interfacing balanced and unbalanced connections

Basically, balanced connections run the signal current through two lines independently of the shield; these are often called hot, '+' or phase (XLR pin 2) and cold, '-' or return (xlr pin 3). Unbalanced connections run the return through the shield.

inputs

In order for a differential input (electronic or transformer coupled) to function at all, it has to see a voltage difference between hot and cold - hence its name. So cold (xlr pin 3) has to be wired to the shield if a balanced input is fed from an unbalanced output - simple.

outputs

The problem arises when connecting balanced outputs to unbalanced inputs. If the output is transformer coupled then again, you need to connect cold (XLR pin 3) to shield (XLR pin 1) for any current to flow at all, as there is no electrical connection between the transformer secondary (the output bit) and ground - no cold no signal. However (and this is where the complications arise) electronically balanced outputs have a ground reference by necessity, so a current can flow between hot and ground unlike transformer systems. Connecting the cold (XLR pin 3) to ground (XLR pin 1) simply shorts the cold output amplifier to ground and I have come across several equipment manuals that explicitly tell you not to do this. In practice most electronic output drivers have an output impedance that is sufficiently high for no damage (or distortion on the other leg) to occur when either leg (XLR pin 2 or 3) is shorted to ground whether deliberately or not. This means that you can use the same wiring for all balanced to unbalanced connections with relative impunity but it is always worth checking the documentation supplied with equipment and don't blame me if you need a new output driver amp occasionally!

The additional problem is that you lose 6dB of headroom by driving an electronically balanced output into an unbalanced input and you will probably also lose 6dB of gain whether you ground the cold or not. You might come across cross coupled output drivers which compensate for the gain loss when the cold is grounded but can't compensate for the headroom loss. However since most unbalanced inputs reference to the lower domestic level, the chances are that they'll clip before the decreased headroom in your line driver becomes an issue

The only truly correct method is have a whole load of cables with pin 3 and pin 1 linked (for transformer and cross coupled output stages) and pin 3 open circuit (for normal electronically balanced outputs), but the confusion this is likely to cause usually means that this doesn't happen. It's a minefield, isn't it?

See also balanced lines and common mode for more details on this.