

## Direct Feeds - Why, What and How By Malcolm Chisholm

A number of secondary techniques used in recording seem to go in and out of style every few years, like trench coats and double breasted suits. Some of them go out and stay out, and we're well rid of them, but every once in a while a really useful gimmick gets shunted aside in the relentless quest for new and more perfect sound, when it doesn't seem to work as advertised, or just doesn't fit in with "The way we do it now." Engineers, at least professionally, are nothing if not stylish.

Direct feeds are a classic example of this sort of thing. Almost every studio owns a couple of directs, and most engineers use them here and there, but very few take full advantage of these remarkably helpful little boxes.

Aside from being about half ugly, directs are probably under used because one of their main functions is somewhat obscure and because they are commonly used as the only pickup on a given instrument. That's too bad, as it's possible to make the housing look decent, the concealed function is critical to both the musicians and the studio, and directs don't have to be used as solo acts. In addition, they sound better than mikes.

That last is a little off. Directs don't sound better than mikes. Directs sound better than woofers.

Musical instrument amplifiers generally don't have tweeters in them. They come with one or two very high quality 12 to 15 inch woofers, and that's it.

There are good reasons for not putting in tweeters, including expense and reliability, but not having them leads to problems. Good woofers produce plenty of low end and a fair amount of mid-range, but when an amp tries to move those big soft cones fast enough to put out high frequencies, they wrinkle up instead of producing top end, and fall dead at something around 5 KHz. The cones also put out very little in the way of transients as they again develop pleats instead of pushing air. Stiff cones work better, but the resonant point of the speaker rises rapidly as the cone is stiffened, and the speaker runs out of low end as it gains top.

This is a no-win situation, and there's no such thing as a single full range speaker.

There are a few amps around with tweeters in them, and they help an audience no end. Unfortunately, they don't do a whole lot for the engineer, as they are separate from the woofers, and he's got to mike the amp from three or four feet away in order to get both the woofer and tweeter. At that distance the mike will pick up everything else in the room, and sounds pretty dull to boot.

Coaxial speakers would solve most of these problems, and a good case can be made for spending the money to shoehorn them into dedicated studio amplifiers, but in addition to being big and heavy, they're not made to sustain continuous high power use, which makes them poorly suited for general stage work.

All of which brings us back to the direct, which avoids the speakers altogether, and sometimes the amp as well, while quietly bulletproofing the musicians against shock hazard.

Bulletproofing first, as it's simpler.

A properly made direct with no repeat NO grounding switches (none) will nail an amp down to the console ground through it's cable to the console input.

This is a very strong ground because the mike cable shield amounts to about #10 wire, and XLR connectors are rated at 10 amps continuous current per pin.

With the direct connected, both the amp and the instrument will be at microphone ground come what may, and that's good, as what may come is a life threatening situation.

Instrument amps have a .05 mfd local grounding capacitor connected from the A.C. line to the amp chassis. The cap is switched from one side of the line to the other by the three position "on" switch, so the cap is in the circuit if the amp is on.

Capacitors fail. If the local grounder cap fails and shorts out, the amp will either be at the A.C. neutral voltage or 120 volts A.C. above it. That puts the attached instrument and the musician playing it 120 volts A.C. above the nearest mike, and a fella could get killed that way.

That sounds like a remote possibility, and it is. On the other hand, the writer has seen grounding caps short on two occasions; once before a session and once in the middle of one. In both cases the amp was on a direct feed, so the result was to blow the amp's A.C. line fuse rather than allow the amp to go hot to ground.

One musician was pretty upset, thinking we had somehow blown his amp. The other understood what had happened pretty quickly and was grateful that the direct had saved him from a bad if not fatal shock. The gratitude was welcome, but the other guy's people would probably have everybody involved in court cases to this day if he'd got killed, and it wouldn't have done a damn thing for the studio's reputation.

It may seem preposterous that a musician's life can hang on a 70 cent capacitor, but it's a fact. The direct's ground insures both him and the studio against this threat, and if the pipe ground (the round pin on the power plug) is lifted with a 3 to 2 pin ground lift adaptor AFTER the direct has been connected, the amp will be at absolute console ground. There will be none of the little shocks guitarists and such constantly get (and hate) and

the intractable hum problems typically associated with direct inputs will disappear. All that will make the players feel that somebody is really concerned for their welfare, which they like, and make your life easier.

Onward to what:

There are lots of direct inputs on the market, and they all work. Some work better than others, mostly because of the designer's background. We all know that most professional recording equipment seems to be laid out by people who know a great deal about electronics and such, but very little about actual recording. It's as if nobody in Detroit knew how to drive, and the car companies depended on letters from their buyers for design input.

Direct inputs are a prime example of this sort of thing. Because of power transformer hum fields around amps, a direct input is almost always placed on the floor beside the amp. In fact direct inputs live on floors, getting kicked, stepped on, and dirty.

Despite this, they are commonly built into lightweight boxes with three colors of paint and a few tiny switches sticking out here and there. Give one of those things a few weeks on the floor and it'll self destruct.

Admittedly, a handy pad switch on a feed saves a bit of time in setup, but it is the writer's opinion that a direct input box should be capable not only of sustaining abuse, but inflicting it, and I know of no switches that can be used to drive nails. A second output XLR at minus 20 will do the job without sissying up the box and is more reliable anyway. As to the box as such, electrical boxes work pretty well, provide considerable shielding, and cost almost nothing. They are also ugly, and if looks are important, Bud and Hammond make some very nice little metal boxes in steel and aluminum. Newark Electronics (branches everywhere) carries both.

As to design, the simpler the better. As with any tool, a direct input should not be interesting. It should just work.

The simplest designs use transformers, which are as reliable as lead balls, as they have no moving parts. Figure one is such a design, and is a little more sophisticated than it looks.

The trick here is that the transformer is a bridging input at about ten times its marked impedance. For that reason, it's a decent match for a guitar pickup when, for some reason, there's no amp for the instrument.

It's a poorer match for a bass, which is normally fed into one jack with the amp fed from the other.

That works out OK because a bass player sets all his instrument controls at wide open, while guitarists usually play at about half volume to allow turning up for solos.

Lastly, the transformer is a terrible match for a power amp at about 1/10 ohm. The result of these varying matches is that everything comes out at about the same level. Handy.

The transformer drawn is a TRW/UTC series "A". These and similar mike input transformers are great for directs as they are moderately priced, well shielded units, with a plus 8 Dbm rating, (strength of ox) and they sound terrific.

The UTC's are off the market, but they can sometimes be found in a studio junk box, which makes the price really attractive.

If you can't find any A's or equivalents, Jensen Transformers in Hollywood makes a dandy direct transformer designed specifically for the purpose.

It's a first rate unit, and much smaller, as it's not shielded.

Again, good stuff. The bad stuff is little half ounce transformers.

Big fat transformers turn out big fat sound. Little ones sound tinny even when they don't distort, and probably account for some of the common misgivings about transformer directs. They also generate more noise; the cheaper the noisier.

The how to part of all this is real easy. Put a direct on anything that comes out of a speaker. As an example, a direct on the B-3 Hammond will get you some actual bass from the instrument, although the key clicks will need equalizing out. On guitars, synths, and the like, the direct will supply a warmth and presence that cannot be picked up any other way. In fact, it's so good a musician may comment that it doesn't sound like his instrument. A fast playback on the Auratones will reassure him, as they're pretty close to the amp speakers, so he'll hear what he expects on them.

Directs sound wonderful, but they also transfer (not generate) some problems. A direct transfers everything that comes out of an amp into the console, including some things you don't want to hear.

In the case of guitar amps, these include amplifier noise, key clicks, fingering noise, a lot of trash from cheap toys if the artist is using them and, occasionally, too much presence. Most of the trash can be either removed with eq or masked by using a mike a couple of feet off the amp. Don't get too close to the speaker with a mike or you'll run into phase cancellation problems, but the combination of direct and mike is so flexible that you can get about anything you want from the amp.

Guitar players use their amp tone controls as part of their sound, so it's best to pick up the amp output rather than using the direct between the axe and it's amp, which is optimum for other instruments. Using a direct on the preamp output of a guitar amp is easy, but it's the writer's experience that it never sounds quite right. That probably has some-

thing to do with going through a chain of inductors, and starting with one (the speaker) makes some sense from that standpoint.

A couple of final notes.

One, a direct will be flat to about 10 cycles, so if the feed seems to be muddying up everything, particularly on bass, try cutting it off at about 60 Hz. It's also good to 80 KHz, so you might need a top end filter. I never have, but who knows.

Two, if you want to know what directs sound like, listen to a country record. They use 'em. In Chicago, FM 99.

Summary: Aside from the obvious isolation advantages, direct feeds prevent electrical shock hazards to musicians and deliver far better sound than can be gotten from music amp loudspeakers. They have been a part of the recording scene for more than 50 years, and are worth listening to on any instrument that will permit their use.