# SpiderBus™

**SpiderAlert® Network Bus**

**SpiderAlert®**

**Design and Wiring Guide**

## 1. INTRODUCTION

**SpiderBus™** is SpiderAlert® network bus. It includes 4-7 wires:

- **A.** Two wires serve as **DATA BUS.**
- **B.** Two wires serve as **POWER BUS.**
- **C.** Two wires serve as **AUDIO BUS** (if SVC-580 units are connected to the SpiderBus™).
- **D.** An optional **BROADCAST** wire can be used for SVC-580 units (see SVC-580 installation instructions document DE7118, section 4.4).

For proper system's operation, pay attention to the following requirements, when designing the system's installation:

- **A.** If power supply unit other than PS-2 is used, the system may not function properly and the warranty will not be valid.
- **B.** The PS-2 maximum output current is 1A - the sum of all the SpiderBus devices current consumption must not exceed 1A.
- **C.** 10VDC at least should be supplied to every system's unit.
- **D.** Since the PS-2 output is 13.8V DC and the minimum supply voltage to each of the system's devices is 10V DC, the voltage drop on the power bus wires should not exceed 3.8DC.

If either of the previously parameters is exceeded, the SpiderBus™ must be split into 2 or more segments and between every 2 segments a repeater and power supply unit PS-2 (SRP-50 UPS, or SRP-51 UPS) should be inserted, as shown in figure 1, 2 and 3. Bus segmentation is also advantageous since it allows easier troubleshooting if a short circuit occurs anywhere along the bus.

Shielded wires should be used in areas in which excessive RF or Electro-magnetic interference exists, to minimize their effects on the data transmission.

The SpiderBus design includes 2 phases:

- **A.** General design (section 3).
- **B.** Equally and differently spaced devices design (section 4).

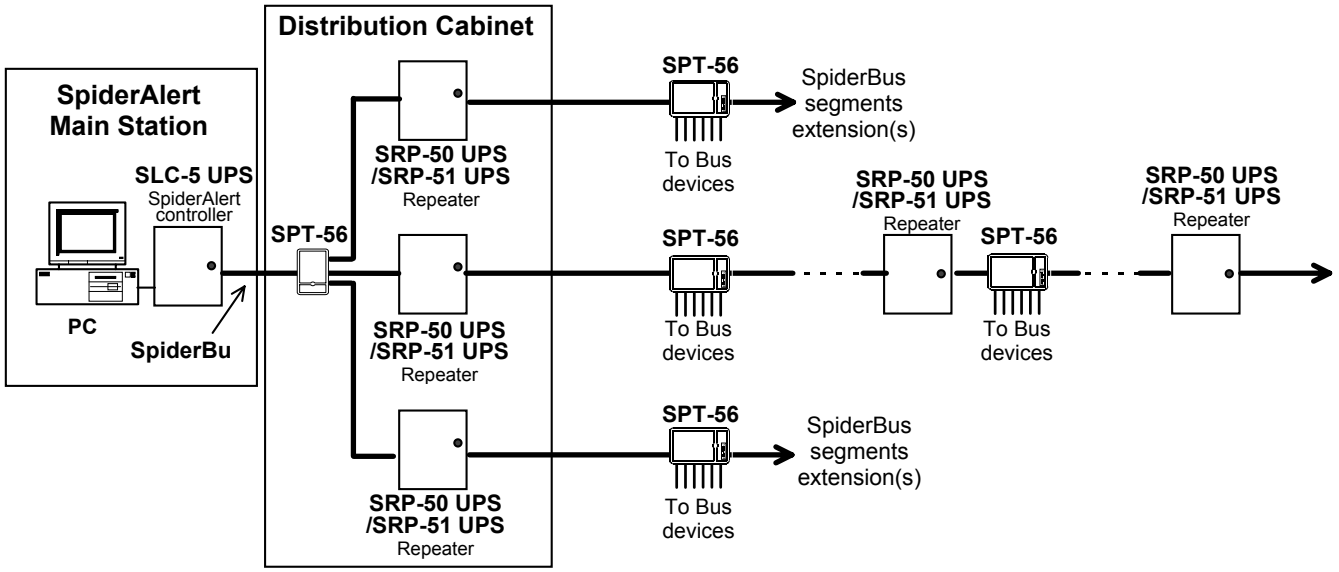


***Figure 1 - SpiderBus Segmentation***

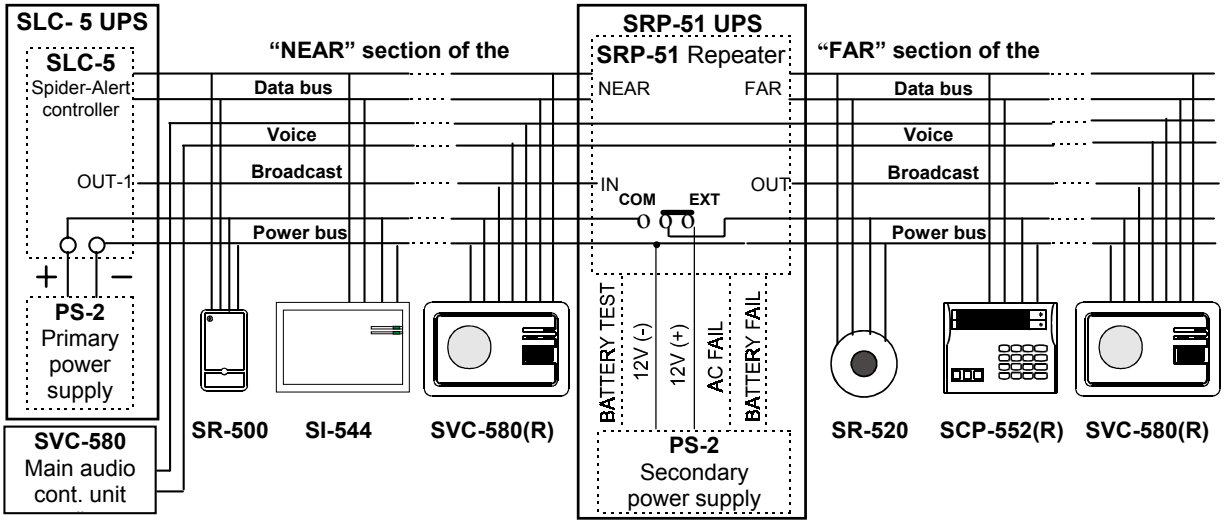


***Figure 2 - Detailed Block Diagram of an Extended SpiderBus with SRP-51 Repeater***

# 2. SPECIFICATIONS

**Data bus maximum capacitance:** 200 nF
**DC power supply:** 13.8V DC
**Minimum supply voltage to all SpiderAlert units:** 10V DC
**Voltage difference between (-) to COM terminals of all remote units:** 0 - 2 VDC (see section 6,4)
**Current Consumption for Bus Devices:** Refer to Table 1.

# 3. SPIDERBUS™ GENERAL DESIGN

## 3.1 Site Map Preparations

Get or prepare the site's installation map. The design can be done on paper first, but preferably on computerized files that can be also updated in the SpiderAlert software.

## 3.2 Devices Location on the Map

Write the bus devices names on the site map, according to the customer's requirements and the site's limitations.

## 3.3 Bus Wire Gauge Selection

When electrical current is flowing through a piece of wire, voltage is "lost" ("voltage drop") due to the wire resistance. A thick wire has low resistance while a thin wire has high resistance. Therefore, the voltage drop across a thick wire is smaller than across a thin wire.
The recommended cables are 4-wire cable (minimum), or 6-wire cable (3 twisted pairs) if audio communication is used. Category 5 cabling is acceptable.
Select the wire gauge according to the distances, the existing supply or the existing facility's wires. AWG 18 wire (∅ = 1.024 mm, 0.021 Ω per meter, 0.006 Ω per foot) is recommended for the SpiderBus™. AWG 20 wire (∅ = 0.813 mm, 0.033 Ω / meter, 0.01 Ω / foot) can be used.

## 3.4 Total Bus Current Calculation

Write the current consumption value of each device and output device like siren (see table 1), on the site map, near the device. This data will be used later in the calculations.

## 3.5 Total Current Consumption

Sum up the current consumption of all the SpiderBus™ devices (including their output devices currents). If the total current consumption is more than 1A, an additional repeater (including power supply unit) is required.

**Table 1 - Maximum SpiderBus devices current consumption**
(Devices names in alphabetical order)

| Device | Current | Device | Current | Device | Current |
|---|---|---|---|---|---|
| **PS-5** | 50mA | **SLC-5** | 35mA | **SR-521** | 15mA |
| **SCP-552** | 50 mA | **SPD-5000** | 21mA | **SR-521 ER** | 45mA |
| **SCP-552 R** | 50mA | **SPT-55/56** | 0 | **SR-522** | 15mA |
| **SCP-552 ER** | 80mA | **SR-500** | 8.8mA | **SVC-580(R)(*)** | 100mA |
| **SI-540** | 13mA | **SR-500 ER** | 38mA | **SVC-580(R)(**)** | 70mA |
| **SI-544** | 13mA | **SR-520** | 15mA | **SVC-580ER(*)** | 130mA |
| **SI-561** | 13mA | **SR-520 ER** | 45mA | **SVC-580ER(**)** | 100mA |

* With BROADCAST.
** Without BROADCAST.

***NOTE:*** *The maximum current supply from a SpiderBus™ power supply unit PS-2 (in the SLC-5 controller or SRP-50/SRP-51 repeater) is 1A. If the total current consumption of all the devices connected to certain power supply unit is 3A, for example, for this specific SpiderBus™ you must assign not less than 3 power supply units. This is a basic rule. The following steps will assist you to find out whether an additional power supply unit (together with repeater) is required.*

## 3.6 Bus Units Distances Recording

Write (on the site map, next to each device) the distance between each device to the closest power supply unit. The distance should be real wiring distance, not point-to-point distance on the map. This data will be used later in the calculations.

# 4. EQUALLY AND DIFFERENTLY SPACED DEVICES DESIGN

## 4.1 Identical, Equi-distant Bus Devices

If your SpiderBus design includes identical, equally spaced devices, without connection to output devices, use table 2 to find out the devices maximum quantity and spacing, without necessity to add repeater(s).

**Table 2 - Maximum Identical Devices Quantity**
(10m/30ft maximum equal spacing)

| Device Name | Max. Quantity |
|---|---|
| SVC-580 ER with Broadcast option | 7 |
| SVC-580 with Broadcast, SVC-580 R with Broadcast, SVC-580 ER without Broadcast | 10 |
| SCP-552 ER | 11 |
| SVC-580, SVC-580 R without Broadcast | 13 |
| SCP-552, SCP-552 R, SR-500 ER, SR-520 ER, SR-521 ER | 14 |
| Devices whose current is up to 15mA (*) | 25 |

* see table 1.

## 4.2 Design of Various, Differently Spaced Devices / with Output Devices

**A. <u>Introduction</u>**
If the power bus devices are not of the same type, not equally spaced, or output devices are to be connected to the devices, the total power bus voltage drop should be calculated, to find out if there is necessity to add repeater(s). The calculation process is described in step "C".

**B. <u>Device specific voltage drop per meter/foot</u>**
Whenever an electric current flows through an electric wire, there is a voltage drop on the wire, proportional to the wire resistance and to the electrical current level. Every bus device causes a specific current to flow through the SpiderBus power wires. We can say that every device "contributes" a part of the power bus voltage drop, proportional to its current and distance from the power supply unit. More than that, we can say that every device "contributes" a **specific voltage drop per meter/foot**. Table 3 details the specific voltage drop per meter/foot of the various bus devices and output devices.

**Table 3 - Devices Specific Voltage Drop Per Meter/Foot**

| Device Name | Specific Voltage Drop | |
|---|---|---|
| | Per Meter | Per Foot |
| Any low current bus device (*) | 0.001V | 0,0003V |
| SCP-552, SCP-552 R, PS-5, SR-500 ER, SR-520 ER, SR-521 ER | 0.003V | 0.001V |
| SCP-552 ER | 0.005V | 0.0016V |
| SVC-580, SVC-580R | 0,006V | 0,002V |
| SVC-580 ER | 0.008V | 0.0026 |
| Any other device/output device | (I x 0,066) (**) | (I x 0,002) (**) |

* Bus devices whose current consumption is less than 15mA (see table 1).
** I = Device current consumption (A).

***Note:*** *The values in table 3 are based on power bus whose wires gauge is AWG-20, but they can be used for all the recommended wire gauges (see par. 3.3), because they are based on the "worst case" of the devices current consumption.*

Specific voltage drop per meter, caused by any output device, or by any bus device, equals to its current consumption multiplied by 0,0066. To find the specific voltage drop per foot, use the number 0,002 instead of 0,0066.

For example, the specific voltage drop per meter (foot) of a bus device (or an output device) whose current consumption is 25mA equals to 0,0025 x 0,0066 = 0,00016 V/m (0,0002 V/ft.).

**C. Voltage Drop Calculation process**

The voltage drop on the power bus wires is the sum of the voltage drops caused by all the bus devices currents. To simplify the total voltage drop calculation, use the following equation:

$$T_V = V_{D1} + V_{D2} + .....+ V_{DN} < 3.8V$$

Where:

$$V_{Di} = S_i \times L_i$$

Voltage drop caused by device No. "i"

Specific voltage drop per meter/foot caused by device No. "i"

Distance meters / feet between device No. "i" and PS-2.

***Important Note:*** *If you use "specific voltage drop per meter", you have to use the distances in meters. If you use "specific voltage drop per foot" you have to use the distance in feet.*

Use the above equation and table 3 to find the total voltage drop on the Power Bus. If the total voltage drop exceeds 3.8V, it is necessary to add repeater(s).

**D. Example of Total Voltage Drop Calculation**

Let's assume that one SCP-552, two SI-544 and five SVC-580 units are designed to be installed along the SpiderBus at various distances from the PS-2. To find the total voltage drop across the SpiderBus, caused by these units, it is recommended to create a calculation-aid table, like table 4.

**Table 4 - Voltage Drop Calculation Example (Simplified)**

| No. | Device Name | Specific Volt. Drop (V) per meter (ft.) | x | Distance m (ft.) | = | Voltage Drop (V) |
|---|---|---|---|---|---|---|
| 1 | SCP-552 | 0.003 (0.001) | x | 50 (150) | = | 0.15 |
| 2 | SVC-580 | 0,006 (0.002) | x | 100 (300) | = | 0.6 |
| 3 | SI-544 | 0.001 (0.0003) | x | 100 (300) | = | 0,1 |
| 4 | SVC-580 | 0,006 (0,002) | x | 150 (450) | = | 0.9 |
| 5 | SVC-580 | 0,006 (0,002) | x | 200 (600) | = | 1.2 |
| 6 | SI-544 | 0.001 (0.0003) | x | 200 (600) | = | 0,2 |
| 7 | SVC-580 | 0.006 (0.002) | x | 250 (750) | = | 1.5 |
| | | | | Total SpiderBus Voltage Drop | | 4,65V |

**Conclusion**

The total power bus voltage drop, in the above example, is 4.65V. Since up to 3.8V voltage drop is allowed for every SpiderBus segment, additional repeater is needed).

# 5. INSTALLATION OF REPEATERS AND SPIKE SUPPRESSORS

## 5.1 Location of Additional Repeaters

If an additional repeater(s) is required, locate repeater(s) (on the site map first):

A. According to the current consumption (PS-2 max. current 1A).
B. Before a big cluster of bus devices.
C. In every building floor or wing.
D. Before long bus lines.
E. According the site restrictions (The installation may be restricted by the power supply units' location or where you are allowed to locate the repeater).

After inserting repeater(s) on the map, recalculate the new distances and the total current consumption of every bus segment (verify that the current does not exceed 1A). Also calculate the bus voltage drop (verify that the total bus voltage drop does not exceed 3.8V). If the calculations results are OK, install the repeater(s). If the results are unsatisfactory, perform again the location of the repeater(s), in a trial-and-error method, until the results are satisfactory.

## 5.2 SPT-55/SPT-56 Installation

1. Install one junction box and spike suppressor unit (SPT-55 or SPT-56) at least at the SLC-5 (refer to figure 1 and to the SPT-55 / SPT-56 installation instructions document).
2. Install SPT-55/SPT-56 at each repeater also (preferable).
3. Any time the SpiderBus™ exits and enters a building, install an SPT-55/SPT-56 at each end.
4. Install 10 feet ground rod (preferable) or cold water ground at each SPT-55/SPT-56. Keep the ground wire as short as possible, with very slight bends in the wire.

# 6. SpiderBus™ CHECK

## 6.1 Wiring Check

Check the SpiderBus™ wiring (before powering the system), by using any wiring tester.

## 6.2 SpiderBus Total Current Check

The total power bus current should be checked in every bus segment. To check the total power bus current, all the volume controls of the SVC-580(R) units (if installed) must be in maximum position (maximum current consumption).

Disconnect the wire that is connected to the "+12V" terminal of PS-2. Connect DC current meter, as shown in figure 3 (positive probe is connected to the +12V terminal and the "-" probe is connected to the power bus). Verify that the current is less than 1A. If the current exceeds 1A, that means that the design must be changed, by adding repeater(s).

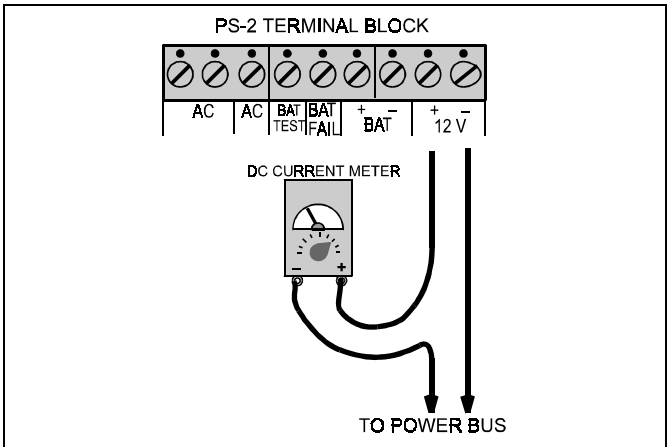


***Figure 3- Measuring Power Bus Current***

## 6.3 Far Located Devices Voltage Check

To check the far located devices power supply, all the volume controls of the SVC-580(R) units (if installed) must be in maximum position (maximum current consumption).
Verify (when the system is powered, by using a volt-meter) that at least 10V DC is supplied to each of the SpiderBus™ remote devices, between the 12V (-) and (+) terminals. If the voltage is less than 10V DC, add additional repeater SRP-51UPS or use larger diameter (smaller gauge number) for the power supply bus.

## 6.4 Voltage Between (-) & COM Terminals

The voltage difference between the negative (–) terminal and the DATA COM terminal of each remote unit should not exceed 2V and should not be a negative value (must not go below 0 Volts). This voltage difference is a result of the current flowing from the power supply to remote units that share the common supply bus. Measure the voltage across the DATA COM and (–) terminals with the voltmeter's positive probe on the (–) terminal and the negative probe on the DATA COM terminal (see Fig.4).

If the measured voltage is not as previously mentioned, the data bus DC level may exceed the proper level and data transmission may adversely affected. In this case, add additional repeater SRP-51UPS or use larger wires' diameter (smaller gauge number) for the power supply bus.

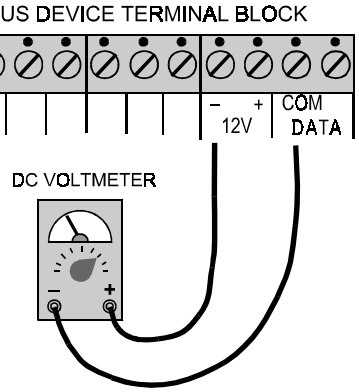


***Figure 4 - Measuring Voltage across (–) and COM Terminals***

***Caution:*** *If the SpiderBus™ wiring method, implementation and check are not performed as described in this document, the SpiderAlert network warranty will not be valid.*

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