Instructions for Cup Hook Station

Updated April 27, 2020

Major changes from prior versions. Thanks to Frank Kenney and Joel Morse for pointing out that this was out of step with my current recommendations.

- Changed color code for to make colors consistent for the most used configurations
- Added functional tables: for station to backboard wiring, for Cup hook switch wiring and for network
- Updated schematic

Contents

Figures:

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Figure 1 - Assembled Cuphook phone on Fascia

Cable and backboard Installation:

Try to locate the system backboard somewhere central that has good accessibility, good light (maybe mount a light stick over it) with access to power. A power strip with a switch is helpful as you can then power the entire system on and off with one control.

Run one piece of Cat5 (or Cat5e, Cat 6 – but there's a lot of tight twisting to undo – or Cat3 works fine if you have any around) cable to each station. This makes for easier trouble shooting and handles per-station features like LED indicators, buzzers, ringers and push buttons better.

Bus the talk pair (tip and ring) to the white/blue and blue/white of each phone. You can use phone style 66 or 110 style punch blocks or 8 position Jones strips, I recommend one strip per phone if using Jones barrier strips. This allows for easy troubleshooting. I recommend this color code:

Backboard to Station Cable Functional Assignments

Position on Cat 5	Color	Designation	Network Connection	Purpose
1	**Wh/Bl**	**T**	**RR**	**Tip of talk circuit (more or less ground)**
2	**Bl/Wh**	**R**	**L2**	**Ring of talk circuit (more or less + Supply)**
3	Wh/Or	A	L1	Switched side of contact aux closure from station* (grounded when station is OFF hook*)
4	Or/Wh	A1	G	Ground side of aux closure from station
5	Wh/Grn	LG	K	As needed – but often used for LED
6	Grn/Wh	L		As needed - but often used for LED
7	Wh/Brn	Gnd	E1	Ground (black) side of buzzer**
8	Brn/Wh	LED or buzzer supply	E2	Hot (+12) side of buzzer**

Figure 2 – Backboard to Station Cable Functional Assignments/Cat 5 Color Code

items 1 and 2 (in bold) are required, others are optional.

*** optionally this can be wired as grounded when ON-Hook.**

**** These are suggested uses, you can use either of these pair for some other function such as button to operate a lamp or buzzer at some other location.**

Installing Cuphook Phones

Phone Installation with Cup Style Hook switch and Network

You will need the following (see figure 1):

- Cup style hook switch with DPDT contacts ***

  http://www.modelrailroadcontrolsystems.com/cup-style-hook-switch/

Figure 3 - Cup Style Hookswitch

- Standard or push to talk G style Handset

  http://www.modelrailroadcontrolsystems.com/push-to-talk-g5-handset-with-cord/

- 425 or equivalent telephone network

  http://www.modelrailroadcontrolsystems.com/425-speech-network/

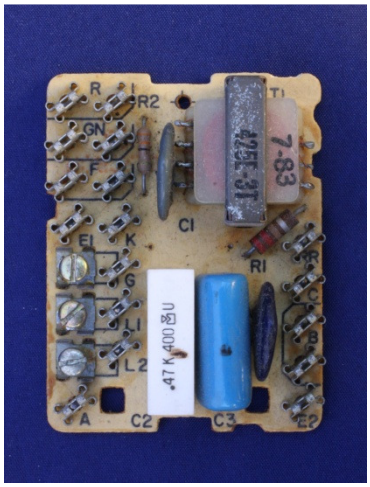

Figure 4 - 425 Type Speech Network

(you can get the handset and network out of an old 500 or 2500 set from a garage sale)

Optional:
6 position terminal block (if you need more tie points – also the section on networks below)
Buzzer (if desired)
LED (if desired)
Push Button(s) (if desired)

- Spade lugs for telephone networks. The connection points on the network are too small for the standard blue crimp connectors at the big-box stores. I like the Radio Shack (you can still buy them from their internet store as of this writing) 64-3070 or Mouser part 571-614982-LP (special order). Do not strip the wire, these are insulation displacement and are designed to pierce the insulation. Use a **D-Sub Pin Crimp Tool** to crimp them on. I like ShowMe cables https://www.showmecables.com/catalog/product/view/id/63291/s/d-sub-pin-crimp-tool/

- Run a piece of Cat 5 cable from the system backboard to a convenient location under the layout near where the phone will be mounted.

- You will need to run a short piece of Cat 5 from the network through the fascia into the back of the cup hook switch.

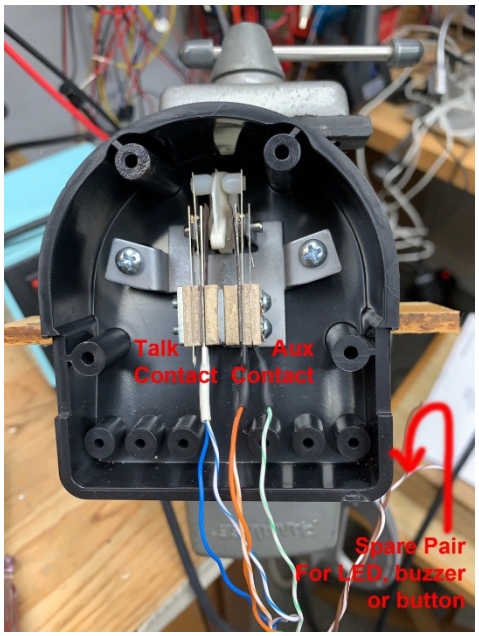

Figure 5 - Inside of Cup Hook (upside down)

Cup Hook Connections (cable from cup hook to network)

Position on Cat 5	Color	Designation	Connects to	Description
1	**Bl/Wh**	**Ring in**	**L2 on Network**	**Ring of talk circuit – Connects when off hook.**
2	**Wh/Bl**	**Ring out**	**C on Network**	**Ring side of network. Common of first Contact**
3	Wh/Or	Aux Off Hook	L1 on Network	Open when ON-Hook, closed when Off-hook 2nd contact for auxiliary circuit such as Morse Code Buzzer Controller
4	Or/Wh	Aux Common	G on Network	Common pin of 2nd contact. Ground side of aux closure from station.
5	Wh/Grn	Aux ON-Hook	K	Connected when ON-Hook, used for relay latch circuit, if used. K is one side of a capacitor in the network that we don't usually use for our circuits. We're using it as a handy tie point. If you need the internal 0.47uF Mylar cap, move this connection. Also can be used for LED if desired
6	Grn/Wh	Not used	Not used	Can be used for LED if desired
7	Wh/Brn	Gnd	E1 on Network	If you want a buzzer, LED or push pushbutton on the cup hook use this pair
8	Brn/Wh	+V	E2 on Network	If you want a buzzer, LED or push pushbutton on the cup hook use this pair

Figure 6 - Cup Hook Connections – lines in BOLD are required, others are optional.

1. **Connect the Wh/Bl (Tip) wire of the Cat 5 from the system back board to RR on the network**
2. **Connect the Bl/Wh (Ring) wire of the Cat 5 from the system back board to L2**
3. **Identify the normally open voice contact from the cup hook switch (left as shown in the photo). These are normally open when the phone is on hook (if you're checking with a voltmeter be sure to leave a handset in the cup while you're testing). Connect from one side of the hook switch to L2 on the network; wire the other side to C on the network. This is the talk circuit. See table above and photo of cup hook.**

4. **Connect the handset to the network:**

   - **One of the white wires and the red wire to R on network**
   - **Black Wire to B on network**
   - **The other White Wire to GN on Network**

Network Connections

Network Terminal	Cup Hook Switch Cable	CAT5 to Back Board	Description
L2	Bl/Wh	BL/Wh	Ring Side of talk pair (tie point only – no internal connection)
L1	Wh/Or	Wh/Or	"A" (tie point only – no internal connection)
C	Wh/Bl		Ring side of the electrical part of the network
RR		Wh/Bl	Tip side of network
G	Or/Wh	Or/Wh	Common side of A, usually ground (tie point only – no internal connection)
A			One side of internal capacitor, not used
K	Wh/Grn		Other side of internal cap
E1	Wh/Brn	Wh/Brn	Ground side of Diode, buzzer or Push Button (tie point only – no internal connection)
E2	Brn/Wh	Brn/Wh	+ side of Diode, buzzer or Push Button (tie point only – no internal connection)
Handset Connections			
R	Handset white Handset Red		common
GN	Other Handset White		receiver
B	Black Wire		transmitter

Figure 7 - Network Connection Table

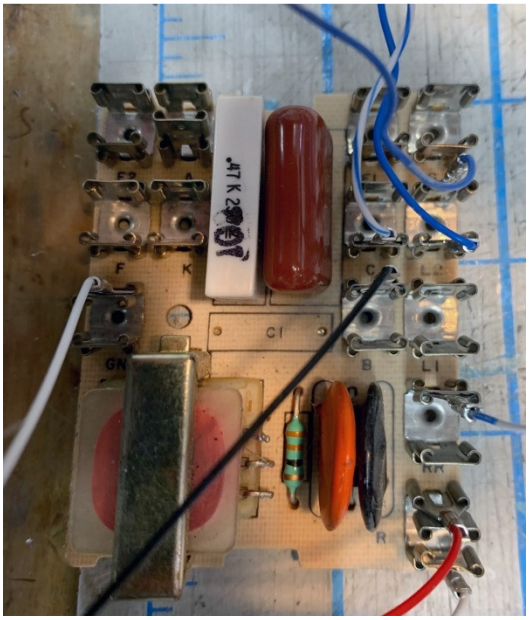

Figure 8 - Network with Connections

5. **Optional:** auxiliary contact. Identify the normally closed (inner) contact of the second contact set (right as shown in the photo) from the cup hook switch. These are normally closed (making contact) when the phone is on hook (if you're checking with a voltmeter be sure to leave a phone in the cup while you're testing). Connect one to the Wh/Or wire from the Cat 5 and the other to Or/Wh. If you will be using the connected-when-off-hook side, connect the White/Green wire to the outer contact of aux contact. See table above and photo of cup hook.

6. **Optional**: Connect the Lamp (LED) pair (Wh/Grn, Grn/Wh) of the cable to the system backboard to either E1/E2 on the network or two terminals of an extra terminal strip. You'll connect the LED leads here if you want it on the fascia by the phone, alternately you can run it up to a structure of some sort on the layout, but this is still a good tie point. Be sure to select an appropriate limiting (ballast) resistor for the LED. I suggest around 1K ohms for 12 VDC (12-1.5 = 10.5V/1000 ohms = 10.5mA). This is a safe value as most LEDs will give about the same brightness from 10 – 30 mA and not burn up. Obviously if you're using something special, check the data sheet for recommended current and any special limiting resistor considerations (I like the big 10mm fat self-flashing LEDs).

7. **Optional:** Connect the Buzzer pair (Wh/Brn/ Brn/Wh) to the E1/E2 if not already used or a pair on the terminal strip. Wh/Brn to the black lead and Brn/White to the (+) Red side. Double-stick the buzzer to the back of the fascia, or mount it up in the cup hook. Note that the loudness of the

buzzer is affected by how well the mounting surface works as a sound board, so feel free to experiment with adhesives/screws and mounting material.

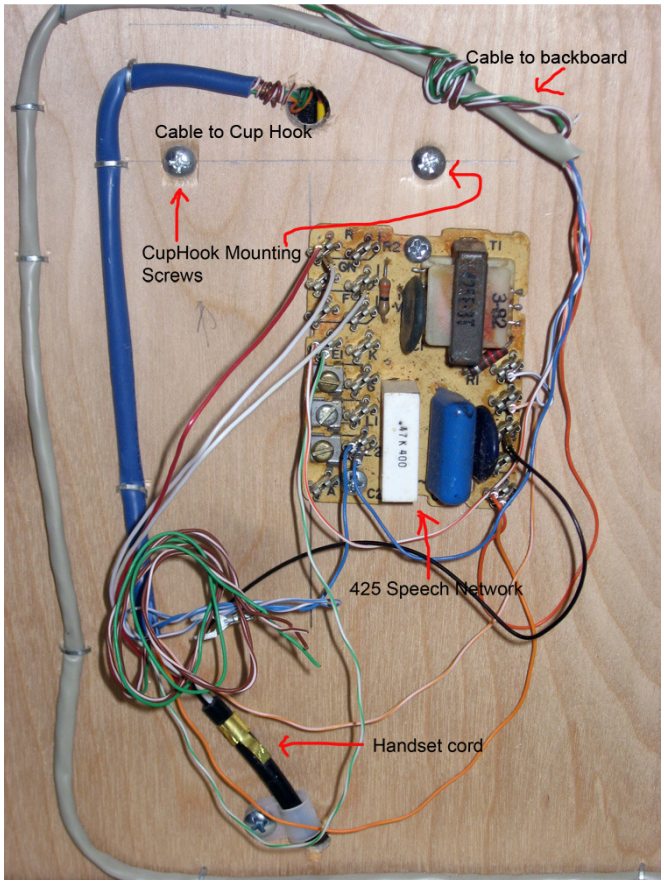

Figure 9 - Assembled Phone from Back of Fascia

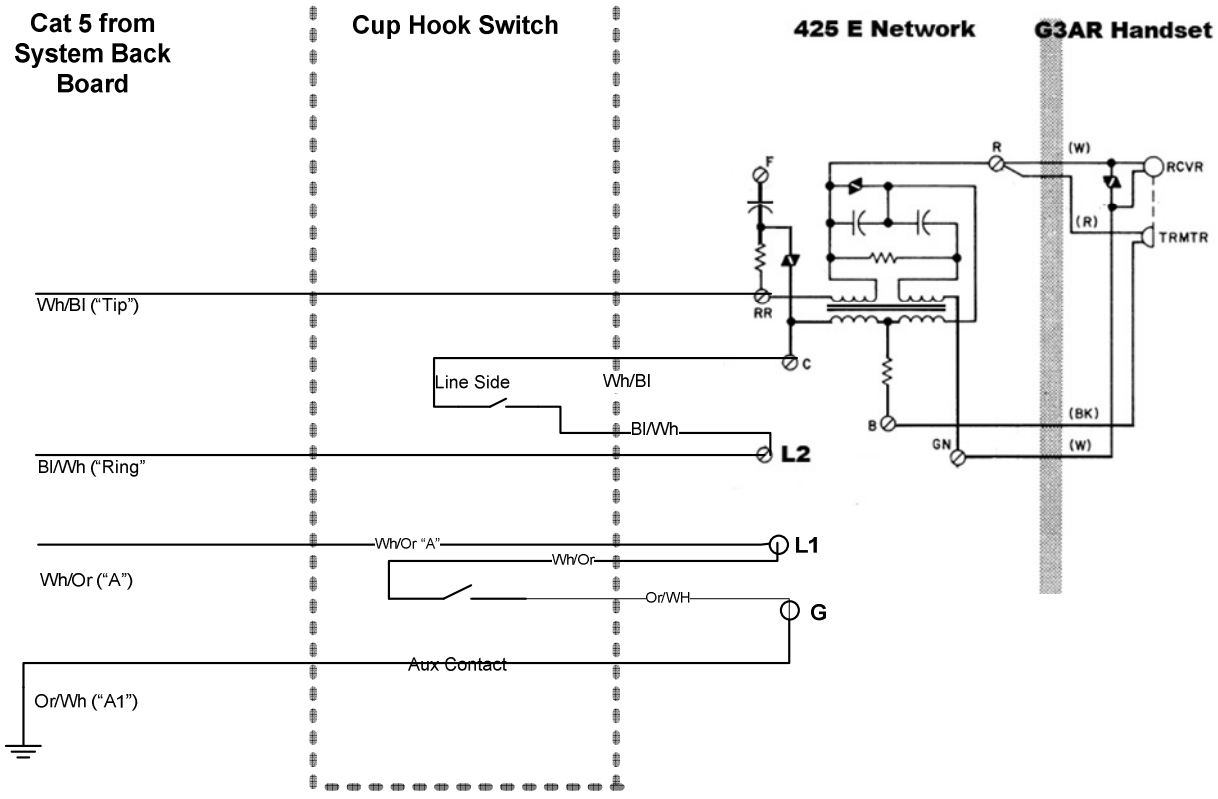

Figure 10 - Cup Hook Switch Phone Schematic

The 3rd (Green) and 4th (Brown) pairs can be used for buzzers, LEDs or push buttons as needed

*** there are multiple terms for contacts, this table is a Rosetta Stone:

General Electronic	Single Poll, Single Throw Normally Open (SPST-NO)	Single Poll, Single Throw Normally Closed (SPST-NC)	Single Poll, Double Throw
Telephone, Industrial Control	Form A	Form B	Form C
Railroad Signaling	Front Contact	Back Contact	Front and Back Contacts