Application Note 001 for the EBF31A - "The 5 Minute Phone System"

Introduction

So you've received your EBF31A Assembled and Tested or built it up, what do you do next? One possibility is the "5 Minute Phone System." This by no means demonstrates all the capabilities of EBF31A but it does show you how to assemble a functional dispatching system in almost no time with almost no wiring! Future notes in this series will show you how to add more "bells and whistles" your phone system.

For this example you'll need:

- EBF31A
- Mounting hardware
- 24 Volt DC regulated power supply with 2.5mm plug
- 5 outlet Modular Telephone Plug Adapter
- 5 phones (preferably of the same type)
- 5 telephone cords long enough to reach where you want to place the phones
- A powered computer speaker or boom box with a 3.5mm mini-stereo plug for input
- A small piece of 1/2" plywood (8" x 12") -- bigger is OK if you expect to expand the system or add more features later. I paint my backboards light grey or white for contrast and visibility, it helps while wiring and keeps the saw dust and splinters down.
- A drill driver, some #8 x 1/2 pan head screws and basic hand tools will complete the job

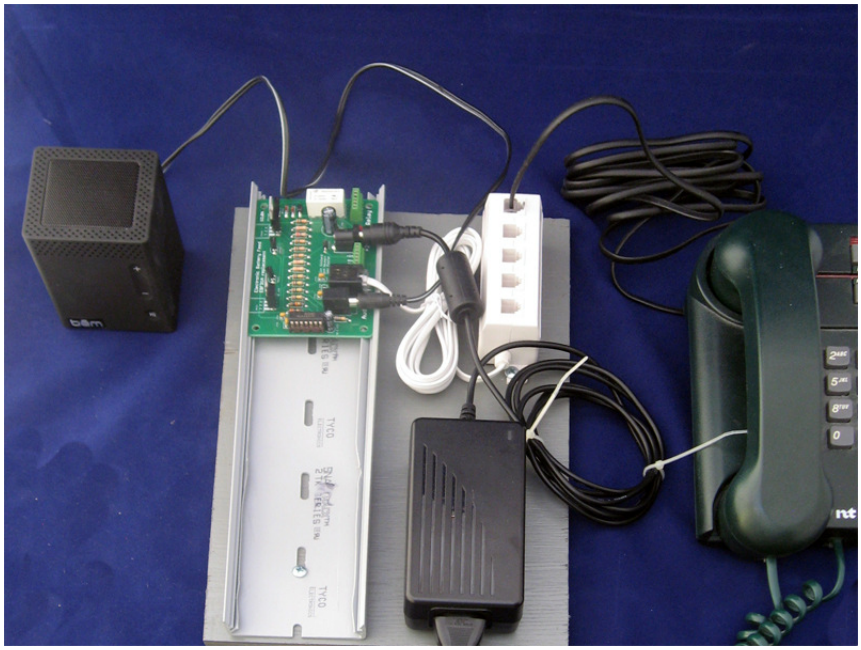

Figure 1 - 5 Minute Phone System

1. Find a location (start your watch)

Try to find a location close to the dispatcher (on the wall under the Dispatcher's desk is ideal). Make sure a 3 prong grounded outlet is available so you can power the system and have some light to work while you do the installation. You'll need another outlet for the wall wart for the powered speaker so a small power strip may be necessary. Take suitable precautions if the area is subject to moisture.

2. Mount the Backboard

You can do some of the subsequent steps on the bench, but you will want to mount the backboard to keep everything organized and off the floor -- especially if your floor is subject to flooding! Nothing is heavy so you don't need to drill into a stud, drywall anchors are fine. Use #6 or #8 screws and the 1/2" plastic anchors. These are strong enough to hold forever but remove easily and leave a hole that can easily be patched if you need the room for something else later.

3. Mount the Pieces to the Backboard

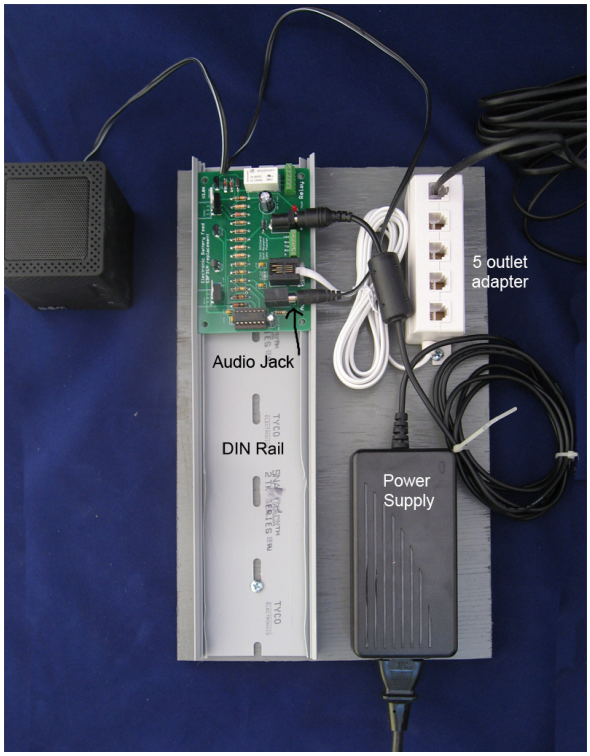

Figure 2 - Back Board

1. Mount the EBF31A

I used a piece of Tyco "DIN Rail" Snap track which I screwed to the backboard with #6 x 1/2" pan head sheet metal screws. The EBF just pops right in. I used a 12" piece to allow room for some boards MRCS is planning for 2015 release, but a 6" piece will do. If you don't want to use the DIN Rail, you can use 4 #4 x 1" sheet metal screws and 4 #4 x 1/2" standoffs.

The DIN Rail is Digikey Part 1437685-12-ND and it is available in the Model Railroad Control Systems store.

2. Mount the power supply.

Radio Shack and Jameco offer these, and a quick check of Amazon or eBay may find you a bargain.

1. I used a piece of double stick Velcro for this "laptop" style supply but carpet tape will work fine too. Wall warts are also available, see the table below. The power supply should be 24 Volts DC Regulated with at least 0.5A current capacity. Multiple EBF31As may share a suitable supply (allow 120 mA per EBF31A).
2. Take the round plug and insert it into the +24V jack on the EBF31A -- if you're using DIN Rail you may need to notch the rail for the power plug
3. Note that there are a couple of styles of 2.5mm plugs with different interior diameters. If yours doesn't work, just cut the plug off and insert the +24 lead into the screw connector terminal marked +24 and the ground side to "Gnd." If you get it wrong it won't hurt anything, it just won't work. If this is the case, reverse the wires. If the wires from your power supply won't fit, just splice them to a short length of 20Ga or smaller wire (Red for +24, Black for Ground)

Supplier	Part Number	Price as of July 2014
Jameco	1953671	$14.95
Radio Shack	55057408* Web only	$14.91

3. Mount the 5 Outlet Adapter

I got this one from Radio Shack (P/N 2790012) for $15 but you can probably find one at a Big Box hardware store for less.

1. Use two #6 or #8 x 1/2" pan head sheet metal screws to attach the 5 outlet adapter to the backboard.
2. Plug the telephone plug into the phone jack on the EBF31A (again notch the DIN Rail if necessary)

4. Locate the Phones

1. I'm assuming the Dispatcher's phone will go on a desk above the backboard
2. Run a modular cord (you can get them in 25', 50' and 100' lengths at Big Box Hardware stores) to each phone -- you'll probably want to use wall phones in the layout room to save space.
3. Plug one end of a cord into each phone and the other into the 5 outlet adapter
4. Run the phone wires with your low level signal wires (DCC Cab bus, any other layout control bus clean DC power) and try to keep them away from track power. I run signal through a series of rings or hoops towards the fascia and DCC power and 110VAC along the back of my benchwork.
5. If you need more than 5 phones total you can cascade 5 outlet adapters

5. Place the Speaker on the Dispatcher's Desk

1. Plug the stereo plug from the speakers into the "Audio" jack on the EBF31A, again, you may need to notch the DIN Rail
2. Plug the wall wart the speaker into the wall and turn it on but not too high: you don't want feedback!

6. Test Your System

Go to each phone and go off hook and announce yourself (you may need a helper for this step):

1. You should hear yourself in the receiver of the phone (this is called "battery" by phone people as in "do you hear battery?")
2. You should hear the person at the phone through the speaker at the Dispatcher's desk
3. As each phone checks in, go off hook at the Dispatcher's phone and ensure that you can converse
4. Once all phones are known to work, check that you can talk with 2 or 3 stations plus the Dispatcher off-hook
5. You may need to adjust the level of the speaker to avoid feedback at the Dispatcher's station. The speaker is just to alert the Dispatcher that a station is waiting for him/her, it's not a 2 way speakerphone.

7. You're Done! (Check your time)

8. Got another 15 minutes? Here's a useful add-on: "Line in Use LEDs" at the Stations

Not many of us grew up on Party Line phone systems, so the etiquette has been forgotten. You are supposed to go off hook carefully so as not to knock the handset and listen for a few moments before speaking. There are often pauses when Dispatchers are dictating orders so just because the line is quiet for a second doesn't mean other operators aren't using the line. You can use one of the auxiliary contacts on the EBF31A to provide a "line in use" indicator at the stations.

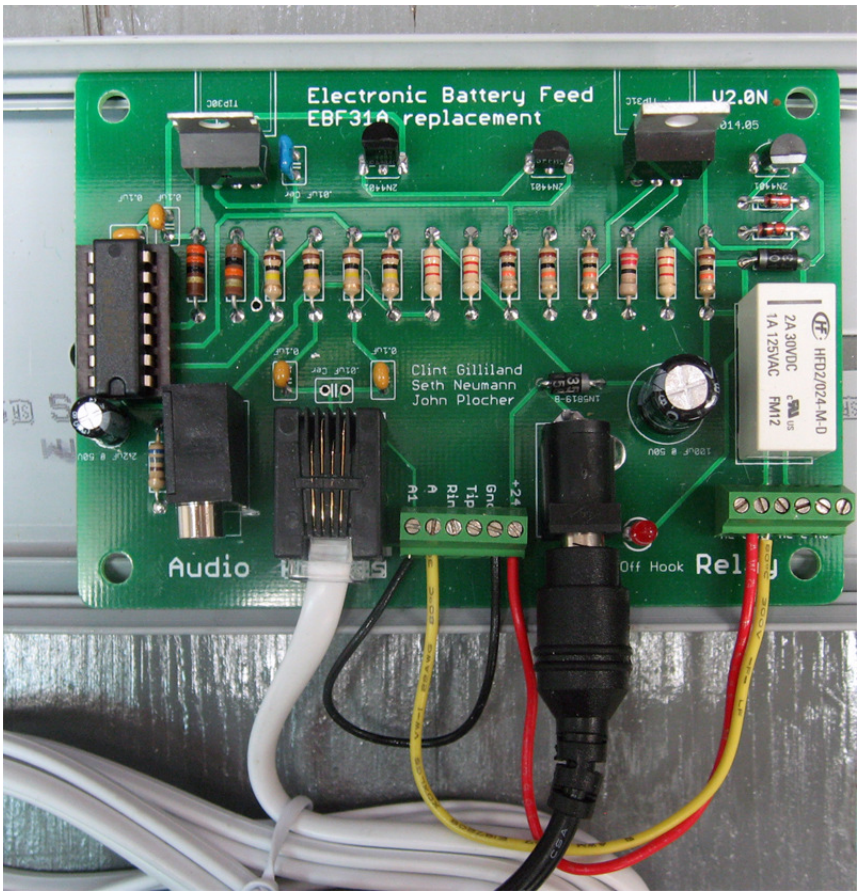

Figure 3 - Off Hook Indicator Wiring

1. I used 22 Gauge wire because I had it on hand but anything from 20-26 Ga will work fine.
2. Connect a piece of RED wire from +24 to one of the C(ommon) contacts on the relay terminal block (lower right on photo)
3. Connect a piece of BLACK wire from Gnd to the A1 terminal
4. Connect a piece of YELLOW wire from the NC (Normally Open) contact associated with the Common contact you used in step 2 to the A terminal
5. Solder one end of a 2,200 ohm (Red, Red, Red) 1/4 watt resistor in series with the long lead (Cathode) of an LED. Slip apiece of heat shrink tubing over the resistor and one lead of the LED and then connect to the A (Black) and A1 (Yellow) lead as shown

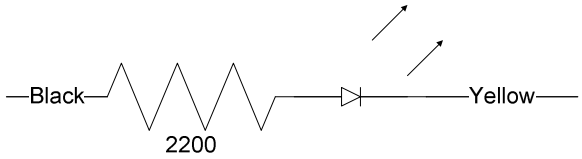

Figure 4 - LED Wiring for Second Pair

You are now putting 24 volts across the second pair (A, A1) on each phone, and you can now connect an LED across the second pair to get a line busy indication. In theory (consumer phone equipment is notoriously bad at respecting polarity, especially on the second pair) you will see 24V on the black wire and Ground on the Yellow wire at the phone. If it doesn't work, try reversing the connections to the LED/Resistor.

Notes and cautions:

- some consumer phones don't bring the second pair out and may not have contacts for it. In this case you can pull the second pair off your modular block or wall adapter plate
- some business phones (and some of the forthcoming examples in this series of app notes) have a contact on the second pair, if so, the phone will short out the whole phone system when it comes off hook. Bring up the phones one at a time and check that everything works. If you have a phone like this, don't use the indicator, or remove the wires to the second pair from the phone at the block. You can mount the LED to the block or adapter plate. On classic 500 and 2500 type phones you can go inside and move the wires as required.

9. What if I want to call a station?

EBF31A is just the voice part of the system. Since phones are usually used on Time Table and Train Order or CTC systems, we assume that you have an order board system (for TT&TO) or Maintainer Call Lamps (MC) on your CTC board. A very simple "call me" system would have a series of switches at the Dispatcher's desk lighting LEDs at stations to indicate the Dispatcher wants a passing train to call but this is dependent on the type of train control (Dispatching) you use and the era you model. Of course you can add semaphore type order boards or other indicators as needed.

MRCS makes a variety of solutions for "Call Dispatcher" lamps and Train Order Boards. Please contact us with your requirements.

10. What if I want a Headset or Speaker/Microphone/Foot pedal arrangement for my Dispatcher

Depending on the phone you provided for the Dispatcher, an office type headset may plug right in, if not another note in this series will show you how to make a simple adapter for a modern headset.

For a mic/speaker/foot pedal arrangement, see my clinic presentation http://bayrails.com/layouts/neumann/Communications%20for%20Model%20Railroads%20new%20020130705.pdf pages 30-32 for a low cost Speaker/Mic/Foot Pedal arrangement. MRCS plans to package this functionality on a compatible board in the near future.

11. Any Questions:

Contact Seth Neumann at Model Railroad Control Systems
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