Pro Intercom LLC ©

Intercom for Sound, Lighting and Production Professionals

Connections.

Cable Types & Sizes.

Applications Notes

• Connections •

1. Single circuit intercom stations should be interconnected with 2-conductor shielded microphone cable.

2. Cable type will be determined by the use and environment of the system.

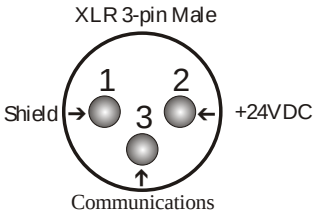
3. Cable size will depend upon the overall length of the cables in the system and the number and type of stations to be connected.

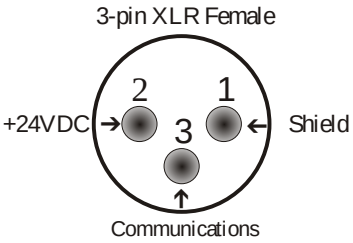
4. Correct phasing is critical. **Pin 2/3 swaps are the number one cause of system failures**

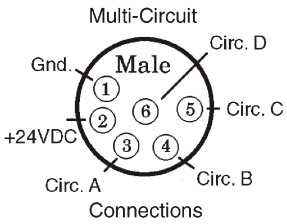
5. Spurs, tees, daisy-chains and loop-in/loop-out are all acceptable.

6. By convention, to avoid confusion with low impedance microphone connections, intercom outlets on source units (power supplies, master stations, etc.) and on wall plates, etc. should be male.

7. In portable applications the system is connected using conventional microphone cables. Single circuit stations use 2-conductor shielded cable fitted with 3-pin XLR's as shown below, left and center.

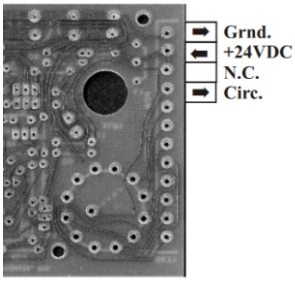


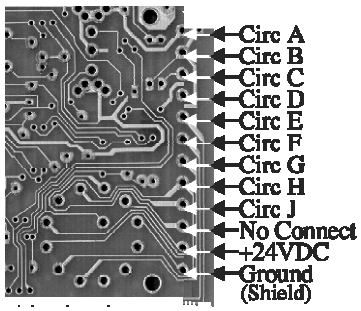




8. Multi-circuit enclosed products are equipped with Neutrik 6-pin XLR-type connectors wired as shown above, right.

9. Single circuit products for flush mounting are equipped with 4-position plug-in terminal strips, and are wired as shown below, left.





10. Multi-circuit products for flush mounting are equipped with 12-position plug-in terminal strips and are wired as shown above, right

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• Grounding •

Rule 1: Cable shields must never be grounded except at the power supply or master station.

Rule 2: Re-read Rule 1.

1. The use of one shielded pair in a multi-pair cable is only permitted if the shield of each pair in the cable is isolated from all the other shields.

2. The ground connection on the AC plug on the power supply must be used and **must be the only ground point in the system.**

3. Where dual muff headsets are used with a binaural 'belt pack'(BP2B), the common conductors to each earspeaker must remain discrete.

4. If headset leads are extended, the microphone common and earspeaker common must remain discrete. Because the microphone is unbalanced, headset cables should not exceed 20ft/6.1m

• Cable Type •

Portable Systems:

For best reliability, use a good quality rubber-covered cable with internal textile reinforcement. This cable is easy to handle, flexible and generally durable. The two most common faults encountered in Pro Intercom systems are due to grounding faults and poor quality or excessively worn cable.

A shielded pair in a 'snake' may be used, with care to avoid contact by the shield of the pair used, with any other shield or ground point.

Permanent Installations:

PVC covered 2-conductor shielded cable may be used. It is less bulky, more economical, and better suited to pulling in conduit, etc. Local regulations may limit or specify acceptable types, fire resistance, etc., particularly if the system is part of a 'life safety' application.

• Cable Size •

Table 2, at the end of this section, is a rough guide to cable sizes in average systems with few, if any, loudspeaker stations. More precise calculations may be made using the data which follows.

Power Considerations:

The most important factor in choosing the correct size of cable for the majority of systems is the DC power loss due to voltage drop across the length of the cable.

Ohm's Law: V=I x R Voltage Drop = Current Drawn x Cable Resistance

The voltage drop is dependent upon the number and type of stations and the resistive characteristic of the cable.

Pro Intercom stations have the following maximum current draw:

Typical Headset Station: 0.03A (30mA) (with signal lamps lit)

Typical Loudspeaker Station: 0.2A (200mA) (at high volume levels)

Other system electrical characteristics:

Maximum supply voltage: 30.0 VDC

Standard supply voltage: 24.0 VDC

Minimum operating voltage: 18.0 VDC

Recommended maximum design voltage drop each way: 6.0 V

It can be seen that the cable size must be increased for:

a) increasing numbers of stations

b) increasing length of cable

c) use of high current-drawing stations (loudspeaker stations)

Particular care must be taken when loudspeaker stations are used at the end of a long cable, for example, 4 loudspeaker stations connected at the end of a 500' cable:

6.0 V (4 x 0.2A) = 7.5

The cable is 500' long but the current traverses the loop out and back again. Therefore we must select a cable with no more than 15 resistance per 1000'. Referring to Table 1, the minimum acceptable wire gauge would be 22 AWG.

Where voltage drops are excessive, it may be more practical to add a remote power supply than to increase wire gauge.

Audio Considerations:

The other factor affected by cable size is the high frequency response of the whole system due to the capacitance of the cable. In small systems, under 500' total cable length, capacitance is not normally significant. In systems with total cable lengths in excess of 3000', it may become critical. In these situations the reduction in high frequencies can become significant as the impedance of the cable approaches that of the standard system termination (200).

For systems with several very remote outstations, the larger cable required to avoid voltage drops usually ensures that capacitance is sufficiently low. However, this factor must be considered in very long low-current applications. Remember that the whole system will be affected, not just the remote station(s) at the end of the long run, as with voltage drop. The cable length we are considering here is not the just the length of a particular run, but the total of all the cable in the system.

Typically, a loss of 3dB at 3kHz is considered the minimum acceptable, though this may not be so in high noise environments where any loss of intelligibility must be avoided. In the following example, we have assumed a 3dB @ 3kHz loss.

The maximum allowable cable capacitance for all the cable used in the system may be calculated as follows:

C(pF) = 10 ˜ 2 (cut off frequency in kHz) x (termination in K)

C = 10 ˜ (6.28 x 3 x 0.2) = 265000 pF

The maximum acceptable length of cable rated at 130pF/m would be:

Total Length = 265000 130 = 2038m/6700ft

• Table 1 •

AWG	**Cross Section (In.)**	Resist. **/1000'**
24	.0003	25
22	.0006	15
20	.0009	10
18	.0014	6
16	.0020	4
14	.0033	2.5

Important Note: This table is approximate and for guidance only. AWG figures refer to a range of standard cable sizes, and those given are average figures.

• Table 2 •

Typical Cable Requirements

Portable System	**AWG**	**Cross Section (mm)**	**Typical Type**
Up to 500 feet	20	.22	Med. duty mic. cable
Up to 5000 feet	18	.45	Heavy duty mic. cable
Permanent Installation			
Up to 250 feet	22	.22	To
Up to 500 feet	20	.5	Suit
Up to 5000 feet	18	.8	Application

Important Note: This table is for quick reference only. See detailed notes on correct system design. The table above assumes a system consisting mainly of 'belt packs' or fixed headset stations, with few, if any, loudspeaker stations. Increasing numbers of loudspeaker stations will require larger cable. For critical or marginal applications, contact the cable manufacturer for exact specifications.