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Connecting Coaxial Cable Key to Radio System Deployment



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▼ *The connector installation process can be simplified with the use of non-solder connectors and the correct installation tools.*

Among the keys to success in any wireless system are the quality and reliability of the connector installations on the coaxial cable transmission lines. And it naturally follows that the more difficult the connectors are to install, the lower the likelihood that they will be installed correctly thus adversely affecting the quality and reliability of the entire system.

Traditional connectors require the pin contact to be soldered to the center conductor of the coax cable. Unfortunately, when RF transmission lines are installed outdoors as is often the case, weather conditions may not be conducive to using soldering equipment. Wind, rain and snow all can make soldering difficult if not impossible. If electrical power isn't available, gas or butane fired soldering equipment may be the only recourse and these devices typically do not generate as much heat as electrically powered devices. Consequently, they may not do as good of a job. The physical handling of the cable, connector pin, butane torch and solder can also be tricky (not enough hands!), especially if there's only one person doing the installation.

For indoor installations, such as distributed antenna systems in buildings, the installer may be working in cramped spaces, on a ladder and in low-light conditions. How can these issues be overcome to ensure a reliable connector installation and proper system performance?

Simplicity is the key. The connector installation process can be simplified with the use of non-solder connectors and the correct installation tools. We have designed non-solder connectors to work with

our LMR® low-loss flexible 50 Ohm coaxial cables. These connectors may be installed under all field installation conditions, because they use either silver or gold plated copper-beryllium spring finger contacts that make positive contact with the center conductor and do not require soldering.

Smaller cable sizes, LMR-400 (3/8") and LMR-600 (1/2"), require a crimp-style outer contact attachment ring. When the cable is larger, the LMR-900-DB (5/8") for example, a larger clamp method of attachment is needed. Interfaces available include 7-16DIN, N, TNC and reverse polarity TNC connectors.

Even though using non-solder connectors is simpler, there are still certain techniques that must be used if a proper connection is to be achieved. Additionally, you must use the proper tools to get the job done, including stripping, prepping and deburring instruments.

Poorly installed connectors are the most common cause of voltage standing wave ratio problems. Likewise, a good connection will achieve the best RF transmission performance with a minimum of signal loss. The following techniques will ensure a good connection and long-term reliability.



fig EZ400-1



fig EZ400-2



fig EZ400-3

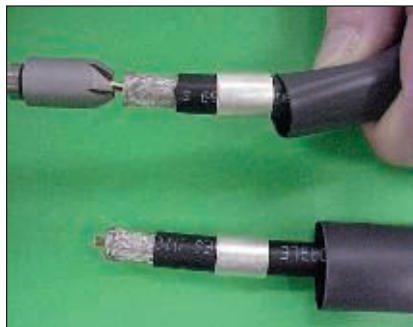


fig EZ400-4



fig EZ400-5



fig EZ400-6



fig EZ400-7



fig EZ400-8

The typical procedure for installing the connector on cable sizes LMR-400 and LMR-600 (also the same procedure on DB and FR) is:

- Flush cut the cable squarely. (fig EZ400-1)
- Slide the heat shrink boot and crimp ring onto the cable. Strip the cable-end using the ST-400-EZ or ST-600-EZ prep/strip tool by inserting the cable into End 1 and rotating the tool. Remove any residual dielectric material from the center conductor. (fig EZ400-2)
- Insert the cable into End 2 of the tool and rotate the tool to remove the plastic jacket. (fig EZ400-3)
- Debur the center conductor using the DBT-01 deburring tool. (fig EZ400-4)
- Flare the braid slightly and push the connector body onto the cable until the connector snaps into place, then slide the crimp ring forward, creasing the braid. (fig EZ400-5)
- Temporarily slide the crimp ring back, and remove the connector body from the cable to trim the excess braid at the crease line, then remount the connector and slide the crimp ring forward until it butts up against the connector body. (fig EZ400-6)
- Position the heavy duty HX-4 crimp tool with the appropriate dies (CT-400/300 tool may be used on LMR-400) directly behind and adjacent to the connector body, and crimp the connector. The HX-4 crimp tool automatically releases when the crimp is complete. (fig EZ400-7)
- Position the heat shrink boot as far forward on the connector body as possible, without interfering with the coupling nut and use a heat gun to form a weather tight seal. (fig EZ400-8)

The procedure for installing the connector on cable sizes LMR-400-LLPL and LMR-600-LLPL is very similar with a couple of differences:

- Flush cut the cable squarely. (*fig EZ600P-1*)
- Slide the heat shrink boot and crimp ring onto the cable. Strip the cable-end using the ST-400-EZ or ST-600-EZ prep/strip tool by inserting the cable into End 1 and rotating the tool. Remove any residual dielectric material from the center conductor. (*fig EZ600P-2*)
- Insert the cable into End 2 of the tool and rotate the tool to remove the plastic jacket. (*fig EZ600P-3*)
- Debur the center conductor using the DBT-01 deburring tool.

(*fig EZ600P-4*)

- Flare the braid slightly, then put a slight taper on the front edge of the aluminum covered dielectric by 'rolling' your fingers around the stripped end. (The heat shrink boot can also be used rather than your fingers). (*fig EZ600P-5*)
- Rotate (turn) and push the connector body with a screwing motion (to prevent the foil from pushing back) onto the cable until the connector snaps into place. Then slide the crimp ring forward creasing the braid. (*fig EZ600P-6*)
- Temporarily slide the crimp ring back, and remove the connector body from the cable to trim the

excess braid at the crease line, then remount the connector and slide the crimp ring forward until it butts up against the connector body. (*fig EZ600P-7*)

- Position the heavy duty HX-4 crimp tool with the appropriate dies (CT-400/300 tool may be used on LMR-400-LLPL) directly behind and adjacent to the connector body and crimp the connector. The HX-4 crimp tool automatically releases when the crimp is complete. (*fig EZ600P-8*)
- Position the heat shrink boot as far forward on the connector body as possible, without interfering with the coupling nut and use a heat gun to form a weather tight seal. (*fig EZ600P-9*)



fig EZ600P-1

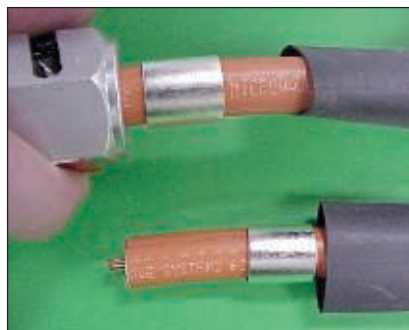


fig EZ600P-2



fig EZ600P-3

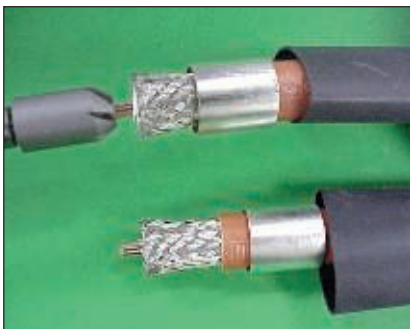


fig EZ600P-4

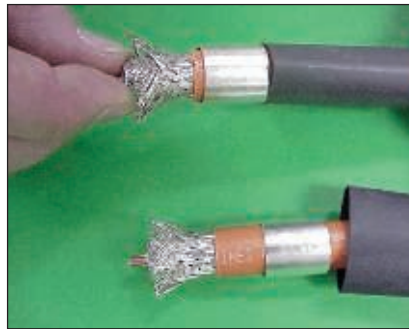


fig EZ600P-5



fig EZ600P-6



fig EZ600P-7

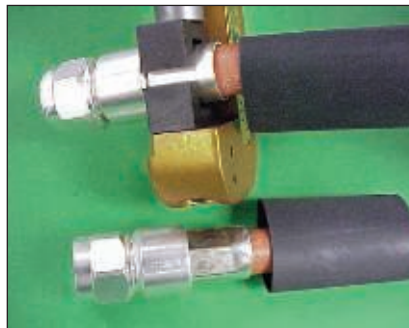


fig EZ600P-8



fig EZ600P-9

For installing the 'EZ' connectors on LMR-900-DB, FR and LLPL cables and larger, the process is as follows:

- Flush cut the cable squarely. (*fig EZ900-1*)
- Slide the backnut and gasket onto the cable. (*fig EZ900-2*)
- Strip the cable-end using the EZ prep/strip tool by inserting the cable into the proper end of the tool (note that only one strip is needed). (*fig EZ900-3*)
- Slide the gland washer on the end of the cable and over the braid (being careful not to disturb the braid) until it rests on the end of the cable jacket. (*fig EZ900-4*)
- Spread the braid over the gland washer. (*fig EZ900-5*)
- Slide the collar over the foil. (*fig EZ900-6*)
- Push the 'spring finger' end of the connector pin assembly into the hollow center conductor. (*fig EZ900-7*)
- Bring up the backnut and gasket. (*fig EZ900-8*)
- Screw the connector head onto the backnut and tighten with proper size wrenches until the gasket is almost fully compressed. (*fig EZ900-9*) **TE**



fig EZ900-1



fig EZ900-2



fig EZ900-3



fig EZ900-4



fig EZ900-5



fig EZ900-6



fig EZ900-7



fig EZ900-8



fig EZ900-9

Reference chart showing 'EZ' connectors for use with LMR, DB & FR Cables

| LMR® FR DB | Interface | Description | Part Number | Coupling Nut | Inner Contact | Outer Contact |
|---------------------------|------------------|--------------------|--------------------|-------------------------|--------------------------|--------------------------|
| 400 | N Male | Straight Plug | EZ-400-NMH | Hex | Spring Finger | Crimp |
| 400 | N Female | Straight Jack | EZ-400-NF | NA | Spring Finger | Crimp |
| 400 | N Female | Bulkhead Jack | EZ-400-NF-BH | NA | Spring Finger | Crimp |
| 400 | TNC Male | Straight Plug | EZ-400-TM | Knurl | Spring Finger | Crimp |
| 400 | TNC Male | Reverse Polarity | EZ-400-TM-RP | Knurl | Spring Finger | Crimp |
| 400 | TNC Female | Reverse Polarity | EZ-400-TM-RP | Knurl | Spring Finger | Crimp |
| 400 | UHF Male | Straight Plug | EZ-400-UM | Knurl | Spring Finger | Crimp |
| 600 | N Male | Straight Plug | EZ-600-NMH | Hex | Spring Finger | Crimp |
| 600 | N Male | Right Angle | EZ-600-NMH-RA | Hex | Spring Finger | Crimp |
| 600 | N Female | Straight Jack | EZ-600-NF | NA | Spring Finger | Crimp |
| 600 | N Female | Bulkhead Jack | EZ-600-NF-BH | NA | Spring Finger | Crimp |
| 600 | TNC Male | Straight Plug | EZ-600-TM | Knurl | Spring Finger | Crimp |
| 600 | TNC Male | Reverse Polarity | EZ-600-TM-RP | Knurl | Spring Finger | Crimp |
| 600 | TNC Female | Reverse Polarity | EZ-600-TM-RP | NA | Spring Finger | Crimp |
| 600 | UHF Male | Straight Plug | EZ-600-UM | Knurl | Spring Finger | Crimp |
| 600 | 716 DIN Male | Straight Plug | EZ-600-716-MH | Hex | Spring Finger | Crimp |
| 900 | N Male | Straight Plug | EZ-900-NMC | Hex | Press Fit | Clamp |
| 900 | N Female | Straight Jack | EZ-900-NFC | NA | Press Fit | Clamp |
| 900 | 716 DIN Male | Straight Plug | EZ-900-716MC | Hex | Press Fit | Clamp |
| 900 | 716 DIN Male | Right Angle | EZ-900-716-MCRA | Hex | Press Fit | Clamp |
| 900 | 716 DIN Female | Straight Jack | EZ-900-716-FC | NA | Press Fit | Clamp |
| 900 | 7/8 EIA | Straight Plug | EZ-900-78EIA | NA | Press Fit | Clamp |
| 1200 | N Male | Straight Plug | EZ-1200-NMC | Hex | Press Fit | Clamp |
| 1200 | N Female | Straight Jack | EZ-1200-NFC | NA | Press Fit | Clamp |
| 1200 | 716 DIN Male | Straight Plug | EZ-1200-716MC | Hex | Press Fit | Clamp |
| 1200 | 716 DIN Female | Straight Jack | EZ-1200-716-FC | NA | Press Fit | Clamp |
| 1200 | 7/8 EIA | Straight Plug | EZ-1200-78EIA | NA | Press Fit | Clamp |
| 1700 | N Male | Straight Plug | EZ-1700-NMC | Hex | Press Fit | Clamp |
| 1700 | N Female | Straight Jack | EZ-1700-NFC | NA | Press Fit | Clamp |
| 1700 | 716 DIN Male | Straight Plug | EZ-1700-716MC | Hex | Press Fit | Clamp |
| 1700 | 716 DIN Female | Straight Jack | EZ-1700-716-FC | NA | Press Fit | Clamp |

**Reference chart showing 'EZ' connectors
for use with LMR LLPL Cables**

| LLPL | Interface | Description | Part Number | Coupling Nut | Inner Contact | Outer Contact |
|------|-----------|---------------|----------------|--------------|---------------|---------------|
| 400 | N Male | Straight Plug | EZ-400-NMH-PL | Hex | Spring Finger | Crimp |
| 600 | N Male | Straight Plug | EZ-600-NMH-PL | Hex | Spring Finger | Crimp |
| 900 | N Male | Straight Plug | EZ-900-NMC-PL | Hex | Press Fit | Clamp |
| 900 | N Female | Straight Jack | EZ-900-NFC-PL | NA | Press Fit | Clamp |
| 1200 | N Male | Straight Plug | EZ-1200-NMC-PL | Hex | Press Fit | Clamp |
| 1200 | N Female | Straight Jack | EZ-1200-NFC-PL | NA | Press Fit | Clamp |

**Reference chart showing the proper tools
for use with 'EZ' connectors**

| LMR® LMR® - FR LMR® - DB LMR® - LLPL | 'EZ' Connector Type | Strip/ Prep Tool | Debur Tool | Crimp Handle | Crimp Dies | Wrenches | |
|---|---------------------------|---------------------|---------------|-----------------|-------------------|----------|----------|
| 400 (3/8") | Crimp | ST-400EZ | DBT-01 | HX-4 | Y1719 | N/A | |
| | | | | CT-400/300 | Included w/Handle | N/A | |
| 600 (1/2") | Crimp | ST-600EZ | DBT-01 | HX-4 | Y1720 | N/A | |
| 900-DB (5/8") | Clamp | ST-900/1200C | N/A | N/A | N/A | WR-900 | WR-900 |
| 1200-DB (7/8") | Clamp | ST-900/1200C | N/A | N/A | N/A | WR-1200A | WR-1200B |
| 1700-DB (1-1/4") | Clamp | ST-1700C | N/A | N/A | N/A | WR-1700 | WR-1700 |

All outdoor installations should be weatherproofed with either a standard weatherproofing kit such as the Times WK-2 kit or a cold shrink kit, also available from Times. Times LMR® coax cables are low loss, flexible and non-kinking, unlike corrugated coax cables which are much less flexible and prone to kinking. Times Microwave Systems offers a complete range of LMR® cables to suit every possible type of installation and need:

- LMR® - Low loss coax, flexible and non-kinking; suitable for general outdoor use such as jumpers, rooftops and short tower runs.
- LMR® DB - Watertight outdoor cable; designed for tower feeder runs, jumpers and rooftops applications; uses the same connectors as LMR® cable.
- LMR® FR - Riser rated (UL/CSA listed); fire retardent; employs a low smoke non-halogen polyolefin jacket; for use in vertical riser/access shafts - unoccupied building spaces or anywhere that fire retardance is needed; uses the same connectors as LMR® cable.
- LMR® - LLPL - Plenum rated (UL/CSA listed); for In-building runs; can be used in open air handling spaces such as above drop ceilings and air plenums; flame retardent and low smoke generating design; uses special 'EZ' connectors.

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