



Modem Installation and Networking Instructions

P/N 36870
Rev F

Introduction

The following instructions cover connecting a phone line to an incoming phone source, installing a modem, and setting up a network of machines in one location. The installation of modems and networking of machines completes the League Master System. This allows the user to transfer league information to and from the dart machines to completely automate the league process.

WARNING: DISCONNECT ELECTRICAL POWER TO MACHINE BEFORE PROCEEDING!

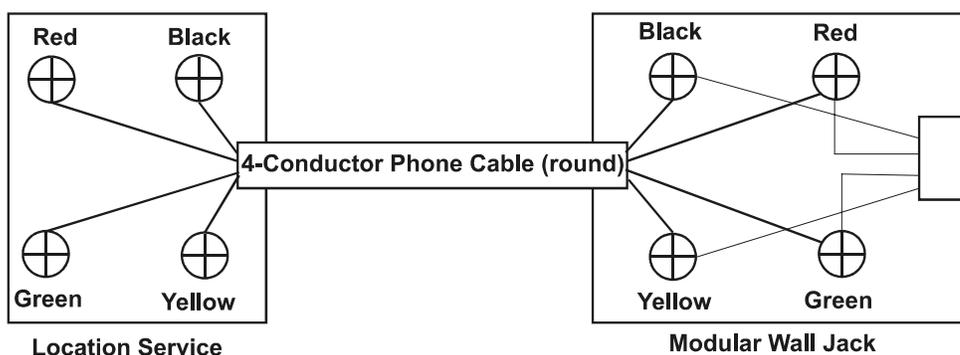
Installing the Phone Line and Modem

Recommended Parts/Equipment for Installation:

- 4-conductor modular phone cable
- 4-conductor round phone cable
- RJ11 connectors & crimping tool
- Modular phone jacks and screws
- Modular "T" adapters
- Phone line polarity tester
- Phone for listening to newly installed phone line
- Internal modems

Phone Line Installation

It is best to connect the phone line where the **service enters the building**. This will avoid problems from existing wire connections that might be poorly made and other equipment that might cause electrical interference. When installing a phone line, it is best to use 4-conductor round phone cable (see Figure 1). Modular wall jacks and screws are recommended for mounting on the wall behind the dart machine. After mounting the wall jack, connect like colors (red to red, green to green, etc.). When the wall jack is completely wired, plug in the phone line polarity tester. A red light means the polarity is reversed; switch the red and green wires in the wall jack and test again. You should have a green light on the tester. If the light does not light at all, this indicates that you have no connection to the wall jack. (Read the instructions that came with your phone line polarity tester to see if the indications differ from the above.)



NOTE: In some cases, black and yellow are not used at the location's service.

Figure 1

When testing is completed, take a modular (flat) cable with the ends attached and plug one end into the wall jack and the other end into the **LINE** jack on the dart machine's mainboard (Galaxy and Galaxy II) or the Modem (Black Widow).

If it is not possible to install the phone line where the service enters the building, a modular "T" adapter can be used (though not recommended) at an existing phone jack at the location. After connecting the "T" adapter to the wall jack, use the phone line polarity tester to locate which of the two jacks has the correct polarity. Connect the modular phone line to the dart machine into that jack. Do not use a modular (flat) cable run over 15 feet. If it is necessary to run the flat cable more than 15 feet, it will be necessary to run round cable and install a modular wall jack closer to the machine.

Modem Installation

WARNING: UNPLUG THE MACHINE FROM ELECTRICAL POWER BEFORE INSTALLING THE MODEM

Galaxy:

Remove the four "thumb nuts" that hold the mainboard in place. Remove all harness connectors, then remove the mainboard. Carefully push the modem into the socket provided (see Figure 2). **Be sure to install the modem in the proper direction. Pin one is clearly marked on the modem, and also on the mainboard.** Make sure that pins are not bent and fully seated in the socket. Re-install the mainboard using only 3 "thumb nuts", as one of the screws is now located directly under the modem (therefore, not accessible). Re-attach the wire harness connections.

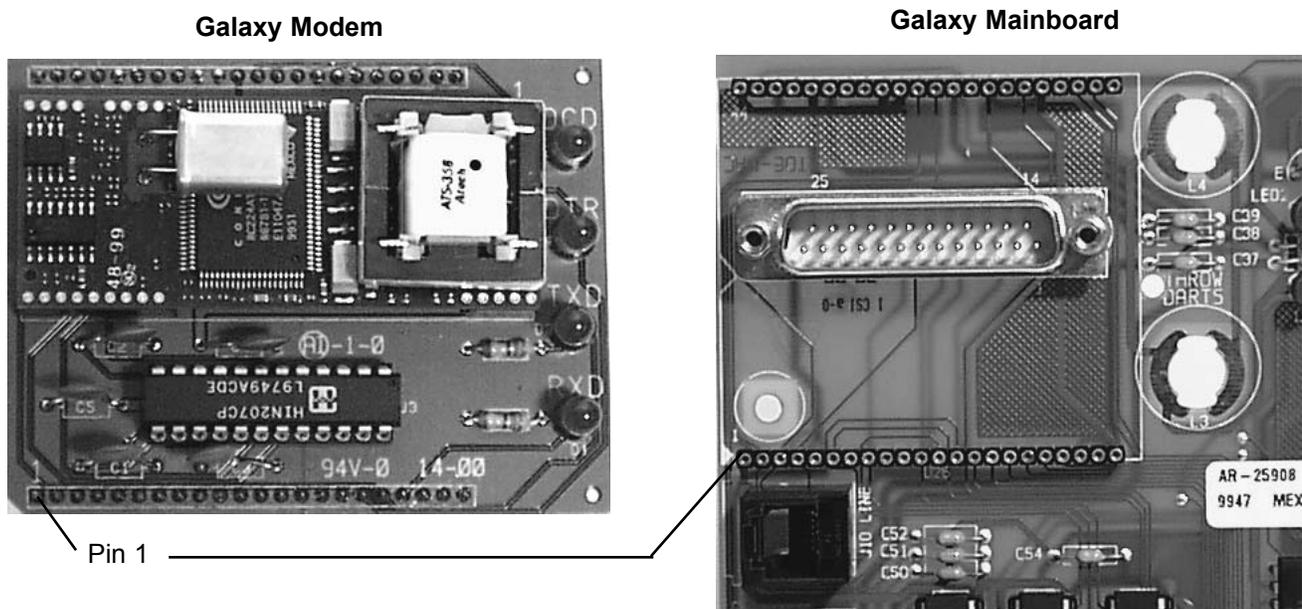
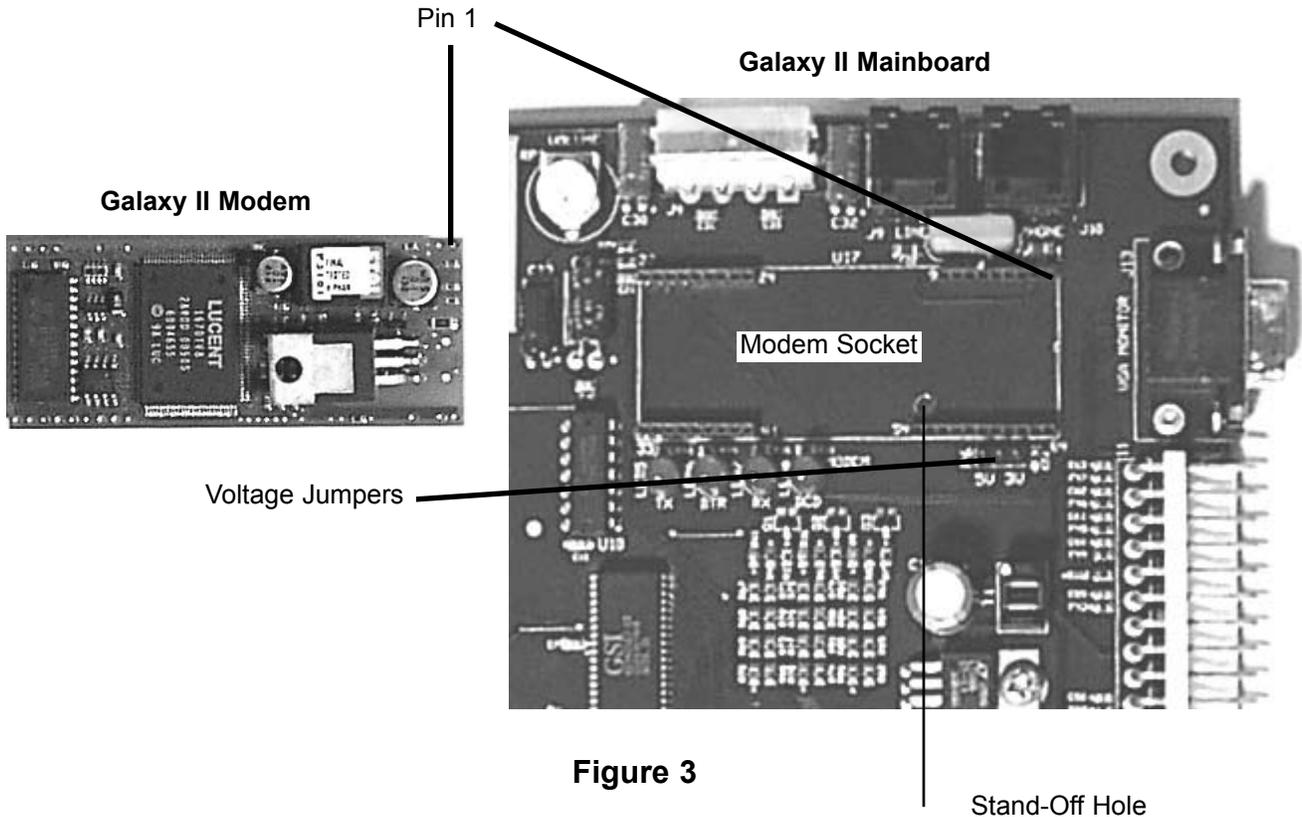


Figure 2

Galaxy II (GII):

Remove all harness connectors. Remove the mainboard from the machine. Locate pin 1 on the modem - look at the back of the modem. There are four sets of pins - one set at each corner of the modem. Find the corner with only two pins, starting from the corner of the board they are pins 1 and 2. Now locate socket 1 on the mainboard. **Carefully push the modem into the socket, making sure pin one is in the proper location and the stand-off is lined up with the stand-off hole on the mainboard** (see Figure 3). Connect the voltage jumper across the two pins indicating the 5 volts. Re-install the mainboard and re-attach the harness connections.



Black Widow:

Refer to the Black Widow Operator's Manual for instructions on installing a modem in these machines.

Testing the Phone Line (all machines)

To test the phone line, plug a telephone into the **PHONE** jack on the mainboard (Galaxy and Galaxy II) or the Modem (Black Widow). Lift the phone's handset and listen for a dial tone. Make a local call and listen for noise on the line (static, buzzing, etc). If noise is present, check all connections and make sure the line is not running past or over any fluorescent lighting, neon lights, power lines, etc. If noise can't be eliminated, try connecting a phone at the service box where it enters the building. If you believe that the noise is coming from outside the building, you will need to contact your local phone company.

If you have a dial tone and the call you make sounds clear, have someone call the machine and make sure the phone connected to it rings. This test verifies that you have the correct number for the line connected to the machine.

Preparing the Machine for Modem Use in the Test/Setup Mode

Galaxy:

Follow these steps to set up the Galaxy Machine containing the modem (see also Networking below):

1. Activate the "Test/Setup" mode by pressing the **Test** switch on the mainboard. This must be done on initial power up, when the screen reads "PRESS TEST SWITCH NOW" (see the Galaxy manual for more details on using the Test/Setup mode functions).
2. **Set the Time/Date:** From the Main Test Menu, select **Set-Up Mode > Machine Setup Menu > Time/Date Setup**. Set the clock to the proper time and date (using 24 hour format - 3 a.m. = 0300, 3 p.m. = 1500, etc).
3. **Set the Machine Name:** From the Main Test Menu, select **Set-Up Mode > Machine Setup Menu > Input Machine Name**. Give each machine a unique name (such as FOXYS I, FOXYS II, etc.).
4. **Set the League Password:** From the Main Test Menu, select **Set-Up Mode > Game Setup Menu > League Password Entry**. Enter the league password. If the machine is to be used with Operator Cards or a Modem, a password must be entered that matches the Location Password used in Dartman (and on the Operator Cards).
5. **Set The Node Number:** From the Main Test Menu, select **Communications > Arachnet Setup Menu > Set Machine to Node ____**. Press the **Enter Button** to change the node number for this machine (1 to 16). Each Galaxy machine in a location must have a different node number. Select **Find a Free Node** and press the **Enter Button** to configure the node in memory or to find an unused node in an existing network (see Networking below). This screen will display the node numbers assigned to the various machines. Up to 16 Galaxys can be added to a network of dart machines.
6. **Set the Call Window:** From the Main Test Menu, select **Communications > Modem Setup Menu > Modem Answer Setup**: Set the number of rings before the modem answers incoming calls, outside the call window (the first field (**Answer After**) (0 to 15), the Call Window (**Except During the Hours of 0300 thru 0600**), and the number of rings before the modem answers incoming calls during the Call Window (**Answer After**) (0 to 15).

Note: If the number of rings is set to 0 (zero) in the first field, then the modem will never answer. In order for Auto-calls to work properly the second field must be set to 1 or 2 rings only.

Galaxy II (GII):

Follow these steps to set up the Galaxy II Machine containing the modem (see also Networking below):

1. Activate the "Test/Setup" mode by pressing the **Test** switch on the mainboard. (See the Galaxy II manual for more details on using the Test/Setup mode functions).
2. **Set the Time/Date:** From the Main Test Menu, select **Machine Setup Menu > Time Settings Menu > Set Time/Date**. Set the clock to the proper time and date (using 24 hour format - 3 a.m. = 0300, 3 p.m. = 1500, etc).
3. **Set the Machine Name:** From the Main Test Menu, select **Machine Setup Menu > Input Machine Name**. Give each machine a unique name (such as FOXYS I, FOXYS II, etc.).
4. **Set the Modem Password:** From the Main Test Menu, select **Communications Menu > Modem Menu > Input Modem Password**. Enter the league password. If the machine is to be used with a Modem, a password must be entered that matches the Location Password used in Dartman.
5. **Set The Node Number:** From the Main Test Menu, select **Communications > Network Menu > Reconfigure Network**. Choose **Yes** to run the configuration utility. This must be done on single machine locations as well as on multiple machine networks (see Networking below).

6. **Set the Call Window:** From the Main Test Menu, select **Communications > Modem Menu > Modem Call Window**: Set the number of rings before the modem answers incoming calls, outside the call window (the top field) **Answer After (0 to 15) ring(s)**, the Call Window (**Except between 3:00 a.m. and 6:00 p.m.**), and the number of rings before the modem answers incoming calls during the Call Window **Answer After (0 to 15) ring(s)**.

Note: If the number of rings is set to 0 (zero) in the top field, then the modem will never answer. In order for Auto-calls to work properly the bottom field must be set to 1 or 2 rings only.

Black Widow:

Follow these steps to set up the Black Widow Machine containing the modem (see also Networking below):

1. Activate the "Test/Setup" mode by pressing the **Test** switch on the CPU. (See the Black Widow manual for more details on using the Test/Setup mode functions).
2. **Set the Time/Date:** From the Main Test/Setup Menu, select **Setup > Machine Setup > Time Settings > Time and Date Settings**. Set the clock to the proper time and date (using 24 hour format - 3 a.m. = 0300, 3 p.m. = 1500, etc).
3. **Set the Machine Name:** From the Main Test/Setup Menu, select **Setup > Machine Setup > Machine Name and Password > Machine Name**. Give each machine a unique name (such as FOXYS I, FOXYS II, etc.).
4. **Set the Modem Password:** From the Main Test/Setup Menu, select **Setup > Machine Setup > Machine Name and Password > Modem Password**. Enter the league password then re-enter it for verification. If the machine is to be used with a Modem, a password must be entered that matches the Location Password used in Dartman.
5. **Set The Node Number:** From the Main Test/Setup Menu, select **Setup > Modem and Arachnet Setup > Arachnet Setup > Reconfigure Arachnet**. Choose **Yes** to run the configuration utility. This must be done on single machine locations as well as on multiple machine networks (see Networking below).
6. **Set the Call Window:** From the Main Test/Setup Menu, select **Setup > Modem and Arachnet Setup > Modem Menu > Modem Setup**: Set the number of rings before the modem answers incoming calls, outside the call window (the top field **Answer After (0 to 15) ring(s)**, the Call Window (**Except between 3:00 a.m. and 6:00 p.m.**), and the number of rings before the modem answers incoming calls during the Call Window **Answer After (0 to 15) ring**.

Note: If the number of rings is set to 0 (zero) in the top field, then the modem will never answer. In order for Auto-calls to work properly the bottom field must be set to 1 or 2 rings only.

The preceding setup requirements are for single machine locations. If you have multiple machines in one location, continue on to learn about Networking.

Networking

Overview

This **Machine to Machine** feature allows multiple machines in one location to be connected together. Networking allows one machine to act as a “master” during communications, eliminating the need to communicate with each machine individually.

Arachnid uses the term “**Arachnet**” when referring to a network of connected dart machines. All Black Widow, Galaxy II and Galaxy machines in one location can be networked, allowing one **master machine** to handle communications between the central computer and all machines on the Arachnet. It is possible to connect up to 16 Galaxy and 48 Black Widow or Galaxy II machines in one network.

Choosing a Master Machine

When you have a combination of machine types in a location, not just any machine can be the master machine (the machine with the modem). The master must be chosen in the following order: Black Widow > Galaxy II > Galaxy. This has no relation to how the machines are connected in series, but is related only to which machine serves as the master for the network. If you have all three types - a Black Widow must be the master. If you have Galaxy and Galaxy II machines - a Galaxy II machine must be the master. If you have Black Widow and Galaxy II machines - a Black Widow must be the master.

Node Numbers

Each machine on an Arachnet is assigned a unique address or **Node** number used for machine to machine communications. Node numbers 1 - 16 are reserved for Galaxy machines and 17 - 64 are used for Black Widow and Galaxy II machines. Galaxy node numbers must be set manually at each machine; Black Widow and Galaxy II nodes are auto-assigned when configuring the network from the master machine.

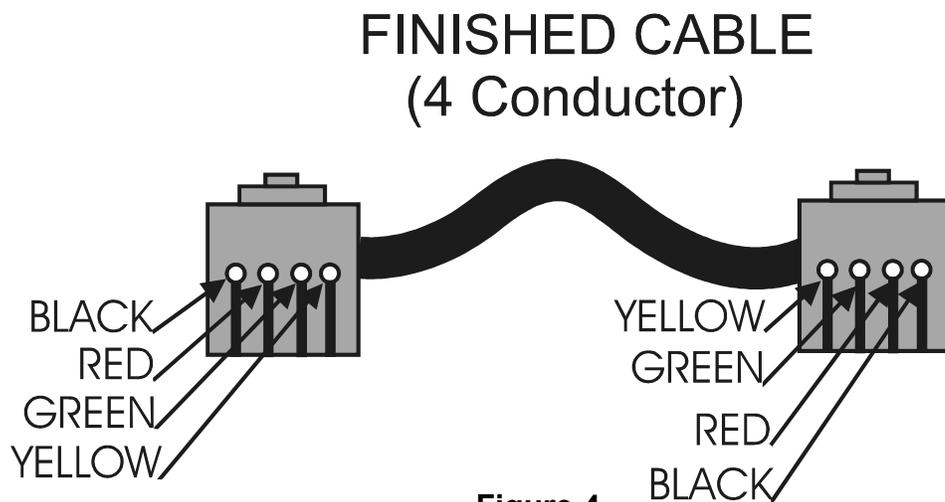
To set up a network, perform the following tasks:

- ♦ Choose a master machine and install the modem and run the phone line (see above).
- ♦ Install a **Network Interface Card** in each Black Widow to be networked (if present). Refer to Chapter 8 - Networking in the Black Widow Operator’s Manual for card installation instructions.
- ♦ Manually set a unique node number (1 to 16) in each Galaxy (if present)(see **Set Node Number** above).
- ♦ Connect the machines together to form a **Network Bus**.
- ♦ Set the network dip-switches: Enable Network & Terminating Resistors.
- ♦ Configure the network from the master machine to allow the machine’s software to recognize each **Node**.

Warning: Each machine MUST be plugged into a three-prong power outlet that is wired with the correct polarity (hot and neutral) and has an earth ground! Damage to the machine can result from failing to observe this requirement!

Building the Network Bus

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



Notice in Figure 4, 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 **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. One wall jack must be wired to like colors (red to red, etc.) and the other must be reversed (red to green, green to red, black to yellow, and yellow to black). This is done to keep the polarity correct within the network.

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).

The machines are connected together using a COM IN to COM OUT protocol. For example: Connect one end of the 4-wire bus cable to COM IN on the first machine and the other end of the cable to COM OUT on the second machine. Adding another machine is simply a matter of continuing this protocol; COM IN on the second machine to COM OUT on the third machine.

Figures 5 through 8 illustrate various possible configurations.

When all the machines are connected together, the next step in creating the network bus is to set the dip-switches.

Figure 5

Single Machine with Modem

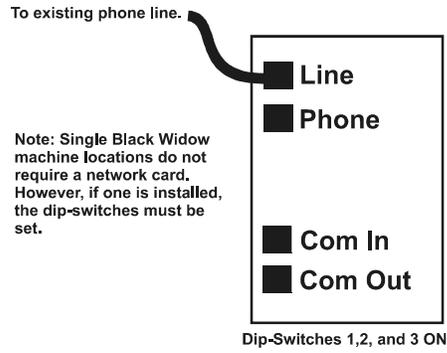


Figure 6

Two Machine Network

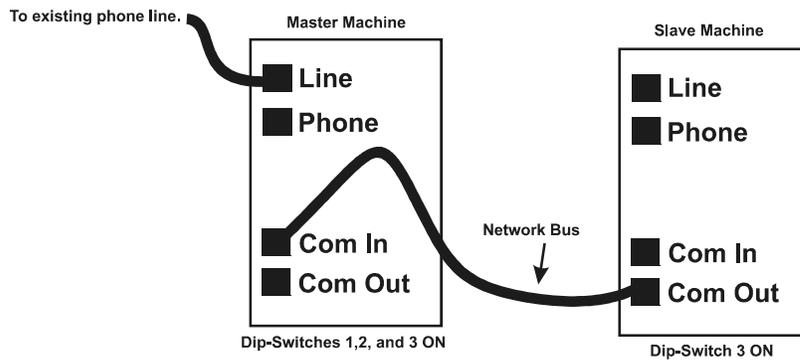


Figure 7

Multiple Machine Network

(Master [modem] machine on end of the network.)

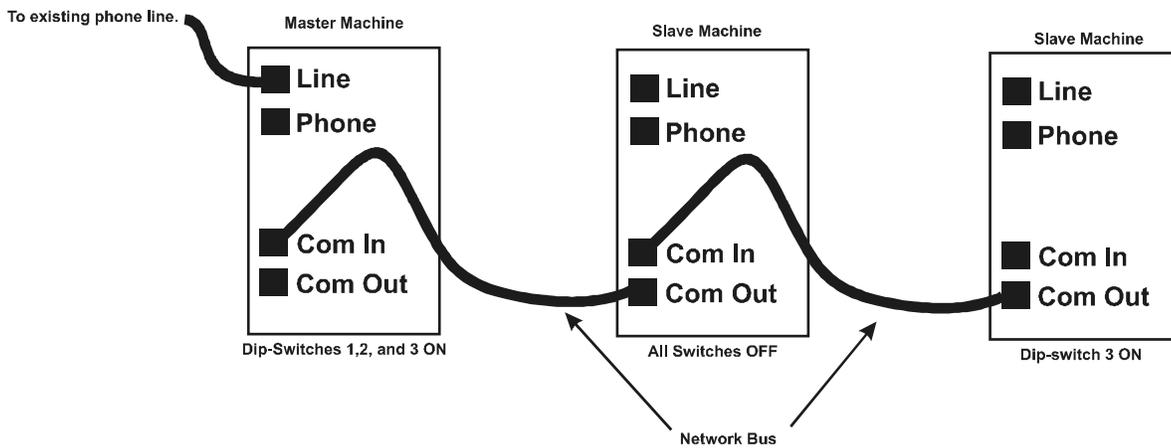
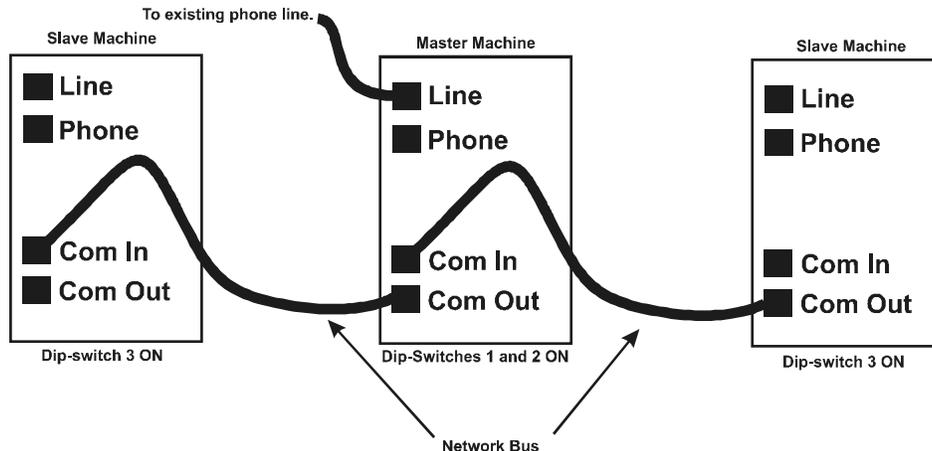


Figure 8

Multiple Machine Network

(Master [modem] machine in the middle of the network.)



Setting the Dip-switches

The dip-switches on the Black Widow network card and on the Galaxy and Galaxy II mainboard are used to: enable the network (switches 1 & 2) and terminate the network bus (switch 3).

To enable the network, **one** machine on the network must have dip-switches 1 and 2 turned "ON". Arachnid has adopted the standard practice of turning these switches on in the machine with the Modem (Master Machine) to avoid confusion during troubleshooting. If you are not using a modem in your network, still set these switches "ON" in the Master Machine as a standard practice.

Terminating the network (dip-switch 3 turned "ON") tells the master machine where the network ends ("There are no other machines beyond this point"). There are **two end points** to a network, therefore, two machines must have switch 3 turned "ON"; the first in the series and the last in the series. Any machine that is not a Master Machine or is not an end machine must have all dip-switches set to "OFF." Familiarize yourself with Figures 5 through 8. These illustrations show correct cabling and dip-switch settings.

Configuring the Network

When all machines are connected and the dip-switches are properly set the network bus is complete. The next step is to "**Configure**" the network from the Master Machine, allowing its software to recognize the network configuration. Configuration is slightly different depending on the type of machine used as the master (see **Choosing a Master Machine** above). Each separate method will be described below.

Prior to configuring any network, perform the following tasks:

- ♦ Manually set the **Node** numbers on each Galaxy machine connected to the network.
- ♦ Reboot all the machines on the network (turn them off and then back on).

Configuration with a Black Widow as Master:

At the master machine, press the Test Button. From the main Test/Setup Menu, select **Setup > Modem and Arachnet Setup > Arachnet Setup > Reconfigure Arachnet**. Choose **Yes** to run the configuration utility. The configuration will begin by detecting any Galaxy machines on the network. The node number of any Galaxys on the network will turn green, indicating that node was found and configured properly. If there are only Galaxy machines connected to the Black Widow, then press **Done** to finish the configuration.

If there are other Black Widow or Galaxy II machines connected, begin configuring the slave machines. The slave machines will be displaying the text, "Press Any Button To Configure This Node." When a button is pressed on a slave, a node number (18 -64) will turn green on the master machine. This indicates the node was detected and configured as "online" by the master. Continue configuring slave nodes, one at a time, until they are all configured as "online."

Returning to the master machine, you will see all the slaves showing as an "online" node (green). Press **Done** at this time to finish the process. If any Galaxy machines fail to turn green on their assigned node number, or any Black Widow or Galaxy II machines fail to show the "Press any Button to Configure this node", see the troubleshooting section of this document.

Configuration with a Galaxy II as Master:

At the master machine, press the Test button on the mainboard. From the Main Test Menu, select **Communications > Network Menu > Reconfigure Network**. Choose **Yes** to run the configuration utility. Continue by following the instructions for the Black Widow configuration above.

Configuration with a Galaxy as Master:

From the Main Test Menu, select **Communications > Arachnet Setup Menu > Find a Free Node** and press the **Enter Button**. This screen will display the node numbers assigned to the various machines. The screen will display the 16 valid node numbers for Galaxy machines. Next to each node number the message "**This Node**" (on the node number assigned to this machine), "**Connect**" (on each node number assigned to other machines) or a dash " " on unused node numbers.

If you fail to get "**This Node**" or "**Connect**" on assigned node numbers, "**Collision**" on any node number, or a dash on any expected (assigned) node number, see the troubleshooting section of this document.

Installing a Modem in the master machine and networking other machines in the location to that machine completes the location portion of the League Master System. Before leaving the location record the following information:

- ♦ Name and Address of the Location
- ♦ Phone number of the phone line connected to the master machine.
- ♦ League or Modem Password entered into the master machine.
- ♦ The Beginning and Ending times of the master Machine's Call Window.
- ♦ The serial ID number of every machine (Black Widow and Galaxy II only - found on the main test menu screen)
- ♦ The Machine Name and Node Number assigned to each machine.

This information will be used in the Software portion of the League Master System and/or for troubleshooting purposes.

Troubleshooting (First commandment - NEVER ASSUME)

Modem Communications Checklist:

(Connect a telephone to the **Phone** jack on the master machine.

Modem does not answer:

- Lift the handset of the connected phone - Is there a dial tone?
- Make a phone call from the machine - Does the line sound clear - no static or other noise?
- Have someone call the machine - Does the connected phone ring (correct phone number)?
- Swap a known working modem into the machine - Working now - Replace modem.
- Swap a known working mainboard into the machine - Working now - Repair or replace mainboard.

Modem answers but will not communicate:

- Make a phone call from the machine - Does the line sound clear - No static or other noise?
- Have someone call the machine - Does the connected phone ring (correct phone number)?
- Is something else answering the phone? (Answering Machine, Fax, Computer, Alarm System, Another Game Machine, Jukebox, etc)?
- Swap a known working modem into the machine - Working now - Replace modem.
- Swap a known working mainboard into the machine - Working now - Repair or replace mainboard.

Manual Calls Work But Auto-Calls Fail:

- Is the machine Time/Date set correctly? Is it different than your computer?
- Is the Machine's Call Window set correctly. (sufficient length to handle all calls you make)
- Make sure Auto-calls are calling within the Call Window (when the machine answers on 1 or 2 rings).
- Time difference between central computer and machines. If the machine's call window is 3:00 a.m. to 6:00 a.m. set Auto-calls to begin at 3:30 am (half an hour later than the beginning of the call window). Time difference problems can also be attributed to: Daylight Savings Time changes (the machines do not auto-update), Different Time Zones (calling across time zones).
- Modem is not being initialized by machine - Swap modem with a known working modem and try again.
- Modem is not being initialized by machine - Swap mainboard with a known working board and try again.

Refer to each machine's manual for additional modem troubleshooting information and diagnostic tests.

Troubleshooting Network Problems.

Network problems can be divided into three areas:

- ♦ Dip-switch Settings and Configuration.
- ♦ Bus Cables and Connections.
- ♦ Mainboard or Network Card Component Failure.

These three areas are listed in a logical order for troubleshooting and will be discussed at length below.

Dip-Switch Settings and Configuration:

Begin troubleshooting a network by establishing that the dip-switch settings are correct. (Refer to Page 9 for descriptions and settings). A common problem is to move machines around a location or between locations and fail to set the dip-switch settings for the new network configuration (each machine's location in the network). For example: Adding a machine to the end of a network - failure to turn off the terminating resistor (dip-switch 3) in the former end machine and turning it on in the new end machine.

It is possible to check the function of dip-switch 3 (the terminating resistor) at the COM IN and COM OUT jacks. Take a short piece of flat modular cable and attach an RJ-11 modular connector to one end. Strip back the outer sheath from the other end a few inches and bare the two center wires (red and green). With the machine's power disconnected, place the RJ-11 connector into one of the COM jacks. With dip-switch 3 turned "ON", use an ohm meter to measure the resistance across the red and green wires. The meter should read approximately 100 ohms of resistance. Move the RJ-11 connector to the other COM jack and measure its resistance, it should read the same. With dip-switch 3 "OFF", there should be infinite resistance (no continuity) on either jack.

If Galaxy machines are used in a network, make sure each one is set to a different node number (Page 4, **Galaxy**: step 5). Remember, each Galaxy must have a different node number (from 1 to 16). They cannot share a node number.

If no problems were found with the above settings, continue with the next section below.

Bus Cables and Connections:

The most common cable problems stem from incorrect polarity in the network or bad connections to cable ends. These two problems are followed by cables that run over or near sources of electrical interference.

Note: Large networks (more than 2 machines) can be difficult to troubleshoot. There are too many variables to pinpoint the problem. For cabling and connection problems or component failures (below), sometimes it is best to break the network into two-machine sections for troubleshooting purposes. Network communication is a two-way process - one machine sending, the other receiving or vice versa. It is possible for one machine to be able to send but not receive, and the reverse is also possible, receive but not send. Arachnid has provided a diagnostic tool in each machine's software to help troubleshoot networking problems: The Send and Receive functions.

Send and Receive

Simply put, the Send function allows one machine to send the alphabet over the network. The receive function allows the machine to display what is being sent over the network (in this case, the alphabet). To use this test, set one machine to send and the others to receive. Each receiving machine should display the characters of the alphabet as they are sent. Each machine, in turn, can be set as the sending machine and the others as receiving machines. Use this test to check the sending and receiving ability of each machine.

Check each receiving machine for proper display of the alphabet. If all the characters are scrambled, it is most likely a polarity problem with the bus cable. See the **Building the Network Bus** section, on Page 7, for proper bus cable construction and polarity information.

If some of the characters are scrambled, it may be an interference problem. Follow the cable bus from machine to machine looking for any possible form of electrical interference: fluorescent or neon lights, power lines, etc. Re-route the cables if you suspect electrical interference. (Note: Electrical interference can cause an intermittent problem that is hard to diagnose.)

If a machine fails to send or receive anything, then it may be either a cable connection or a component problem. First check the cable for continuity from one end to the other. Possibly one or more of the wires are not making contact with the connectors on each end. Next, check the solder joints of the jacks (COM IN & COM OUT) on the mainboard or network card. If the connections are ok, there may be a component failure on the mainboard or network card (see below).

Mainboard or Network Card Component Failure:

If all the settings are correct, the cables are properly wired and connected, and still you have troubles, you can start looking for hardware component failure.

Each machine has a chip or set of chips that handle network communications:

Galaxy (on the mainboard):

Board Location	Arachnid Part No.
♦ U24*	13653
♦ U18	26964
♦ U20	33655

Galaxy II (on the mainboard):

♦ U9*	13653
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Black Widow (on the Network Interface Card):

♦ U7*	13653
♦ U8	11433

* This is the same component in all three machines.

If any of the above components are bad, network communications cannot occur, or one function (send or receive) will not work. Use the Send and Receive functions (described above) to help troubleshoot component failure.

If you have any questions about the information presented in this document or have followed all the troubleshooting steps and still have problems, contact Arachnid's Technical Support at 800-435-8319 or 815-654-0212.