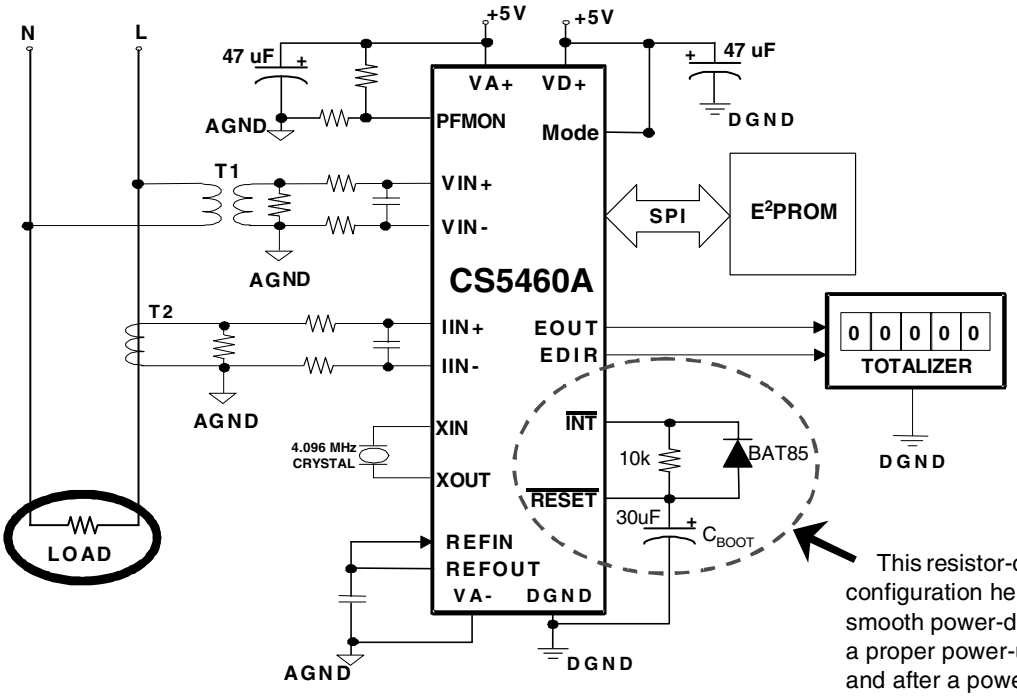


**Figure 1. CS5460A Auto-Boot Configuration: Automatic Restart After Power Failure**

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