Most PTI Remotes require a minimum of 12V (AC or DC). PTI Remote Power Supplies provide approximately 14VDC output unloaded and 12VDC output at rated amperage. Long runs of wire and multiple remotes powered on the same line can cause the voltage to drop below the required 12V. Multiple Power Supplies, separate wire runs, or larger gauge wire may be required to compensate for this voltage drop. Use the examples below to calculate the voltage drop at each remote location while preparing the wiring plan for your site. Please read the entire document before beginning, and be sure to follow all steps in order. Planning the wiring of a site and calculating voltage drop is a process that requires a high degree of technical knowledge; PTI recommends that this be done by a knowledgeable, trained professional.

1. When calculating voltage drop, it is helpful to draw a diagram of your site showing each remote, power supply, and the distance between them. You must know the measurement in feet between each remote, where the line's location, and run. To perform the calculation, you use the length of wire between each remote, which includes the straight line distance plus any extra wire needed for turns, depth for burial, or height to the overhead conduit. For the calculation to be correct, you must have the measurements as exact as possible. If unsure, it is better to round up by 10% to be safe.

2. You must know the current draw for each piece of equipment on a given line. The current draw in milliamps (thousandths of an amp) is given below for PTI devices. When powering other equipment, such as door strikes, HID readers, maglocks, or sirens from a Weigand, consider the current specifications of that equipment. Power door strikes, maglocks, cameras, sirens, and PTI devices from the same power supply can cause power spikes, underpowering the other devices. PTI recommends that you use a separate power supply for these items. Refer to the manufacturer's specs for the current draw to calculate voltage drops for these items.

    ❖ The actual amperage rating of the Power Supply (1, 2, 4, 6, 10A) has no bearing on the voltage calculation. You still must select a power supply with a sufficient amperage rating to support the total current draw of all remotes on site. See the Power Supply Installation Manual for details on this.

Device Type	Current Draw
Keypad w/wo Intercom	300mA
Wired Door Alarm Mux	300mA
Wireless Door Alarm Mux	500mA
PWIE	300mA
8-Channel Relay Board	500mA
RB5 Relay Module	120mA

❖ If the keypad supports a camera or prox reader, include the current draw from the additional devices in the amperage calculations. This rule also applies to additional devices connected to a PWIE.

3. You must know the resistance in Ohms per foot for the wire used. The table below shows the resistance per foot of wire for the cable that PTI sells. We strongly recommend using this cable to ensure you have the correct type to support the system. If you are using a different wire, refer to the specifications provided by the manufacturer. PTI strongly recommends that you not use wire gauges smaller than 18 AWG for power or data when installing our gate system. Larger gauges are acceptable (16, 14, 12, and 10).

AWG	Ohms/1000 Feet of Wire	Ohms/100 Feet of Wire	Ohms per Foot of Wire
18	6.92	0.692	0.00692
16	4.459	0.446	0.00446

4. The Voltage calculation must be done separately at each remote unit on a line, beginning with the first remote closest to the power supply and calculating at each remote further away from the power supply through the last one on a line. The calculation is as follows:

$$V - (S) \times (D \times R) = X$$

Refer to Examples I – IV on the following pages. It is essential to do this calculation correctly, completing the calculations in parenthesis first and multiplying the results before subtracting from V. If you do this in the wrong order, the answer will be incorrect.

V	The voltage comes into the remote from the power supply or the previous remote in the line. Generally, PTI Remote Power Supplies generate 14VDC at the source, with the voltage decreasing at each remote.
S	Total of the Amperage for the remote you currently are calculating for plus any remotes connected to the the same line further away from the power supply beyond the remote you are currently calculating.
D	The length of wire in feet is between the previously remote and the remote you are currently calculating.
R	Resistance in Ohms per foot of wire. (Varies by the wire type you are using)
X	After the voltage drop calculation, the voltage at this remote uses this number as V in the calculation for the next remote in line further away from the power supply.

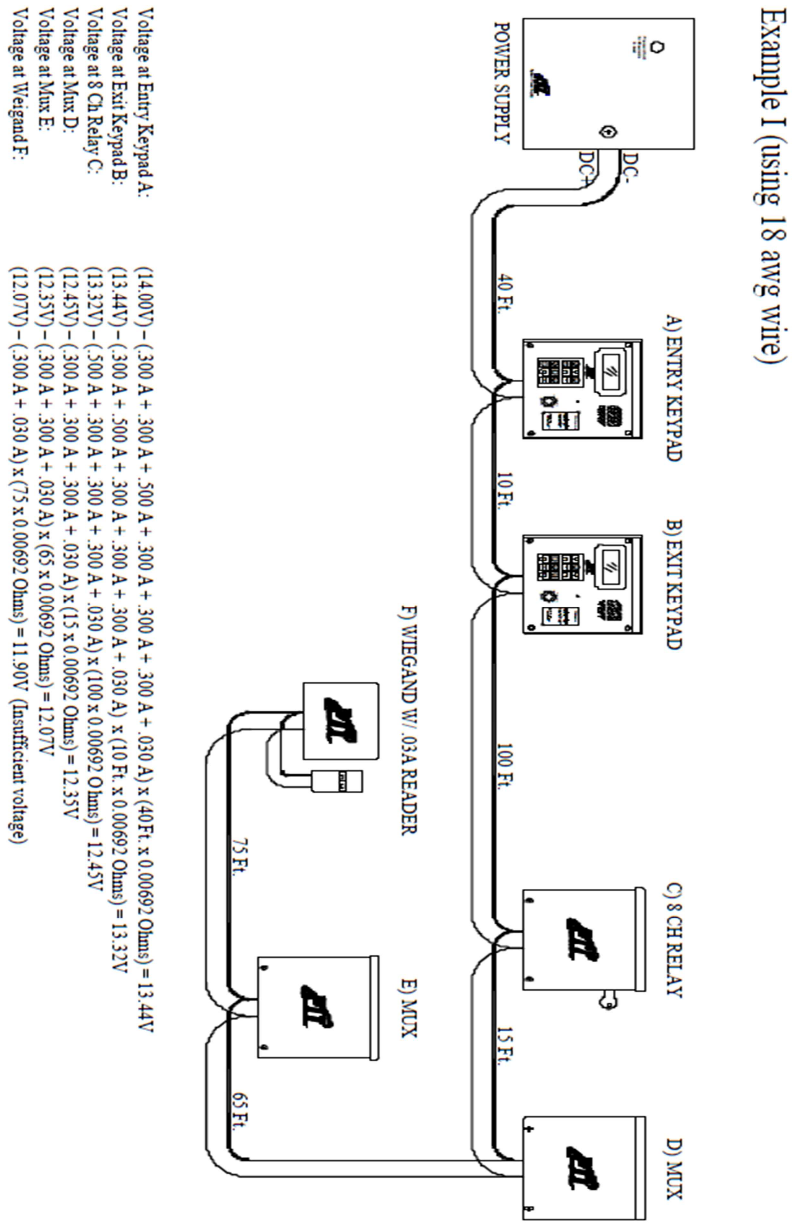
5. When you complete the calculations for a particular line, verify that there is a minimum of 12V at the last remote. There are three possible solutions if the voltage drops below 12V anywhere on the line, as in Example I on Page 3.

   a. As long as the power supply amperage is rated high enough to handle all of the remotes on one power supply, consider running some of the remotes on a separate line, as in Example II on Page 4. You will have to run additional wires, but this is the best way to deal with this issue.

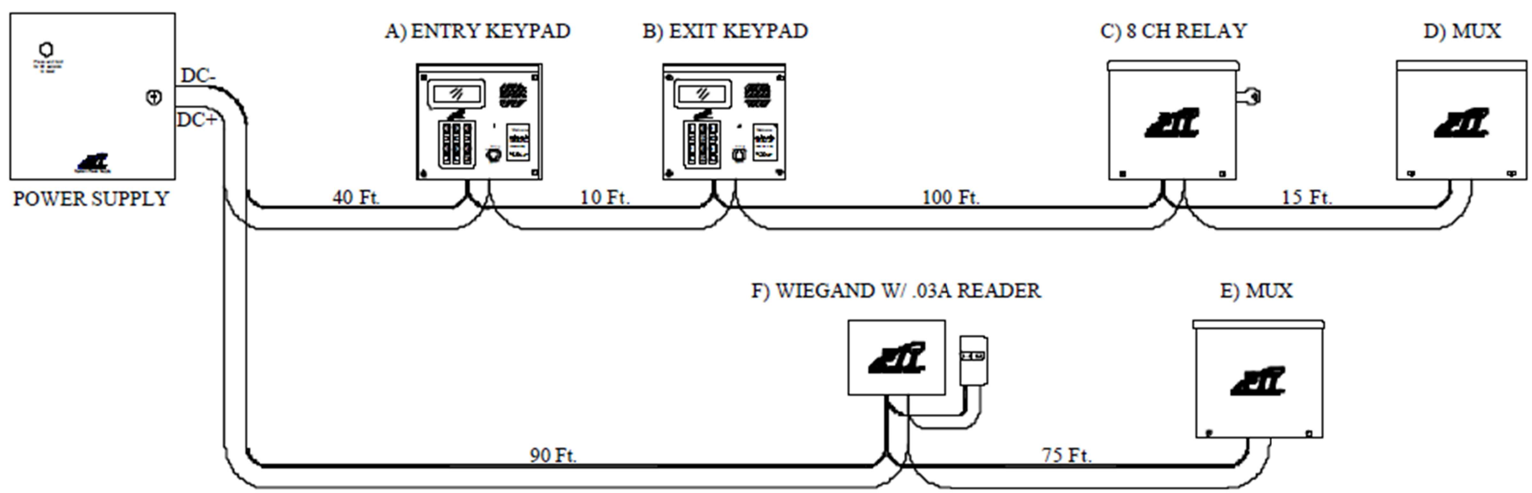
   b. Install an additional power supply next to the first one and run some of the remotes on this separate line, as in Example III on Page 5. Connect the negative wire from one power supply to the negative but keep the positive system wires for each line separate. This method keeps the ground as a common reference point without interfering with the voltage. If you need to reset the site later, you must press both reset buttons simultaneously.

-Continued on Next Page-

c. Install an additional power supply on the line elsewhere on the site, as in Example IV on Page 6. This installation can be anywhere along the convenient line. An RB5 Relay module is required so that one person, pressing the reset button at the main power supply, can reset the system later. Resetting the main power supply cuts the power to the RB5, that in turn cuts the power to the other power supply. You must remember to include the current draw of the RB5 in the calculations.

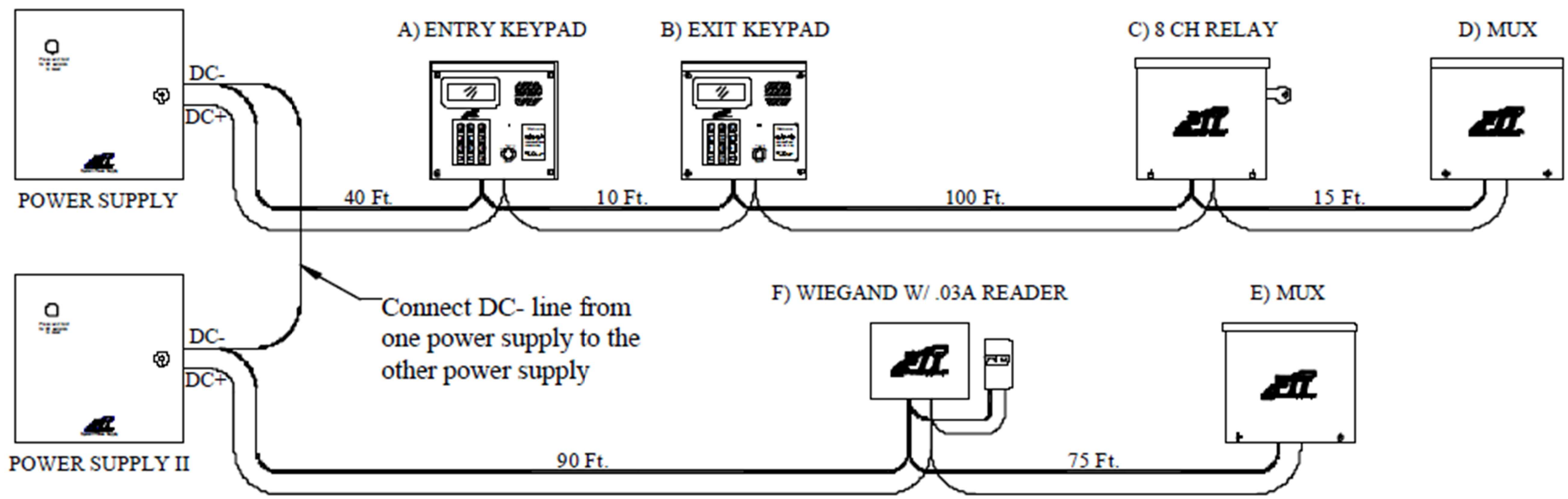


Example II (using 18 awg wire)



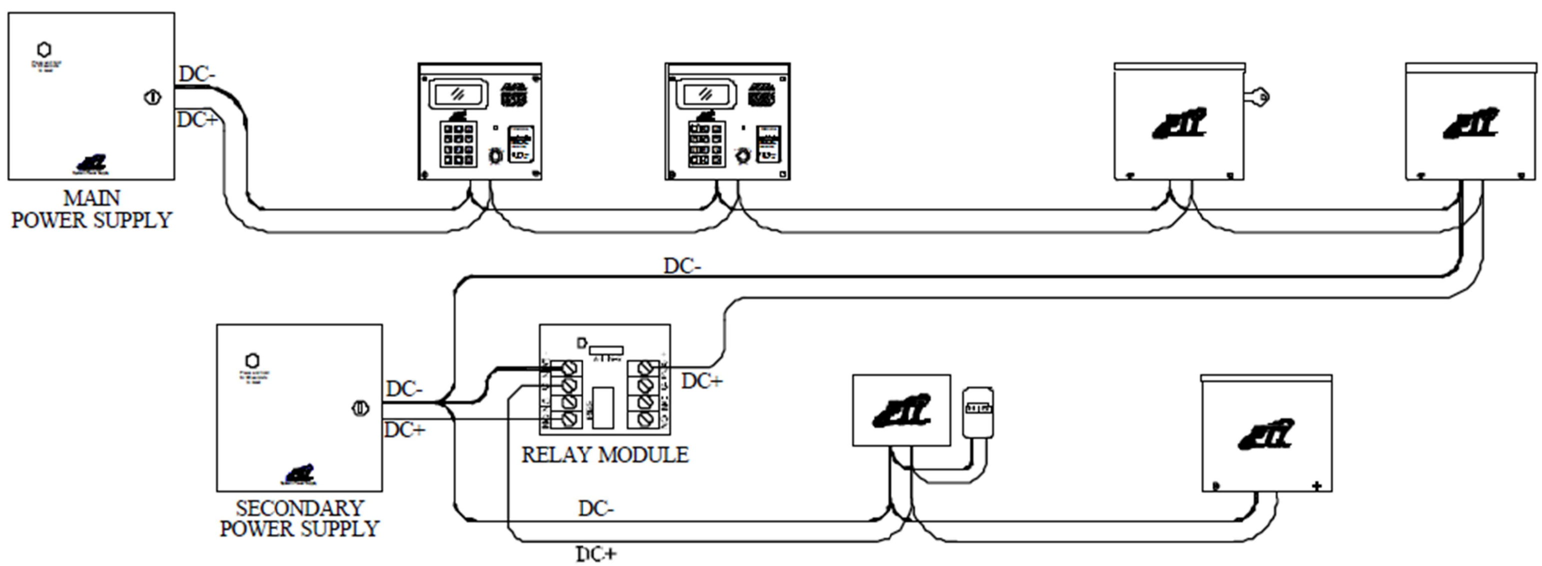
Voltage at Entry Keypad A:	(14.00V) – (.300 A + .300 A + .500 A + .300 A) x (40 Ft. x 0.00692 Ohms) = 13.61V
Voltage at Exit Keypad B:	(13.61V) – (.300 A + .500 A + .300 A) x (10 Ft. x 0.00692 Ohms) = 13.53V
Voltage at 8 Ch Relay C:	(13.53V) – (.500 A + .300 A) x (100 x 0.00692 Ohms) = 12.98V
Voltage at Mux D:	(12.98V) – (.300 A) x (15 x 0.00692 Ohms) = 12.95V
Voltage at Weigand F:	(14.00V) – (.300 A + .030 A + .300 A) x (90 x 0.00692 Ohms) = 13.61V
Voltage at Mux E:	(13.61V) – (.300 A) x (75 x 0.00692 Ohms) = 13.45V

Example III (using 18 awg wire)



Voltage at Entry Keypad A:	(14.00V) – (.300 A + .300 A + .500 A + .300 A) x (40 Ft. x 0.00692 Ohms) = 13.61V
Voltage at Exit Keypad B:	(13.61V) – (.300 A + .500 A + .300 A) x (10 Ft. x 0.00692 Ohms) = 13.53V
Voltage at 8 Ch Relay C:	(13.53V) – (.500 A + .300 A) x (100 x 0.00692 Ohms) = 12.98V
Voltage at Mux D:	(12.98V) – (.300 A) x (15 x 0.00692 Ohms) = 12.95V
Voltage at Weigand F:	(14.00V) – (.300 A + .030 A + .300 A) x (90 x 0.00692 Ohms) = 13.61V
Voltage at Mux E:	(13.61V) – (.300 A) x (75 x 0.00692 Ohms) = 13.45V

Example IV (using 18 awg wire)



Voltage at Entry Keypad A:	(14.00V) – (.300 A + .300 A + .500 A + .300 A + .120 A) x (40 Ft. x 0.00692 Ohms) = 13.58V
Voltage at Exit Keypad B:	(13.58V) – (.300 A + .500 A + .300 A + .120 A) x (10 Ft. x 0.00692 Ohms) = 13.50V
Voltage at 8 Ch Relay C:	(13.50V) – (.500 A + .300 A + .120A) x (100 x 0.00692 Ohms) = 12.86V
Voltage at Mux D:	(12.86V) – (.300 A + .120 A) x (15 x 0.00692 Ohms) = 12.80V
Voltage at Relay Module:	(12.80V) – (.120 A) x (125 x 0.00692 Ohms) = 12.70V
Voltage at Weigand F:	(14.00V) – (.300 A + .030 A + .300 A) x (10 x 0.00692 Ohms) = 13.96V
Voltage at Mux E:	(13.96V) – (.300 A) x (75 x 0.00692 Ohms) = 13.80V