Connectors for (Almost) All Occasions—*Part 2*†

Tips on installing shielded phono, DIN, mike and RF plugs round out our two-part look at most-used ham connectors.

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Now that you've gotten comfortable with connector installation by working a bit with phone and phono plugs, you're ready to tackle the rest of the common connectors our ham shacks can't do without. Here they are: Shielded phono plugs, and DIN, microphone and common RF connectors (UHF, BNC and N). As was my aim in Part 1, I intend to help you obtain and install the right connectors with the right tools for the right job. Not all of the connectors I discuss this month are available at Radio Shack, but this presents no problem: I'll tell where you can buy what you need by mail or phone.

The Connectors Ham Cables Connect—*Continued*

Before I get down to our second heap of connectors, here's another ad for Reading The Fine Manual: I assume that you'll *read and use* the interconnection information in your equipment operating manuals in addition to what I tell you here; this article isn't a substitute for the information your manual contains. Now, have a look at the sidebars "Suggested Tools for Connector Installation—Part 2" and "Connector-Installation Hints and Kinks—Part 2" They'll give you more information about tools and techniques specific to this month's connectors not otherwise covered in the text.

Really Shielded Phono Plugs

In Part 1's "'Shielded' Connectors That Really Aren't" sidebar, I moaned about the relative lack of RF shielding in two phono-connector styles commonly used by hams. (If you're a bit hazy about what I said there, reread that sidebar before continuing here.) Chances are, though, that you'll wish you had well-shielded phono connectors at some point. (You *must* use such phono plugs with equipment that uses phono jacks for RF connections, for instance. And hum and RF-feedback problems encountered with phono connectors like those in Fig 4 [see Part 1] can sometimes be cured by using well-shielded connectors.) Such phono connectors *do* exist—see Fig 6 for what they look like and how to install them.

One source of such plugs, Digi-Key Corporation—see the sidebar, "Connectors By Mail or Telephone," for their address—catalogs them as "conventional." That sounds fine to me, because if you're after good RF shielding, the simpler the phono plug, the better. (Departures from phono-plug conventionality usually involve the addition of various forms of strain relief—crimp-around or solder-the-cable-in sleeves that may tempt you *not* to solder the coax braid and plug to each other around their entire circumference.) If good RF shielding is your goal, resist the temptation to buy anything other than conventional phono plugs, and install your plugs as shown in Fig 6.

DIN and Mike Plugs

Phone and phono plugs fall short when the interconnection task involves more than two or three conductors. That's where DIN and microphone or mike plugs (Fig 7) come in.

DIN stands for *Deutsches Institut für Normung*, the German Standardization Institute, under whose auspices these popular multipin connectors were developed. DIN connectors usually handle transverter, amplifier-control and "line-level" audio signals, and (especially on ham equipment of the late 1970s and early 1980s) remote-

†Part 1 of this article (April 1991 *QST*, pp 35-38) covered connector and cable basics, and how to install phone and phono connectors. While supplies last, single copies of April 1991 *QST* are available for $3 each, postpaid, from the Circulation Department, ARRL, 225 Main St, Newington, CT 06111.

Suggested Tools for Connector Installation—Part 2

The connectors described this month call for these tools *in addition to* those identified in Part 1. Exactly which tools you'll need depends on the type and number of connectors you need to install. Before starting installation, anticipate your requirements by working through the job in your mind.

Heat-shrinkable tubing, small-diameter—Radio Shack's 278-1627 assortment includes 1/16- to ½-inch sizes. Shrink the tubing with a match or heat gun.

Helper—Consider asking someone to help you position, manipulate and restrain heavy coaxial cables like RG-8, RG-11 and Belden 9913.

Phillips-head screwdriver, small—to drive strain-relief and plug-retaining screws on mike connectors.

Ruler, 6-inch, with 1/32- or 1/64-inch divisions—for sizing cable cut and strip lengths when installing RF connectors.

Slip-joint ("gas") pliers—preferably two pairs, to screw coaxial cable, reducers and clamp nuts into connector bodies.

Scissors—to trim cable braid to size.

Soldering iron—A pencil iron should suffice for mike, DIN, BNC and N plugs; for PL-259 (UHF-series) RF plugs, a 140+-watt soldering iron or gun, or a small gas torch is a must. Old-fashioned 140+-watt soldering irons with massive, heat-reservoir tips work just fine for this purpose and may be available used at ham flea markets; get one if you can. Such an iron is probably not worth buying new just to install a few connectors, however.

Vise—to restrain components your soldering jig can't handle.

Wrenches, open-end—to turn clamp nuts into, or hold, connector bodies: 7/16-inch for BNC clamp nuts, 5/8-inch for N clamp nuts, and 11/16-inch for N bodies. (The flats on BNC bodies often disallow wrench use; slip-joint pliers will suffice to hold BNCs.)—*WJ1Z*

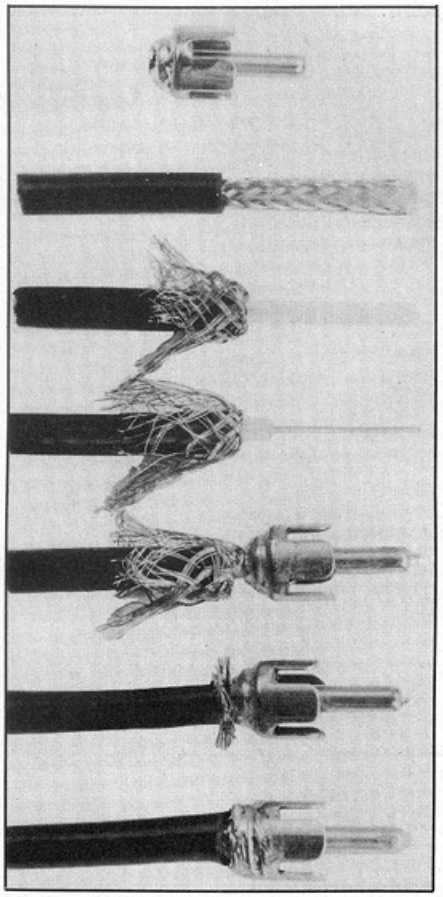


Fig 6—A conventional phono plug allows good RF shielding because its grounding sleeve can continue the entire cable-braid circumference through to the jack that receives it. (I say "*can* continue" because you must solder the coax braid and connector sleeve together *around their entire circumference* to take advantage of the plug's shielding characteristics. If you twist the braid into a wire and solder it to the connector at just one spot, you might as well be using plugs like those shown in Fig 4.)

To install a conventional phono plug: Tin the plug's ground-sleeve collar all the way around; lightly file the plug's center-conductor-pin tip down to base metal; remove about 7/8 inch of the cable jacket without nicking the underlying braid; push the braid back to fan and widen it; strip enough insulation (about 13/16 inch) from the center conductor so the center conductor fits through the pin and protrudes from the pin tip by about 1/16 inch; slip the plug onto the cable and solder the center conductor to the plug pin; trim the cable braid back with scissors (to 3/16 inch or so) and dress it (twisting it flat if necessary) so that it just covers the ground-sleeve collar; and rapidly solder the braid to the sleeve collar all the way around. Avoid flexing the completed assembly until it cools thoroughly.

VFO connections. For some years, ham equipment rarely required DIN connectors with more than 7 pins; some current transceivers sport *13-pin* DIN jacks. Radio Shack currently carries 4, 5, 6, 7 and 8-pin DIN plugs.

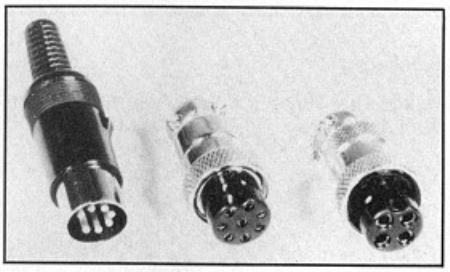


Fig 7—DIN (left) and microphone plugs (center and right) serve as essential control- and audio-signal connectors on many ham transceivers. Radio Shack currently stocks 4- and 8-pin mike connectors and 4, 5, 6, 7 and 8-pin DIN plugs.

Despite DIN plugs' close pin spacing, you needn't qualify as a watchmaker to install them. But if you've been wrestling your way through phone- and phono-connector installation without some sort of "third hand," the jig's up! DIN plugs, especially the four-piece versions currently stocked by Radio Shack, will make you appreciate your soldering jig—especially a spring-clothespin version—all the more. See Fig 8. Although some manufacturers' DIN plugs consist of a plug and screw-on shell, those currently stocked by Radio Shack consist of a plug, two metal sleeve/shield halves, and a slip-on, flexible-plastic shell. The plug carries the connector pins; the metal sleeve, which provides the plug's index and some strain relief, can serve as a shield and chassis-common connection for circuits connected via the plug; and the shell holds the shield halves together, traps the plug in place and provides more strain relief.

The basics of DIN-plug installation differ little from the installation techniques we've walked through so far. Because of DIN plugs' pin density, you may have to use multiwire shielded cable (rather than zip cord or coax) for space efficiency.

Before working on a DIN plug, study how its pieces go together and how its pins are numbered. Sketch the plug pinout—as viewed from the *back* of the plug, since this is how you'll see it as you work—on a piece of paper for reference as you go. And *study your equipment operating manual* to figure out which pin does what.

Microphone connectors (center and right in Fig 7) are found almost exclusively on transceiver front panels handling—you guessed it—mike connections. But mike jacks usually do more: Many transceivers of the 1970s and early 1980s used 4-pin jacks for mike and push-to-talk (PTT); Kenwood's TS-130V low-power transceiver used a 2-pin mike jack for dc supply; and modern transceivers' 8-pin mike jacks may also carry signals to and from **UP/DOWN** frequency-slewing buttons, dc for mike-preamplifier circuitry, and speaker-level audio output! (Radio Shack carries 4- and 8-pin versions; Amateur Electronic Supply, Universal Radio and Ocean State Electronics [addresses in "Connectors By Mail] or Telephone" make other configurations available by mail and telephone.) No industry-wide standard exists that equates particular pin numbers with these functions, so be sure to refer to your radio's operating manual when wiring its mike

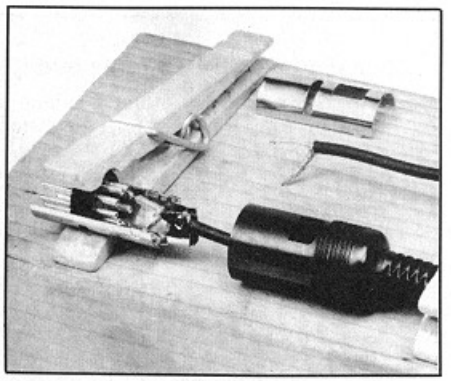


Fig 8—If you haven't caught on to the value of a soldering jig before now, installing a four-piece DIN plug can make a believer out of you! Here, one of the jig's spring clothespins holds the connector plug into the lower sleeve half while keeping both parts immobile. The other pin traps the cable and the connector shell. Above them lies a length of prepared-for-installation cable; above that, the upper sleeve half.

To install a DIN plug, clamp the lower sleeve half and plug into the jig; tin the pins' solder cups (and all areas on the lower sleeve half to which a ground connection must be made); size, strip and tin the cable wire(s); *slip the connector shell, facing the right way, over the cable(s)* and trap the shell and cable(s) in the second clothespin; solder the cable wire(s) to the plug; gently crimp the lower-sleeve-half strain relief around the cable wires; remove the plug from the jig and put the upper sleeve half in place; and slip the shell over both sleeve halves to complete the connector.

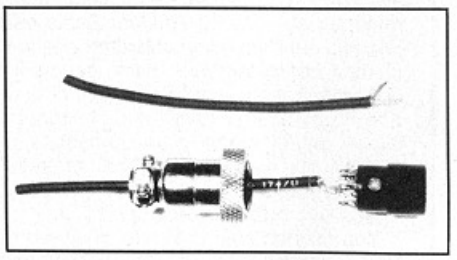


Fig 9—If you can install a DIN plug, you can also handle mike connectors. To keep from losing those tiny strain-relief and plug-retaining screws, temporarily turn them back into their holes after removing the removable strain-relief half and plug. Almost invisible in this picture is the clear plastic tubing that fits inside the shell to avoid pin-to-shell shorts. Be sure you slip it onto the cable—between the shell and cable end—*before* you begin soldering. If your cable is too skinny to be clamped by the strain relief, build up its diameter with electrical tape.

Connector-Installation Hints and Kinks—Part 2

- When feasible, minimize traffic jams at mike and DIN plugs by using shielded multiwire cable instead of multiple two-conductor-coax runs.
- When installing multicolored, multiwire cable to multipin connectors, assign the wires to connector pins according to the resistor color code (brown = pin 1, red = pin 2, and so on). If possible, use black for negative, common or ground.
- When installing multicolored cable to DIN and mike plugs, keep a written record of which wire color equates to which pin and circuit function. *If you work from an operating-manual connector-pinout diagram as you wire your plug, write this information on the diagram.* This backs up the resistor-color-code wire-assignment scheme just described.
- Use heat-shrinkable tubing to avoid short circuits between closely spaced connector terminals. This adds three steps to each connection: (1) cut a piece of suitable-diameter tubing to the desired length; (2) slip the tubing over the wire *and down the wire far enough so soldering heat won't shrink it prematurely*; and (3) *after the soldered joint has cooled*, slip the tubing over the joint and shrink it. You may be able to save time by shrinking all of a multipin connector's tubing at once.
- For all mike, DIN, BNC and N connectors, but not UHF-series plugs (PL-259s) and reducers (UG-175s and UG-176s): *Solder rapidly* as opposed to following the misleading "use minimum soldering heat" instruction so commonly preached. Soldering well, cleanly and quickly with a hot—700- to 750-°F—iron gives much better results than torturing cable and connector for half a minute with an insufficiently hot iron. Use as heavy a soldering-iron tip as feasible, too; heavier tips' higher heat-storage capacity allows them to heat connections faster. Staging the job (see "Connector-Installation Hints and Kinks—Part 1") goes a long way toward minimizing heat damage to wire and connector insulation.
- Use liquid flux to speed soldering coax braid to UHF-series plugs and plug/reducer combinations.
- Enlist the aid of a helper when installing UHF-series RF plugs (PL-259s), especially when large-diameter cable (RG-8, RG-11, Belden 9913 and so on) is involved.
- If your soldering iron can't adequately heat UHF-series connectors, consider installing a BNC or N connector instead—a pencil iron is sufficient to install them—and using connector adapters between your UHF jacks and BNC/N plugs.
- Don't guess at cable cut and strip lengths when installing UHF, BNC and N connectors—*use a ruler to size your cable according to the correct dimensions.*
- When installing clamp BNC and N connectors, turn the clamp nut into the connector body. Don't turn the connector body onto the cable.—*WJ1Z*

Connectors By Mail or Telephone

Radio Shack carries phone, semi-shielded phono, DIN, mike and solder-on UHF-series RF plugs and connector adapters generally suitable for Amateur Radio use. Because the critical impedance, frequency, shielding and weather-resistance characteristics for which hams generally turn to BNC and N connectors are best achieved at home with *clamp*-type plugs, and Radio Shack's BNC- and N-connector selection consists almost entirely of *crimp*-on connectors (exception: the RS 278-149 clamp N plug for RG-8 cable suits our purposes), I suggest you look to other suppliers for BNC and N connectors. That's where this sidebar comes in.

You may be able to locate what you need at local electronic supply houses. And parts vendors at ham flea markets can be an excellent source of RF connectors and connector adapters. If, however, you're unable to purchase the right stuff over the counter, don't hesitate to order what you need by mail or telephone. The following list—by no means all-inclusive—names mail-order suppliers that carry BNC, N and/or well-shielded phono connectors. (Most of them also carry coaxial cable, connector adapters, and/or phone, mike, DIN and UHF connectors.) Contact them for price and shipping information, and to confirm that the connector(s) you need are in stock.—*WJ1Z*

Well-Shielded Phono Connectors

Digi-Key Corporation, 701 Brooks Ave S, PO Box 677, Thief River Falls, MN 56701-0677 (voice phone 800-344-4539; fax phone 218-681-3380), carries Keystone "Conventional Type" phono plugs under catalog number 561K-ND.

*Clamp-Type BNC Connectors**

Amateur Electronic Supply, 5710 W Good Hope Rd, Milwaukee, WI 53223 (voice phone 800-558-0411, fax phone 414-358-3337), carries clamp BNCs for RG-58 cable under catalog number 31-002, and for RG-59† cable under catalog number 31-012.

Digi-Key (address above) carries clamp BNCs for RG-58 cable under catalog number ARF1040-ND, and for RG-59† cable under catalog number ARF1043-ND.

Ocean State Electronics, PO Box 1458, Westerly, RI 02891 (voice phone 800-866-6626; fax phone 401-596-3590), carries clamp BNCs for RG-58 cable under catalog number 27-9021, and for RG-59† cable under catalog number 27-9020.

Universal Radio, 1280 Aida Dr, Reynoldsburg, OH 43068 (voice phone 800-431-3939 [Ohio, Alaska, Hawaii: 614-866-4267]; fax phone 614-866-2339), carries clamp BNCs for RG-58 cable under catalog number 2376, for RG-59† cable under catalog number 2364, and for Belden 9913 cable under catalog number 0136.

*Clamp-Type N Connectors**

Amateur Electronic Supply (address above) carries clamp Ns for RG-58 cable under catalog number 34025, for RG-8 cable under catalog number 82-61, and for Belden 9913 cable under catalog number 82-202-1006.

Digi-Key (address above) carries clamp Ns for RG-58 cable under catalog number ARF1016-ND, for RG-59† cable under catalog number ARF1017-ND, for RG-8 cable under catalog number ARF1014-ND, and for Belden 9913 cable under catalog number ARF1020-ND.

Ocean State Electronics (address above) carries clamp Ns for RG-8 cable under catalog number 26-8000.

Universal Radio (address above) carries clamp Ns for RG-59† cable under catalog number 1853, for RG-8 cable under catalog number 2208, and for Belden 9913 cable under catalog number 0823.

*This listing does not differentiate between standard- and improved-clamp plugs. All parts listed are six-piece, 50-ohm connectors.

†Connectors intended for use with RG-59 cable can generally be used with RG-8X, RG-8M and Mini-8 cable by reducing these cables' center-conductor diameter as described in the text.

plug. And don't assume that a mike wired for one make of radio will work with another! ICOM, Kenwood and Yaesu mike-plug pin assignments differ, for example.

Installing mike plugs on cable is similar to doing a DIN plug: A soldering jig is essential if you want to maintain your sanity. Unlike a DIN plug, though, a mike plug's metal shell and coupling ring usually do *not* serve to continue a conductor through the plug. Mike-plug shield/ground/common connections are usually completed through one or more of the plug's pins, so you won't have to solder to the plug shell. The mike plugs currently stocked by Radio Shack require the use of a small-tipped Phillips-head screwdriver to remove and install plug-retaining and strain-relief screws.

Learn how your mike plug comes apart and goes together before beginning installation. You'll notice—with chagrin if you're installing the plug on, say, a length of RG-174 coax or skinny audio cable—that the plug's strain relief is designed to grip cables no smaller than ¼ inch or so in diameter. One solution: Build up the cable diameter through the strain relief with electrical tape. Fig 9 shows a close-up view of RG-174 before and after connection to an 8-pin mike plug; Bruce Hale showed how to connect three-conductor cable to a mike plug in January 1991 *QST*'s "Packet Hardware for Beginners."

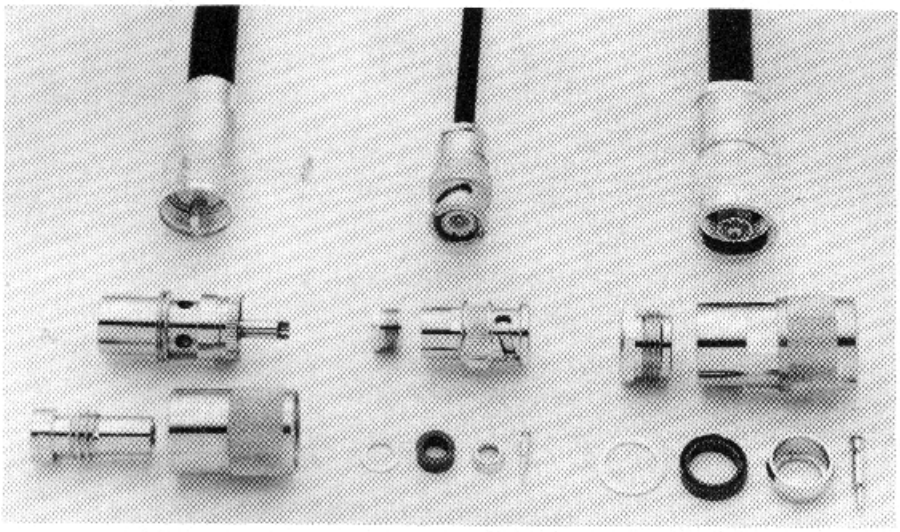


Fig 10—Hamdom's most common RF plugs (left to right): UHF, BNC and N. Each comes in various solder-on and solderless (crimp- and screw-on) versions. Of them, *solder-on* UHF connectors and *clamp* (referred to in this article as *clamp* or *clamp-type*) BNC and N connectors give best results when installed with basic hand tools. You'll find UHF jacks on most MF/HF and some low-VHF transceivers; BNC and N connectors are common on gear that operates on the ham bands between 144 and 1300 MHz. UHF, BNC and N connectors are available in nickel- and silver-plated versions; the nickel-plated versions work fine at the frequencies just mentioned and cost less. The threads of silver-plated UHF and N connectors sometimes bind annoyingly; nickel-plated plugs are less prone to this problem.

RF Connectors

Now that you've got your various pieces of station equipment talking to each other via phone, phono, DIN and mike plugs, it's time to turn them into a radio station by connecting an antenna. Three plug types handle the bulk of Amateur Radio antenna-connection jobs: UHF, BNC and N (Fig 10).

I aim to steer you toward *solder-on* UHF connectors, and *clamp-type* BNC and N connectors, because they provide the best results when installed with basic hand tools at home. *Crimp-on* UHF, BNC and N connectors abound—crimp-on connectors intended for mass production and designed to be installed *right* only with special crimping tools that can cost up to several hundred dollars apiece! Use solder-on (UHF) and clamp (BNC and N) connectors—please!

UHF Connectors

Just about all current Amateur Radio gear built for operation in the 1.8- to 29.7-MHz (160- to 10-meter) range uses *UHF-series* antenna jacks hams refer to generically as *SO-239s*. SO-239s receive plugs generically known as *PL-259s*. Like the RG (*R*adio *G*uide) designators we commonly use when specifying coaxial transmission lines, these designators got started when flexible coaxial cable and matching connectors were first produced for military use at frequencies above 30 MHz—all of which were loosely termed *ultra-high frequencies* (*UHF*) back then. ("Further Reading—Part 2" points to more about the advent of the flexible coax we now take for granted.) Subsequent events have rendered these connectors' UHF label ironic because *UHF* now denotes frequencies from 300 to 3000 MHz (0.3 to 3 GHz)—and because today's connector manufacturers realistically specify UHF-series hardware as usable only up to 300 MHz! Over fifty years after their introduction, UHF-series jacks remain the antenna connector of choice for manufacturers of medium- and high-frequency (MF/HF) ham gear.

Installing UHF plugs requires patience and more soldering heat than many hams' soldering irons can provide. (If you don't own soldering gear capable of heating UHF plugs sufficiently for good installation, consider the no-compromise alternative I propose in the sidebar "Connector Adapters: Cool Solution to a Hot Problem.") Fig 11 shows you how to install PL-259s on RG-8, RG-58 and RG-59 cable, and "Further Reading—Part 2" shows where to look in *The ARRL Handbook* for more on the subject.

Exactly which UHF-plug hardware you need depends on the cable you use. Used alone, the PL-259 (Radio Shack 278-205 [standard] or 278-188 [silver plating, Teflon insulation and higher price]) fits RG-8 cable perfectly. Used with a UG-175 (Radio Shack 278-206) *reducer* or *adapter*, the PL-259 fits RG-58 cable perfectly. A UG-176 reducer (Radio Shack 278-204) resizes the PL-259 to fit RG-59/RG-8X/RG-8M/Mini-8 cable.

UHF-connector hints: Commonly available UHF hardware consists mainly of nickel-plated brass. Although nickel's grudging affinity for solder can be improved somewhat with soldering flux, I get best results by filing down to bare brass the areas to be soldered. *Don't* file silver-plated PL-259s; silver takes solder readily.

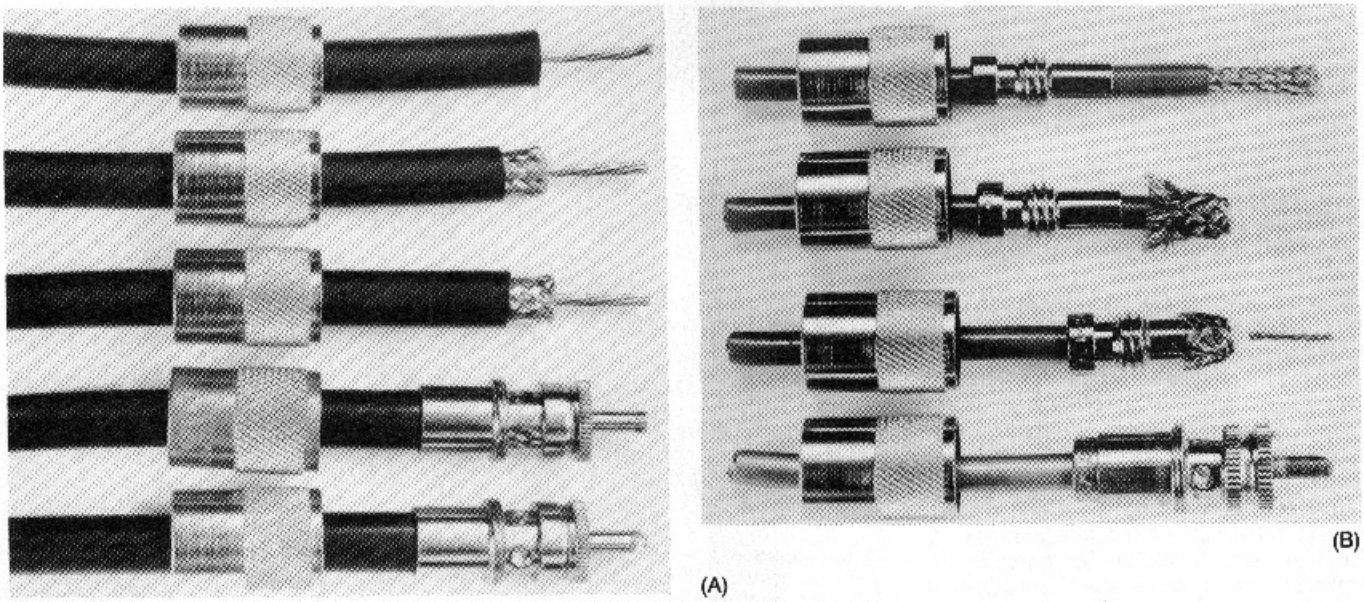
Further Reading—Part 2

On the advent of flexible coaxial cable and matching connectors: Bill Orr, "Coax Revisited," Ham Radio Techniques, *HAM RADIO*, June 1989, pages 21 to 24.

On installing UHF, BNC and N connectors: Larry D. Wolfgang and Charles L. Hutchinson, eds, *The ARRL Handbook for Radio Amateurs*, 1991 ed (Newington: ARRL, 1990), pages 36-13 to 36-15.

On removing the cable jacket without nicking the underlying braid: Thomas Cott and Phillip D. Dolan, "Stripping Coax Without Nicking Its Braid," Hints and Kinks, *QST*, April 1991, page 47.

On the origin of UHF, BNC, N and other RF connectors: Allen Nemetz, "A Designer's Guide to RF Connector Selection," *rf design*, September/October 1980, pages 18 through 22, and 24.—*WJ1Z*



(A) (B)

Fig 11—The basic PL-259 fits RG-8 cable (A). Install one as follows *after you've slipped the plug coupling ring, facing the right way, onto the cable*: (1) Remove 3/4 inch of the cable jacket, braid and dielectric without nicking the center conductor. (Using a sharp knife to do all three at once keeps the braid from separating.) (2) Also without nicking the braid, score the outer jacket 5/16 inch back from the first cut and remove this 5/16-inch wide jacket piece. Flux and lightly tin the exposed braid. (3) Using two sets of pliers—one to hold the cable and the other to turn the plug—screw the connector body all the way onto the cable. (4) Solder the braid to the plug through all four of the plug's solder holes. You may need to heat the plug for a minute or more, heating the plug at each hole in turn for 15 seconds or so, before this is possible. Liquid flux, applied to the braid through the solder holes, can speed the process considerably; you can also improve the solderability of nickel-plated brass by filing away the plating. (5) Solder the center conductor to the plug pin, and trim the center conductor if necessary. Don't flex the completed assembly until it cools.

The PL-259 requires a reducer/adapter for cables with diameters smaller than that of RG-8. When using nickel-plated parts, file all areas to be soldered—including the outside of the reducer tube (right of the reducer threads in B)—down to bare brass before beginning assembly. To install a PL-259 and reducer (B), begin by slipping the plug coupling ring *and reducer, facing the right way,* onto the cable and out of the way. Then: (1) Remove 3/4 inch of the cable jacket without nicking the braid. (2) Fan the braid slightly and fold it back over the cable. (3) Position the reducer so its end is flush with that of the cable jacket. (4) Press the braid down over the reducer body and trim the braid to 3/8 inch. (5) Without nicking the center conductor, remove 5/8 inch of the cable dielectric. Tin the center conductor; *do not tin the braid*—the plug's tight clearances won't allow it. (6) Screw the plug body onto the adapter, solder the braid to the connector shell through the solder holes, and solder the center conductor to the plug pin. Don't flex the completed assembly until it cools.

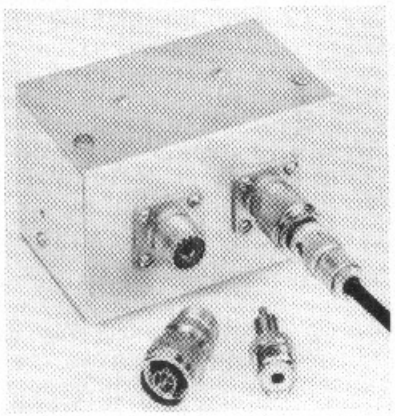
"Suggested Tools for Connector Installation—Part 2" kids you not when it lists a 140+-watt soldering iron as necessary for successful UHF-plug installation. Soldering these connectors takes considerable heat because you need to get the plug and coax *hot enough* to melt solder—*and* because you need to complete the job *fast enough* to keep from destroying the cable dielectric. (This is most critical with foam-dielectric cable.) If your iron turns out to be incapable of sourcing enough heat, or you can't get the knack of installing one of these plugs after several tries, reread "Connector Adapters: Cool Solution to a Hot Problem" and reconsider your options. If you decide to take the connector-adapter route, no sweat—literally.

UHF plugs are not weatherproof. Used outdoors, they allow water ingress that degrades their associated cable over time. If you use UHF connectors outside, cover them with electrical tape, Coax-Seal or

Connector Adapters: Cool Solution to a Hot Problem

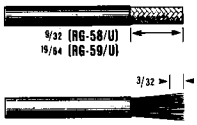
UHF plugs and their adapters require more soldering heat than common soldering pencils can provide. (I recommend using a soldering iron or gun that draws 140 W or more, or its gas-torch equivalent, for PL-259 jobs. Doing the job outdoors and/or in moving air requires considerably more heating capacity.) The discipline (some say hassle) involved in properly installing UHF plugs drives many radio amateurs to develop alternative—and usually questionable—PL-259-installation techniques that vary from the creative to the wacky. Don't be one of them. If you can't install solder-on PL-259s well, don't fudge them or cop out with kludged-on crimp connectors. Use clamp BNC or N connectors instead, and mate them with your UHF jacks via connector adapters.

Clamp BNC and N plugs require only enough heat to solder their center pins to the cable center conductor—a pencil iron is sufficient. Connector adapters—available at Radio Shack and the suppliers listed in the sidebar "Connectors By Mail or Telephone"—work fine at UHF-connector frequencies and go on with a few twists of your wrist. They're an entirely practical, electrically sound alternative to UHF-series plugs.—*WJ1Z*

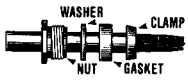


Don't let insufficient-soldering-heat hassles trap you into using half-baked UHF connectors. Install a BNC or N connector on your coax, and plug that connector into your UHF-jack-equipped transceiver via a connector adapter.

BNC CONNECTORS (STANDARD CLAMP)

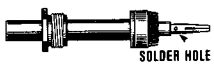


1. Strip jacket. Fray braid and strip dielectric. *Don't nick braid or conductor.* Tin conductor.



2. Taper braid. Slide nut, washer, gasket and clamp over braid. Clamp inner shoulder should fit squarely against end of jacket.

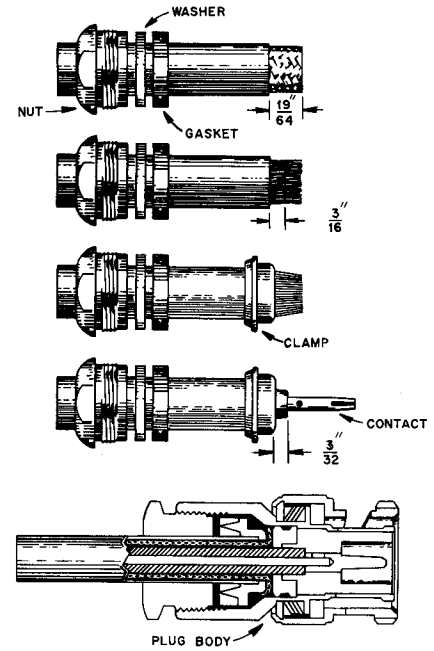
3. With clamp in place, comb out braid, fold back smooth as shown. Trim 3/32 " from end.



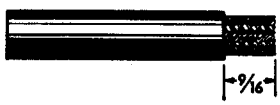
4. Solder contact on conductor through solder hole. Contact should butt against dielectric. Remove excess solder from outside of contact. Avoid excess heat to prevent swollen dielectric which would interfere with connector body.

Fig 12—Installing BNC plugs requires a bit of careful measuring and light-duty soldering. Your reward: Weatherproof, constant-impedance connections that work well into the gigahertz range.

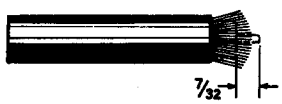
Improved Clamp



Follow 1, 2, 3 and 4 in BNC connectors (standard clamp) except as noted. Strip cable as shown. Slide gasket on cable *with groove facing clamp.* Slide clamp on cable *with sharp edge facing gasket.* Clamp *should* cut gasket to seal properly.



1) Remove 9/16" of vinyl jacket. When using double-shielded cable remove 5/8".



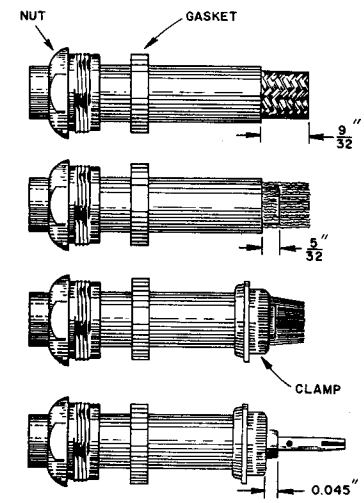
2) Comb out copper braid as shown. Cut off dielectric 7/32" from end. Tin center conductor.

3) Taper braid as shown. Slide nut, washer and gasket over vinyl jacket. Slide clamp over braid with internal shoulder of clamp flush against end of vinyl jacket. When assembling connectors with gland, be sure knife-edge is toward end of cable and groove in gasket is toward the gland.

4) Smooth braid back over clamp and trim. Soft-solder contact to center conductor. Avoid use of excessive heat and solder. See that end of dielectric is clean. Contact must be flush against dielectric. Outside of contact must be free of solder. Female contact is shown; procedure is similar for male contact.

5) Slide body into place carefully so that contact enters hole in insulator (male contact shown). Face of dielectric must be flush against insulator. Slide completed assembly into body by pushing nut. When nut is in place, tighten with wrenches. In connectors with gland, knife edge should cut gasket in half by tightening sufficiently.

Improved Clamp



1) Follow instructions 1 through 4 as detailed in the standard clamp (be sure to use the correct dimensions).

2) Slide the body over the prepared cable end. Make sure the sharp edges of the clamp seal properly in the gasket. Tighten the nut.

Fig 13—In many ways, N connectors are just bigger BNCs that take bigger cable (and therefore handle higher power): They're weatherproof, constant-impedance and just as easy to install.

other weatherproofing material to inhibit this process.

Minimize frustrating scrap and rework by checking for short circuits and continuity as you install UHF plugs, especially when the job involves both ends of a cable. *And be sure to slide the connector coupling ring on the cable, facing the right way, before you start soldering!* Attempts to desolder and reuse fully installed PL-259s usually result more in dangerous fumes and incinerated plugs than salvaged parts. *Snip off questionable or botched UHF plugs and throw them away.* If you're just learning to install UHF plugs, expect to sacrifice a few to education!

BNC and N Connectors

Legend has it that the *N*s in these connectors' designators stands for Paul Neill, the man credited with developing the N connector at Bell Labs during World War II, and who, legend also has it, worked with Carl Concelman to develop the BNC (Bayonet Neill-Concelman) connector. ("Further Reading—Part 2" shows where to read more about these connectors and their genesis.) Properly installed, clamp BNC and N connectors far outshine UHF hardware because (1) they're weatherproof; (2) their impedance generally matches that of the cables they connect; and (3) the only soldering they require involves installing their center pins on their cables' center conductors—a light-duty, soldering-pencil job.

The BNC connectors most used by hams accommodate one of two cable diameters: 0.195 inch (RG-58 cable) and 0.242 inch (RG-59/RG-8X/RG-8M/Mini-8 cable). BNCs are also available to fit other cable types, including RG-174-size (0.1-inch-outer-diameter) cables. Standard BNCs are designed for 50-ohm service but also work well in noncritical 75-ohm systems. Special optimized-for-75-ohm-service BNCs are available for critical applications; these mate with 50-ohm BNCs.

The N connectors most commonly used by hams accommodate RG-8-diameter (0.405-inch) cable. N connectors are also available to fit several other cable diameters and types, including RG-58 (0.195-inch outer diameter), RG-59 (0.242-inch outer diameter) and Belden 9913 (special center conductor) sizes. Standard N connectors are designed for 50-ohm service but also work well at 75 ohms below 300 MHz. Special optimized-for-75-ohm-service Ns are available for critical applications; *these do not mate with 50-ohm Ns.* (Something else that's neat about N connectors: They mate and provide good electrical connection with, but do not lock or screw onto, BNC jacks—a fact worth remembering in an emergency.)

BNC- and N-connector hints: You may encounter three species of clamp BNCs and Ns. *Standard*-clamp connectors are—you guessed it—standard; unassembled, those for RG-58 and RG-59-size cables come in six pieces. *Improved*-clamp connectors, which, unassembled, also come in six pieces for RG-58 and RG-59-size cables, grip the cable braid a bit better than the standard variety. *Captivated-contact* ("C. C.") clamp connectors—*eight* pieces unassembled—trap the connector center pin to position it and keep it from moving within the connector. Of these three types, the standard- and improved-clamp varieties are most common (and work just fine) in Amateur Radio stations; captivated-contact connectors are best for hookups that must be connected and disconnected often. Fig 12 shows how to assemble standard- and improved-clamp BNCs, and Fig 13 shows how to assemble standard- and improved-clamp Ns. "Further Reading—Part 2," shows where to look in *The ARRL Handbook* for how to assemble captivated-contact BNCs and Ns.

Although RG-8X/RG-8M/Mini-8 cables fit neatly through the clamp nuts of RG-59-sized BNC and N connectors, their stranded center conductors are considerably thicker than RG-59's and don't fit into the connectors' pins. Here's where you get to nick a cable's center conductor on purpose: *Carefully* cut away center-conductor strands *circumferentially* until the remaining strands just fit into the plug pin.

Conclusion, Part 2

Now you can install the phone, phono, mike, DIN and RF connectors you need, and you can do it well. Here's hoping that knowing how to keep your gear solidly connected will let you spend less time wrestling wires at the bench and more time enjoying wireless!

Nix on Nicks

The phrase "don't nick braid or center conductor" appears in most RF-connector-installation texts. It's an instruction worth following because the flexing associated with connector and cable movement eventually severs nicked conductors through the action of metal fatigue. ("Further Reading—Part 2" lists a Hints and Kinks item in which two hams reveal their techniques for minimizing nicking during connector installation.) Many hams, including me, put up with *some* conductor nicking in braid and stranded center conductors—especially if the connector involved will be readily replaceable once installed! So, if you can't entirely avoid nicking cable conductors, do your best to minimize it. If you badly nick a solid (single-wire) center conductor, or shower your bench with hacked-off wire bits in your efforts to remove a cable jacket or strip a center conductor, by all means start over!—*WJ1Z*

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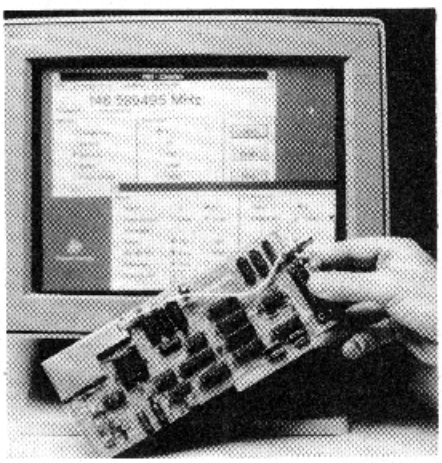

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