



# Technical Bulletin

**Subject:** Network Fundamentals

**Scope:** Black Widow and Galaxy Users

## Networking Concepts

The following key concepts will be covered in this bulletin:

- Network
- Master Machine
- Network Bus
- Parallel Connection
- Terminal Resistors
- Network Interface
- Network Bus Cables

### ***Network:***

A network is a group of dart machines, in one location, that are connected together to allow machine to machine communications. Arachnid uses the term "**Arachnet**" to refer to a network of connected dart machines.

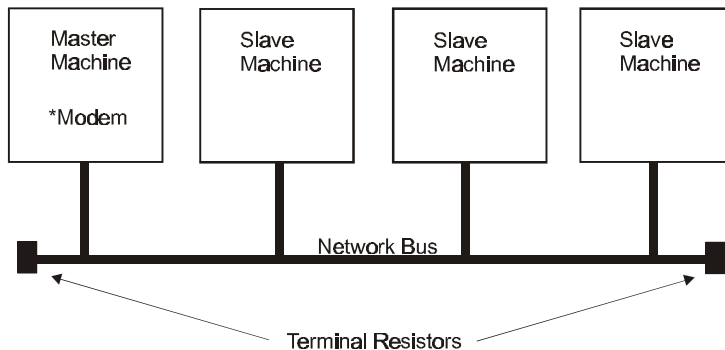
Networking, or machine to machine communication, should not be confused with modem communication. Modem communication is where a central computer communicates, via an outside telephone line, with a single dart machine (or network of dart machines) on location. Networking only connects the dart machines together within a location.

### ***Master Machine:***

In any network of dart machines, only one machine serves as the master. All other machines are called slaves. The following rules apply when designating a machine as the master:

1. The master machine always contains the modem. (Note: Not all master machines have a modem. There is no point in networking an all Galaxy location unless you are using a modem to collect stats. However, it is possible, even desirable to network a mixed (Galaxy and Black Widow) or an all Black Widow location, even if you are not using modems.)

2. When Black Widows and Galaxy's are combined in a network, a Black Widow must be the master.



**Figure 1. Typical Network Components**

## ***Network Bus:***

The wires that connect machines together are collectively called the Network Bus, or just plain Bus. Each machine connected to the Bus is called a **Node**. If the Bus were compared to a street, then each Node would be the same as a house on that street, each with a unique address or **Node Number**. Just as you would write a letter to a friend, communication on the Bus consists of **Packets**, each a discreet amount of information, addressed to a particular Node.

## ***Parallel Connection:***

Communication on the Bus is a little different than the way your mail gets delivered. When one Node sends a Packet it gets put on the Bus. Once on the Bus it goes past all the Nodes. Each Node looks at the address on the Packet. If it is addressed to them, it is read, if not it is ignored. It does not go through each Node (Serial Connection), it just goes past each Node. If no one is home to see if it belongs to them (the addressed Node is turned off) it will not be delivered. Once the Packet reaches the end(s) of the Bus, it is thrown away whether it was read or not. There are no return deliveries the next day.

## ***Terminal Resistors:***

To understand why Packets are removed, think of the Bus as a very narrow street, allowing traffic to travel in only one direction at a time. Even though it is a two-way street and Packets can go in either direction, there isn't any room to pass. When two Packets meet, going in opposite directions there is always a fatal **Collision**.

In order to avoid Collisions, a **Terminal Resistor** is placed at both ends of the Bus. When a Packet reaches the resistor it is absorbed and removed from the Bus. Without the resistor, the Packet would “bounce” off the ends of the wires and head back in the opposite direction.

Figure 1, shows the Terminal Resistors on each end of the Bus. The resistors are applied to the bus by setting dip switch number 3 to the ON position in each machine at the end of the network.

### ***Network Interface:***

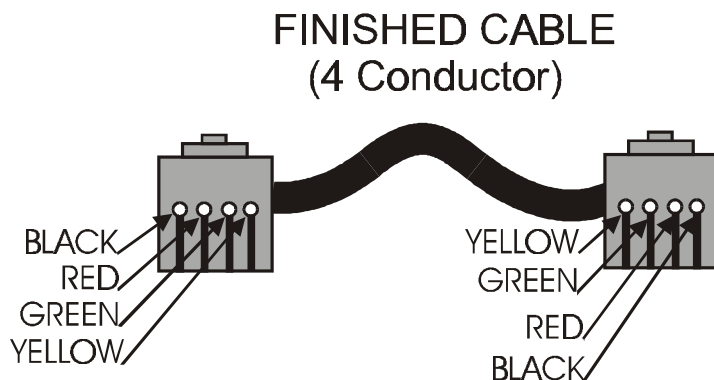
Looking again at Figure 1, we can see the Network Bus, which is the horizontal line with a Terminal Resistor at each end. The vertical lines leading to each machine would be the **Network Interface**.

A Network Interface is required between the Bus and each machine's CPU (Central Processing Unit). The interface takes care of all the machine to machine communications as directed by the CPU. In the Black Widow the interface is an optional card plugged into an ISA slot on the main board. In the Galaxy it is permanently installed on the main board as chips U18, U24, U20, and dip-switch packet SW1.

Both configurations provide for the same functionality; a dip-switch to enable the terminal resistor and two jacks to plug the Bus cable into (COM IN and COM OUT).

### ***Network Bus Cables:***

On Arachnet networks, normal 4-wire phone cables are used to construct the Bus. The cable should be equipped with a modular RJ-11 male connector at each end. Figure 2, shows the proper orientation of the wires within the connectors.



**Figure 2. Connection Diagram**

Notice in Figure 2, that the two black wires are on the outside and the two yellow wires are on the inside when the connectors are held side-by-side. When making custom phone cables, make sure the connectors are attached according to the diagram on all cables in the network. Be sure to check pre-made cables for proper connector attachment - never assume they are properly constructed.

### Cable Type and Length.

A normal **flat** modular phone cable is adequate for short runs between machines of less than 15 feet. For cable runs longer than 15 feet it is best to place a modular phone jack on the wall behind each machine and then run **round** phone cable between the jacks. Flat cable can then be run the short distance from the wall jack to the machine. When using round cable and wall jacks, care must be exercised in wiring these devices to assure proper wire color orientation.

When placing any cable, avoid running next to any noise sources such as: electrical wiring, fluorescent or neon light fixtures and do not make the cable any longer than necessary.

### Interface Connections.

Connecting the machines together, creating the Bus, is a simple matter of plugging the ends of the cables into the proper jacks at each machine. Arachnid uses two jacks on each machine to accomplish this: Communications In (COM IN) and Communications Out (COM OUT).

Figure 3, is a typical network, showing the COM IN to COM OUT convention used to create the Network Bus.

### Connecting Multiple Games (One containing modem on end of network)

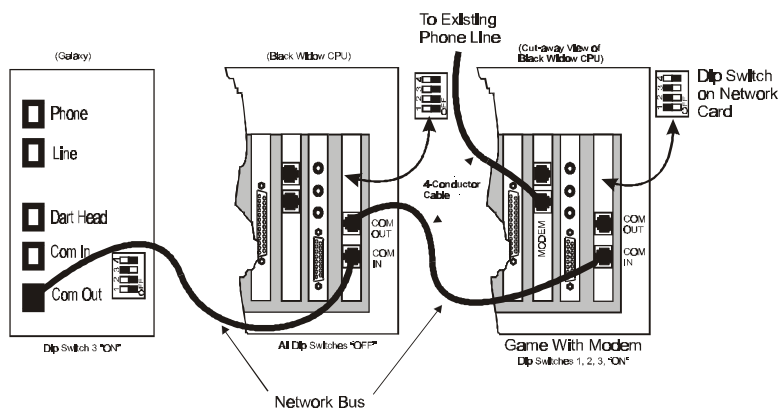


Figure 3. Typical Network

### ***Putting it all together:***

Understanding these network concepts should help in setting up, running and troubleshooting dart machine networks. For specifics on setting up an Arachnet at a location see the following Arachnid Documents:

The Black Widow's User Manual, P/N 41173

Arachnid League Master System, P/N 31681

Galaxy Modem and Phone Line Installation Instructions, P/N 35793

Any question contact Arachnid Technical Support at:

[techsupport@bullshooter.com](mailto:techsupport@bullshooter.com)

Or call 800-435-8319