

How to use a 425/4288 Speech Network

The Speech Network is an important and poorly understood part of the telephone. The network serves a number of important functions:

- Controls side tone - Side tone is hearing your own speech in your ear when you talk. It is important to provide some side tone to confirm the phone is working but it is also important to keep the level low so that the user does not talk more softly upon hearing his own loud voice in his ear.
- Directs most of the speech energy out on the line towards the other stations.
- Regulates the amount of current that the phone draws from the battery feed coil. This is important in situations like our model railroads where multiple phones are off hook at once. It also prevents excessive current from going through the transmitter,
- Provides a handy terminal block on which to connect all of the components of the phone

I strongly recommend that all phones use a speech network. On earlier or non-WECO models, there may be an exposed transformer and some external components that provide this function.

System performance is better when all stations draw the same amount of current, so standardize if possible. You can retrofit most period phones to use modern speech networks and I recommend you do so.

Speech Network Connections:

In the simplest case you only need to worry about 5 wires on the network:

Network Terminal Designation	Function	G Handset	F Handset	Hook Switch
R	Handset Common	Red,White (either one)	Red	
B	Transmitter	Black	Black	
GN	Receiver	White (other one)	White	
C	Ring side telephone line			We'll get there
RR	Tip side of telephone line			

Table 1 - De minimis network connection

Speech Networks

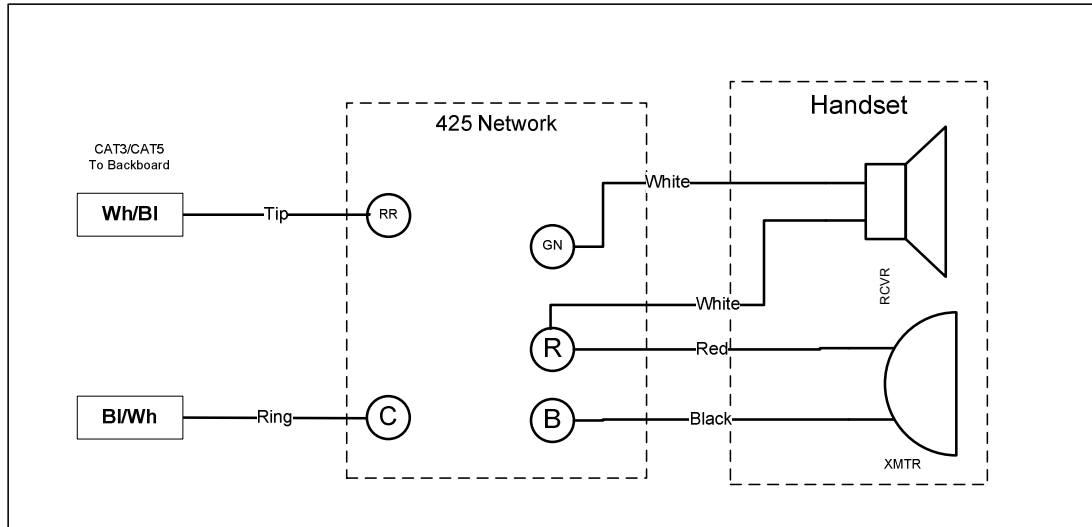


Figure 1 - De Minimus Phone - no hook switch

This is a complete phone in the sense that you can connect to your layout party line, talk and hear. Of course there is no hook switch so the mic is always on (and will pickup conversations in the aisle) and the phone will always be drawing current which means voice quality will degrade if there are more than 4 phones off hook (usually most will be on hook at any time and not drawing current).

So we need a hook switch (and in many layout phone systems that's about **all** we need – I'll cover some extras later) to finish this phone!

Speech Networks

Network Terminal Designation	Function	G Handset	F Handset	Hook Switch
R	Handset Common	Red, White (either one)	Red	
B	Transmitter	Black	Black	
GN	Receiver	White (other one)	White	
C	Ring side of Network, to hook switch			One side of a normally open contact
RR	Tip side of telephone line			
L2	Tie point for hook switch			Other side of contact above, Goes to Ring

Table 2 - Typical network connection for layout phone

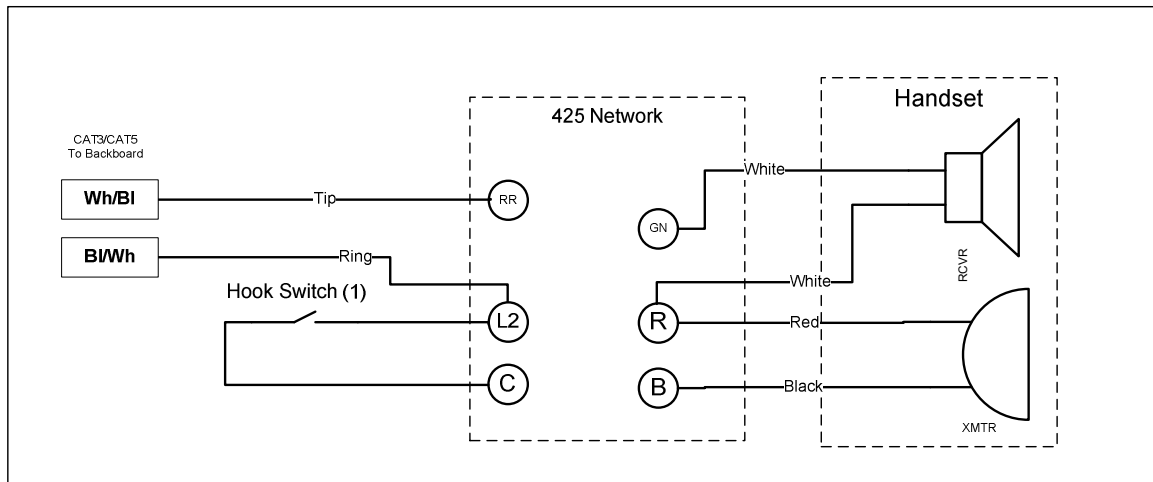


Figure 2 - Basic Layout Phone

Many of my clients use “Push-to-Talk” handsets which have a contact in series with the black handset lead so the mic is out of the circuit until pressed. This keeps noise from being picked up by phones waiting to talk, such as conversations in the aisle and breathing (we have a lot of mouth breathers in our demographic what with sleep apnea and all). These handsets are available: I stock new and used ones in various colors. OTOH if you are trying to start out with a minimum outlay, a standard handset is fine and you can upgrade later at the stations that are problematic (e.g. noisy yards). Feel free to mix and match.

Speech Networks

Terminal Designation	Function	G Handset	F Handset	Hook Switch	Note
R	Handset Common	Red, White (either one)	Red		
B	Transmitter	Black	Black		
GN	Receiver	White (other one)	White		1
C	Ring side of Network, to hook switch			One side of a normally open (NO)contact	
RR	Tip side of telephone line				2
F	Other side of dial pop suppression network				2,3
L1	Tie point* for Tip side hook switch contact				
L2	Tie point for Ring Side hook switch			Other side of NO contact above, Goes to Ring	4
G	Tie Point for ground in 2 Party, Party Line ringing				5
A	One side of 0.47 uF cap to block DC through the ringer				6
K	Other side of the ringer cap				6
E1	Tie point				7
E2	Tie point				7

Table 3 - Definitions of All Speech Network Connections

“Tie Point” means the terminal is not connected to anything else on the network, the tie point is just there to provide a handy place to connect other wires.

Speech Networks

Notes:

1. Originally meant green, sometimes you'll see a green wire on a 3 wire handset cord or on the transmitter of a Push to Talk Handset, but that was gone by 1955, maybe as early as WWII
2. Also one side of spark/pop suppression network for rotary dials, the other side is F. We don't use dials in our party lines, so we pretty much ignore F.
3. If using a dial, the tip side hook switch goes here and the line side (tip) is L1. The phone companies broke both sides of the line to protect against a power line cross which could happen on either or both sides of the line. It also protects against certain types of taps.
4. I recommend putting the center of the SPDT contact on L2. It can be used for many purposes
5. I recommend putting either the NO or NC side of the SPDT contact on G. See below
6. We don't use ringing on the party line, so normally we don't use A&K, but there are some tricks you can do with it. However since our applications only use DC A and K can be used to tie down the 3rd pair, typically used for LED to indicate line in use.
7. I recommend bringing a 4th pair in to these tie points for a buzzer to signal the station.

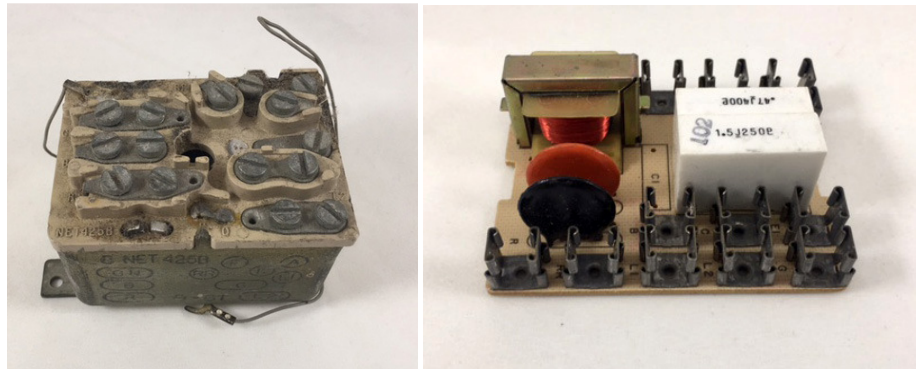


Figure 3 - Older Style Screw Terminal Network (425) On Left And Newer Push-In (4228) Terminal Style On Right

See the photos of networks above. Note the older screw terminal networks may have a hook switch lead soldered to C, this one has been modified by soldering a spade lug tipped lead to C. You'll need spade lugs and a tool to crimp them to work with the new style network.

Spade lugs are available as [Mouser Electronics as part number 571-614982](#), you have to cut them apart. You'll need the tool below to crimp the lugs. Note the lugs pierce the insulation so don't strip the wires. You can also use the lugs on the terminal strip ends of the wires but it is OK to just loop the wires under the screws.



Figure 4 - Crimper for Spade Lugs - often called an RS232 crimper

Show-Me cables has the crimper for ~\$10, https://www.showmecables.com/d-sub-crimp-tool?gclid=CjwKEAjwvr3KBRD_i_Lz6cihrDASJADUKGCajSR0AKOStO0XCG0CRqTBEo2VwSbX_0fnAuyeUEur_nxoCTWbw_wcB

Recommended Color Code for CAT5 wire:

Position on Cat 5	Color	Desi	Network Terminal	Purpose
1	Wh/bl	Tip	RR	Tip of talk circuit (more or less ground)
2	Bl/wh	Ring	L2	Ring of talk circuit (more or less – battery)
3	Wh/Or	A	L1	Switched side of contact aux closure from station
4	Or/Wh	A1	G	Ground side of aux closure from station
5	Wh/Grn	L	(A)	lamp supply to station (+ Anode side of LED)
6	Grn/Wh	LG	(K)	lamp ground to station (- Cathode side of LED)
7	Wh/Brn	Gnd	E1	Ground (black) side of buzzer
8	Brn/Wh	(#)	E2	Hot (+12) side of buzzer

Table 4 - Cat 5 Color Code Recommended Assignments