YAMAHA RECORDING SYSTEM

MULTITRACK GUIDEBOOK II

CONTENTS

FOREWORD

Multitrack recording is no longer merely a means to give you greater control over musical art, it is an art form in itself. As much creativity and energy goes into the actual recording as goes into the creation of the music to be recorded. In fact, most of the contemporary music that we hear in recorded form would not have been possible without the multitrack recording process.

Today's state-of-the-art technology is making a wide range of extremely versatile recording equipment available to the amateur at remarkably low cost—the Yamaha Recording System used throughout this guidebook forms an outstanding example of a modern compact recording system. In addition, sound-processing units such as Yamaha's Digital Reverberation Unit, Digital Delay Unit, Graphic Equalizer and Compressor/Limiter demonstrate how sophisticated high-quality recording is now possible on a surprisingly low budget.

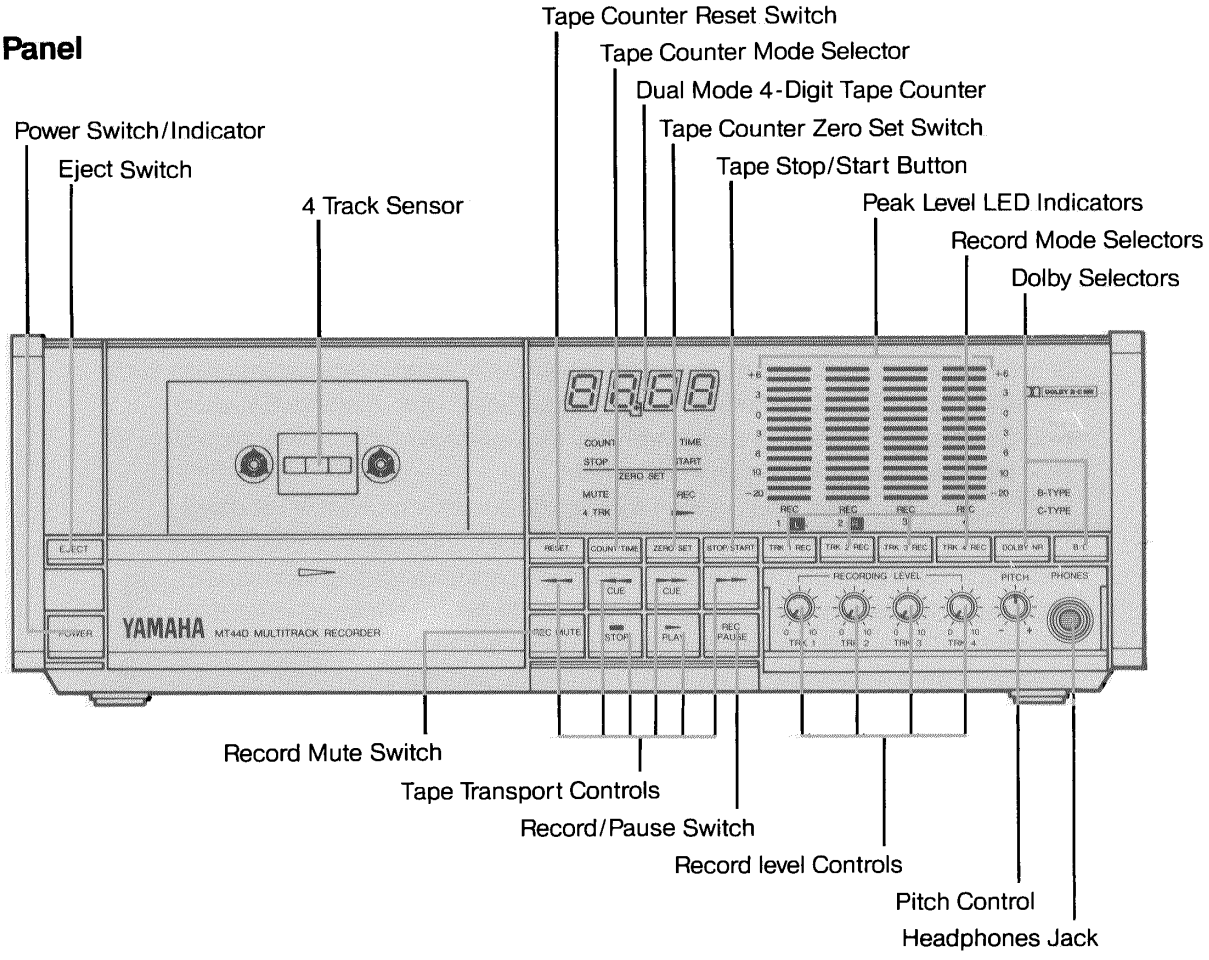
This guidebook has been written to help the amateur multitrack recordist to utilize his equipment effectively right from the start. It presents a brief outline of the multitrack recording process, introduces many useful recording techniques, and provides actual examples of situations that might be encountered while making a recording. There's also a chapter covering what will be the standard recording system of the future—and is available now—the use of a Tape Sync pulse and MIDI equipment not only for recording, but for composing expressive, modern music. For all musicians, composers and arrangers, Yamaha's low-cost high-performance Recording System can function as an ideal musical "notebook", making it possible to "sketch out" musical ideas with more freedom and precision than was ever before possible with pen and paper, because you're working directly with sound—not with symbols. You can use it to turn out excellent demo tapes, and it also provides superb creative tools for video or audio/visual production.

With this book and Yamaha's superb compact Recording System, the exciting world of multitrack recording is literally at your fingertips.

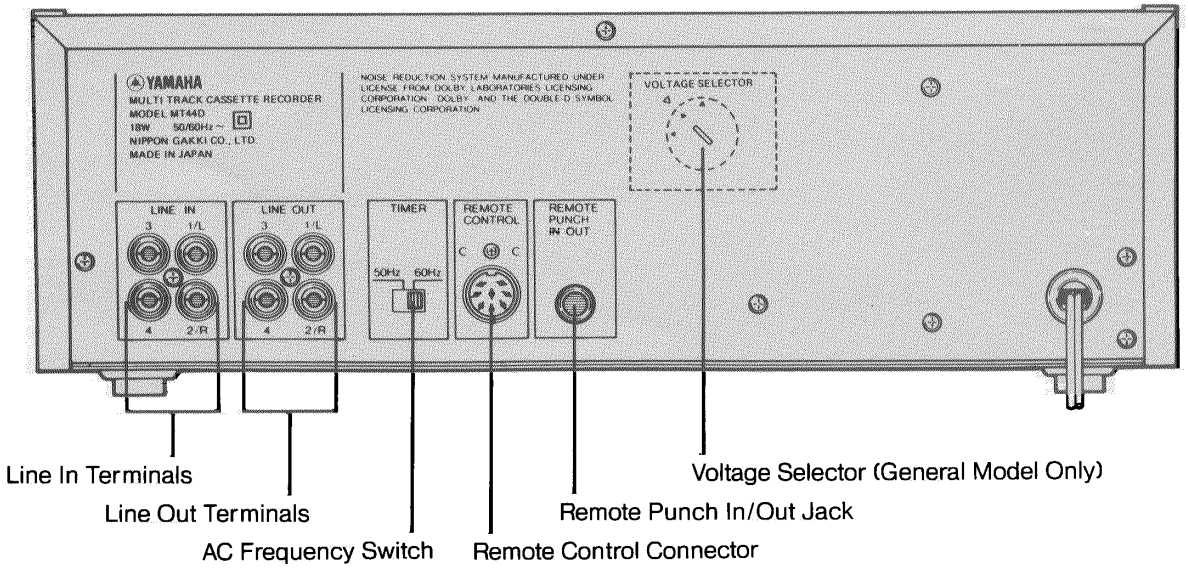
Good reading, and good recording!

MT44D MULTITRACK CASSETTE RECORDER

• Front Panel

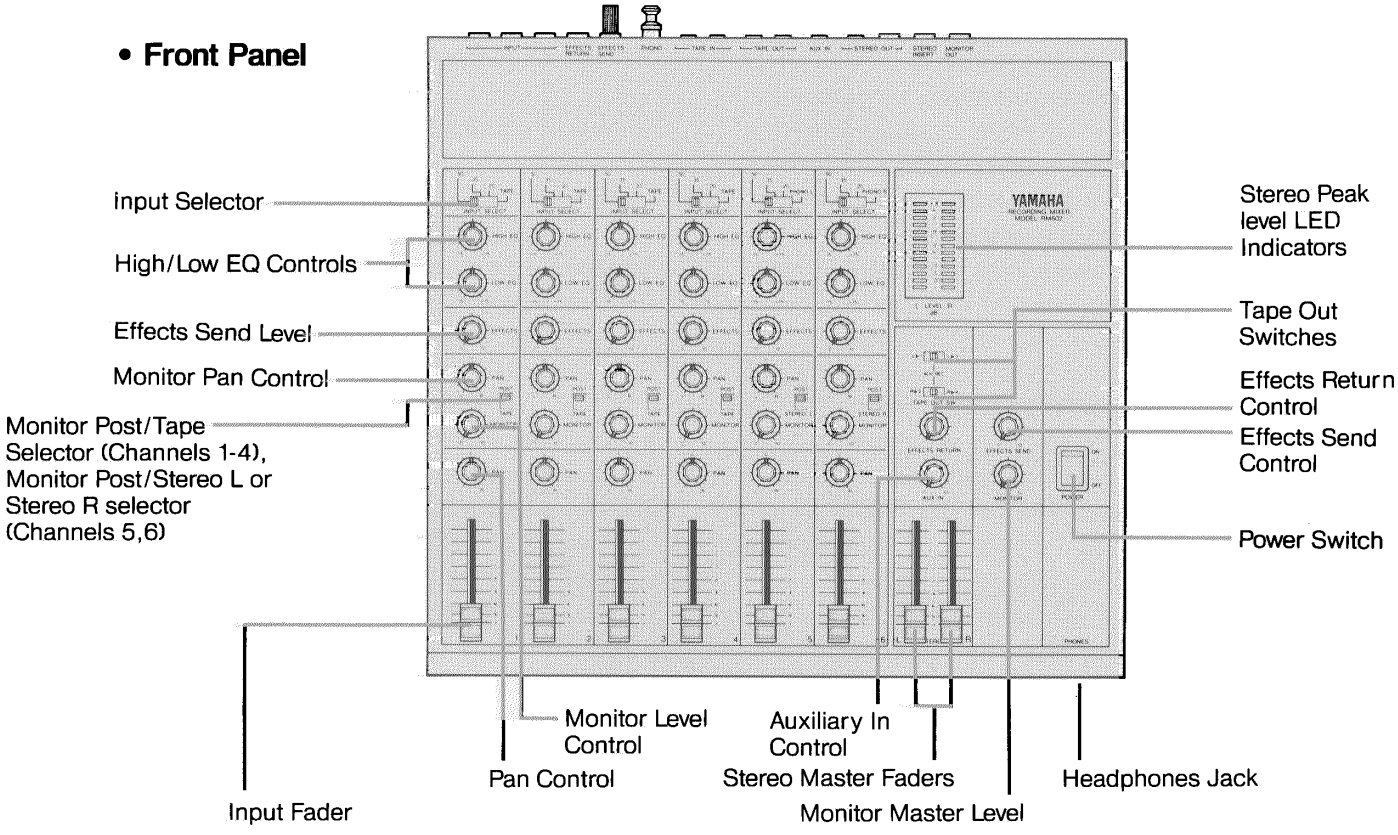


• Rear Panel

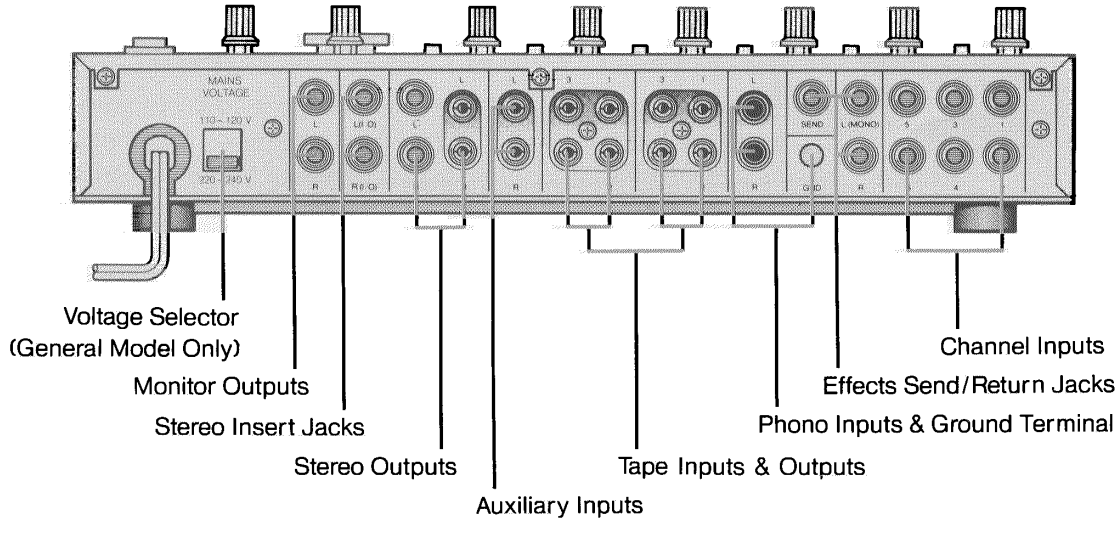


RM602 RECORDING MIXER

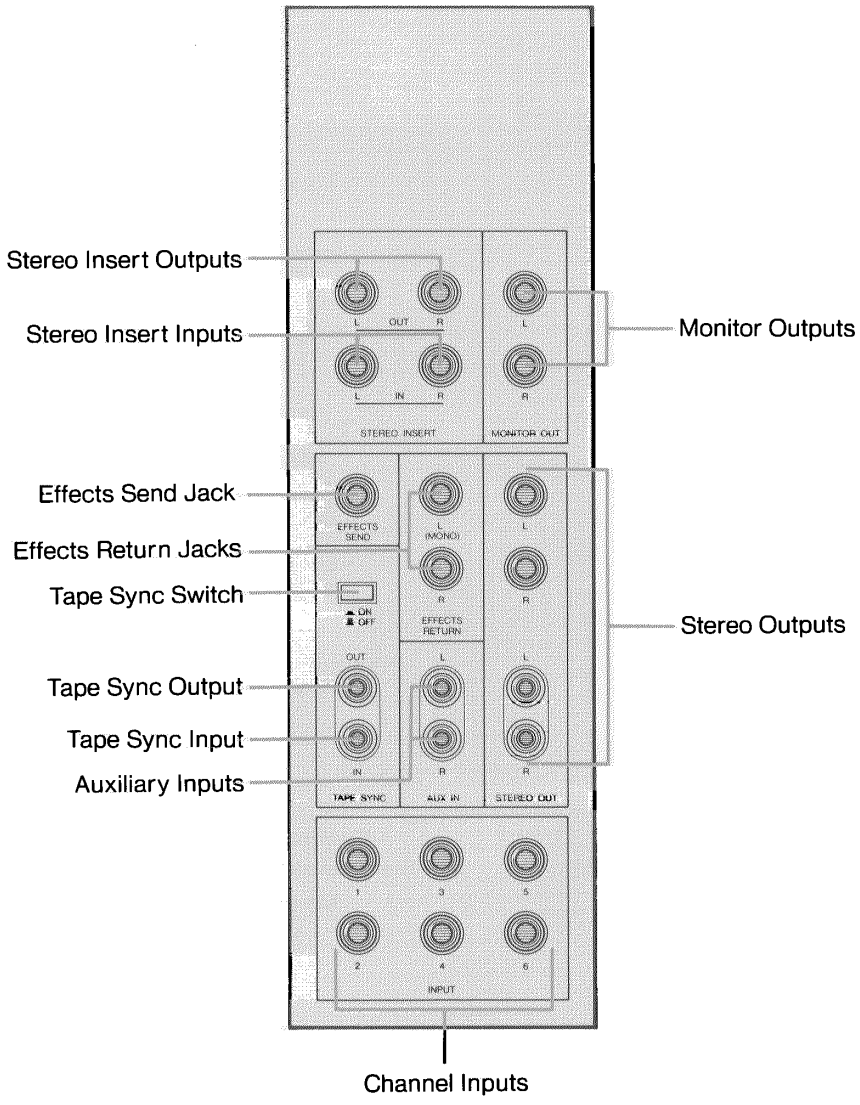
• Front Panel



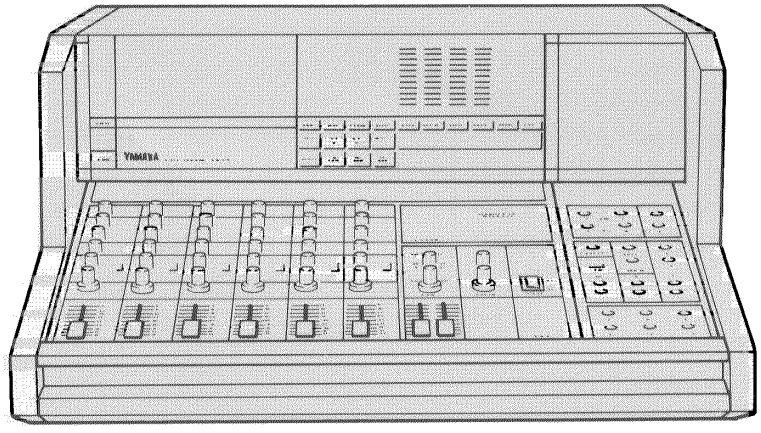
• Rear Panel



RB35B RACK/PATCH BAY UNIT



- **MT44D and RM602 mounted in RB35B Rack/Patch Bay**



CHAPTER I

HOW MULTITRACK BEGAN

Multitrack recording is a relatively new process that was developed, like many other technological innovations, out of necessity.

Music recording was originally a "one-take" event—you simply have the musicians play "live" and record the whole thing.

Unfortunately, a recording is permanent and much less forgiving than a live performance. If one violinist plays a wrong note, that wrong note is recorded for posterity. This meant that many retakes of an entire piece were often necessary to get everything just right.

Of course, technical demands were also the cause of time-consuming recording sessions. Achieving the right balance between instruments, for example, was a formidable task. Each musician had to be located just the right distance from the single microphone to achieve the desired volume level in relation to the other instruments. Patience and trial-and-error were the requirements of the day—compromise was frequently the result.

When multitrack recording appeared on the scene all these problems were immediately resolved. The creative compromises imposed by the technology of the day were transformed into creative advantages. It was suddenly possible to tightly control the recording of each individual instrument or group of instruments; all the musicians did not have to be recorded at the same time so scheduling became extremely flexible; one performer could play several parts on the same recording; an error made by one musician could be corrected without having to re-record the entire piece; and it became possible to determine the final overall sound and balance *after* the parts were initially recorded so the producer and artists had the time and freedom to perfect their musical product.

In contemporary music, two approaches to the *creative* use of multitrack have clearly emerged: (1) The solo performer—often a keyboard player, who can use multitrack to create whole "orchestras" all by himself—he can even carry out all the engineering. This approach has actually given rise to new forms of music. (2) "Dub Mixing": the creative mixing of a recording, using the mixer and various sound-processing devices to modify the sound drastically, often dispensing with vocals altogether, and adding large amounts of echo to the instrumental tracks, for a highly atmospheric effect. "Disco mixes" or "dance mixes" also fall into this category.

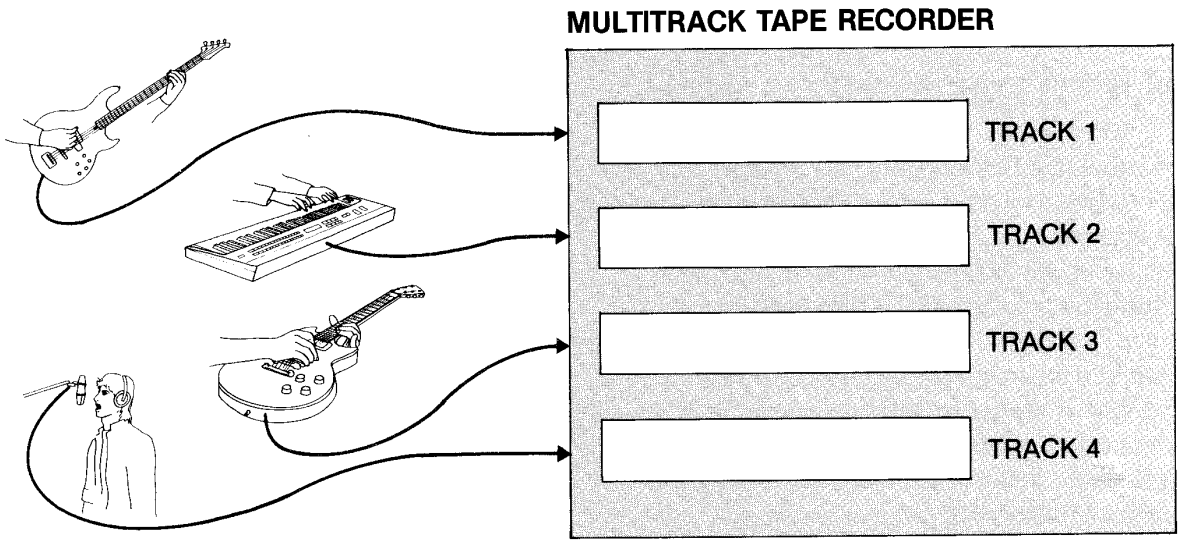
Mixing and recording—both these areas have been transformed by the advent of multitrack recording. And as the technology advances, the music is also transformed.

THE BASIC MULTITRACK RECORDING SYSTEM

The most important element of a multitrack recording system is the Multitrack Tape Recorder. Unlike conventional tape recorders that have one (mono) or two (stereo) tracks, the multitrack tape recorder may have 4, 8, 16, 24, or even 32 tracks that can be recorded individually or in any combination. Naturally, the tape used on a 32-track machine is wider than the tape used on a regular stereo deck—more than 2 inches wide, in fact—and the deck itself is a rather hefty piece of machinery.

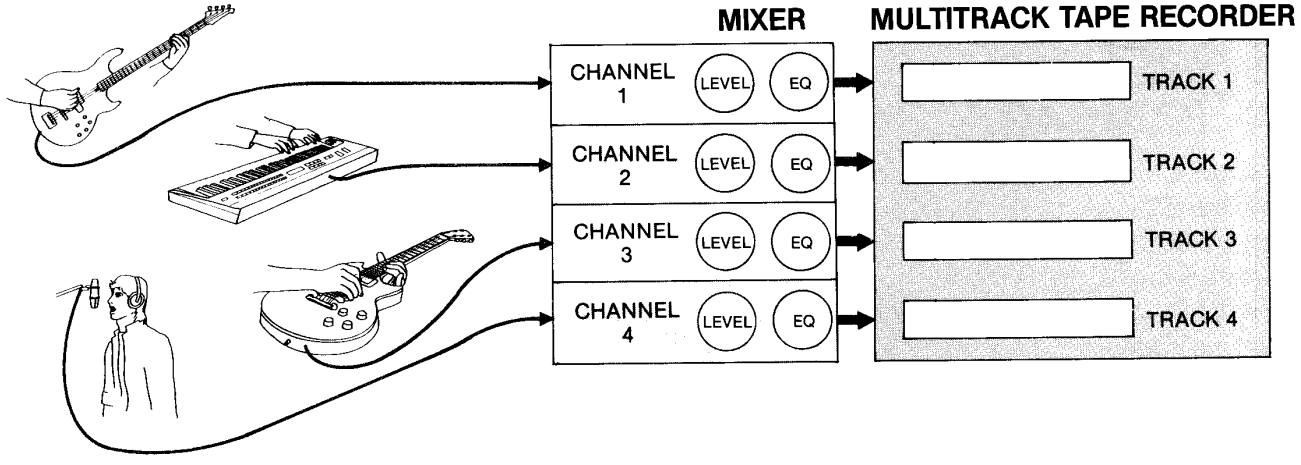
The deck we'll be using in this guidebook is a compact, portable 4-track machine that uses standard cassette tapes—the Yamaha MT44D 4-Channel Multitrack Cassette Recorder.

So—now we have a multitrack recorder, and we can connect a microphone or electronic instrument to the input of each track and record one performer or a group of performers on each. This is great because we can optimize the recording level individually for each instrument, and even individually choose microphones that best complement the sound of each instrument.



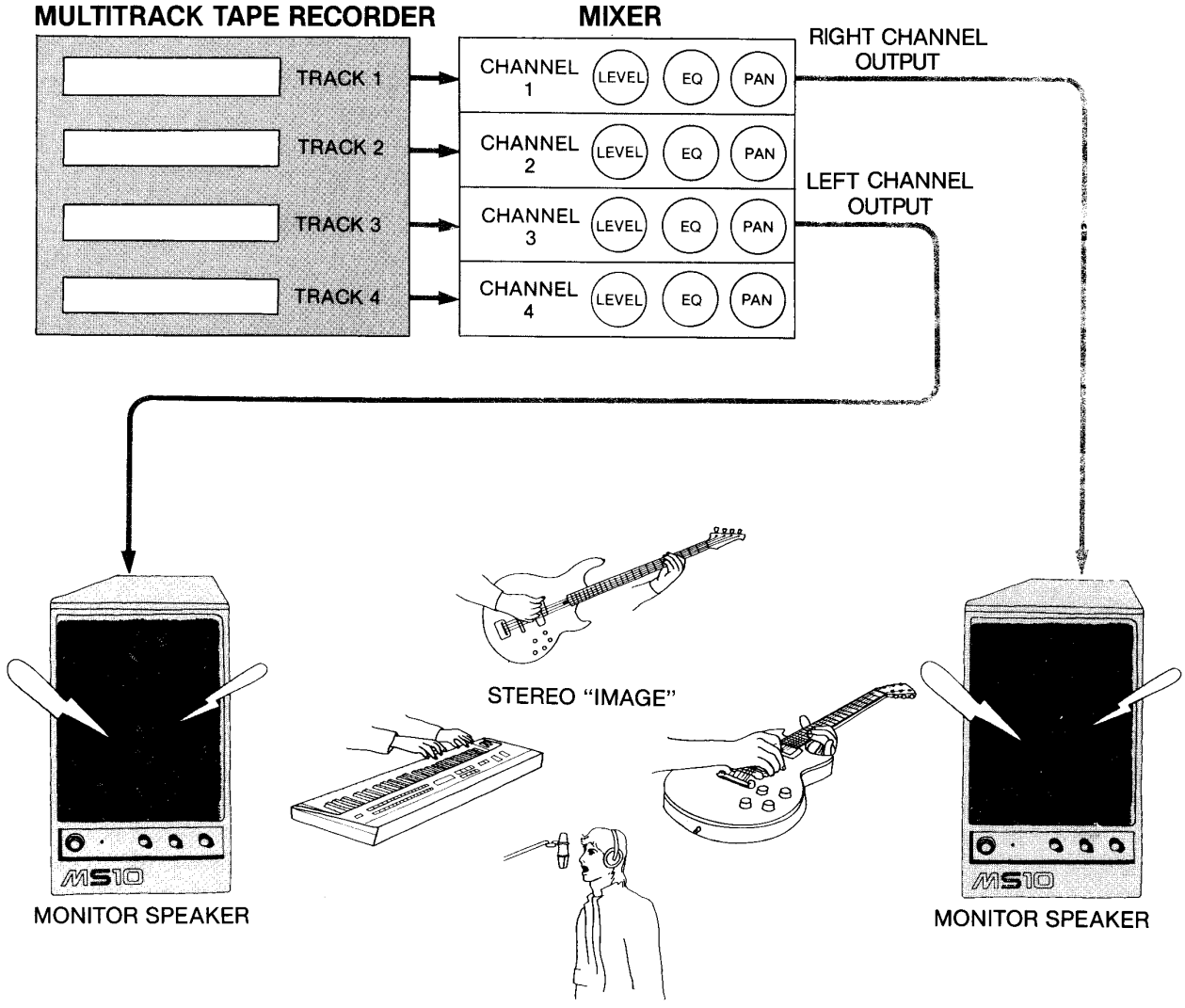
But how do we play the tape back? Do we need individual amplifiers and speakers for each track?

Modern technology comes to the rescue again with the Multitrack Mixing Console. In fact, we can use the mixing console or "mixer" when recording as well as playing back. The mixer has several input channels. Each source, that is, a microphone or direct line from an electronic instrument, is connected to its own input channel on the mixer. The mixer's input channels provide the ability to independently control the level of that channel's signal via a fader (a slider-type level control), some equalization (tone control), and many other handy functions depending on the size and complexity of the mixer. The important thing, though, is the fact that we can independently control each input in many different ways. For recording, the mixer's outputs are connected to the inputs of the multitrack tape recorder.



For playback, the multitrack tape recorder's outputs are connected to the mixer's inputs. The mixer's stereo outputs are connected to monitors (speakers). The signal from each track can be set to the left or right stereo outputs, or anywhere in between. For example, the bass recorded on track 1 of the multitrack tape (being played back via channel 1 of the mixer) could be sent to both the left and right channels, so you'll hear the bass sound coming from a point halfway between your stereo speakers. The piano on track 2 could be sent to the left channel, the guitar on track 3 could go to the right channel, and the

vocalist on track 4 could be positioned in the middle along with the bass. And, of course, we can control the level of each track independently so it is possible to set up the ideal balance between instruments during playback. In this way we can electronically create a stereo image of the original performance using independently recorded tracks.



The mixer we'll be using in this guidebook is the Yamaha RM602 Recording Mixer: a compact, sophisticated unit, it will let you do everything described above, and carry out many other useful functions.

The RM602 Mixer together with the MM44D Multitrack Recorder form the core of our basic (but versatile!) multitrack recording system. As you can see, it eliminates the major limitations of the pre-multitrack recording equipment by making it possible to independently control the recording and playback of each instrument. It can, however, do much, much more in creative terms.

CHAPTER II

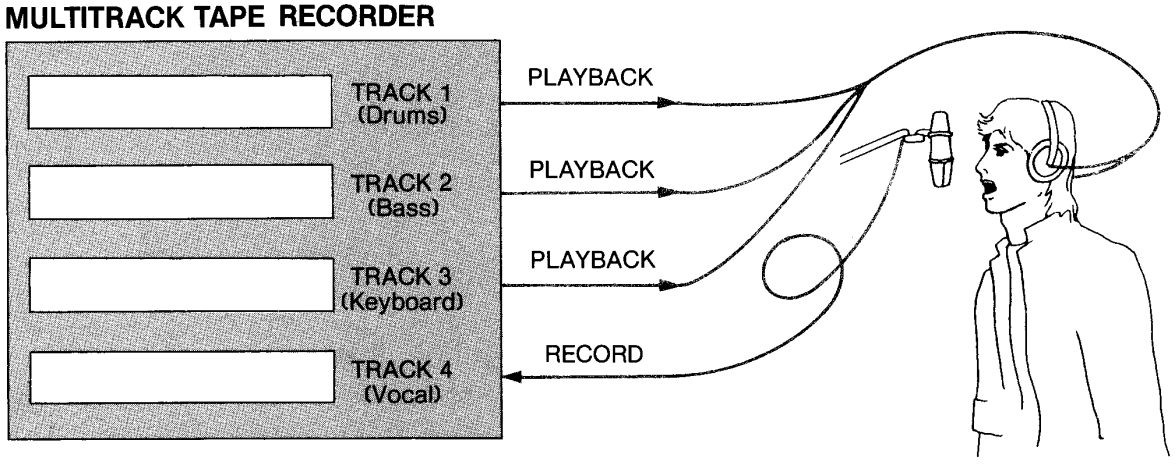
IMPORTANT MULTITRACK RECORDING TECHNIQUES

• Overdubbing

Overdubbing is a recording technique that allows you to record each part of an arrangement, one after the other, to gradually build up the entire piece. In short, overdubbing can make you a one-man band.

You can record, say, drums on track 1 of your MT44D multitrack recorder, then rewind the tape to the beginning and record a bass guitar on track 2 while listening to the drums on track 1. Then rewind again and record a keyboard track while listening to the drums and bass tracks. And finally, listen to the whole "backing track" and add your vocals.

You can actually create some very impressive, professional-sounding recordings like this, but there is a way to squeeze even more parts onto your 4-track machine...



Overdubbing

• Ping-Ponging

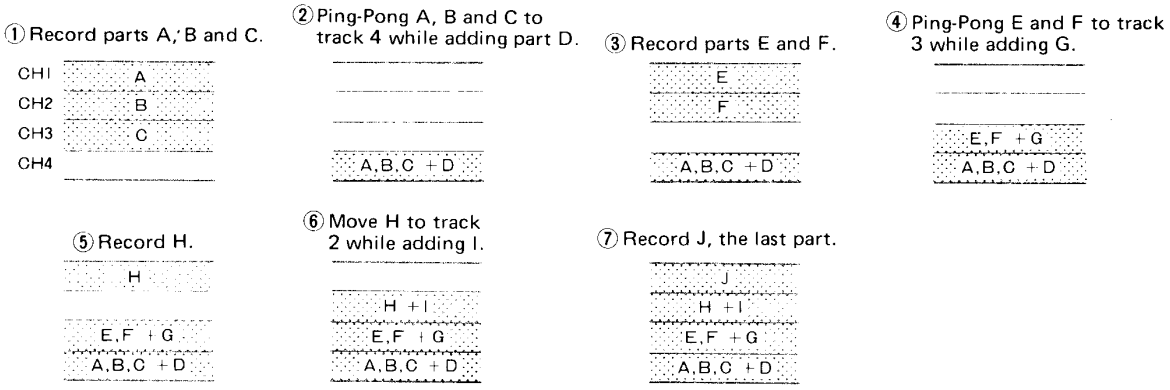
You record tracks on 1, 2 and 3, for example, and then re-record these tracks onto track 4, using the mixer to set up the right balance between the three tracks—this is "ping-ponging". You now have a "mix" of the first three tracks on track 4. That means tracks 1, 2 and 3 are available for more recording. That's 6 tracks on your 4-track recorder.

But wait—there's more. Suppose that while mixing the first three tracks down onto track 4 that you also mixed in a live instrument (and you can do it with the RM602). That would mean you have four tracks mixed onto track 4 of the tape, with three available. Seven tracks? Yes, but think again. If we then record tracks 1 and 2, and ping-pong these to track 3 while mixing in another live instrument, we have four parts on track 4, three parts on track 3, and two tracks available. That's nine. It turns out that you can actually record up to ten tracks like this (refer to the illustration). Note that no one track has been ping-ponged more than once.

As each track transfer adds a slight amount of noise to the recorded signal, you probably won't want to do any more ping-ponging than this. And you should make use of the Dolby B/C noise reduction system built into the MT44D, to minimize the audible effects of noise buildup.

Example:

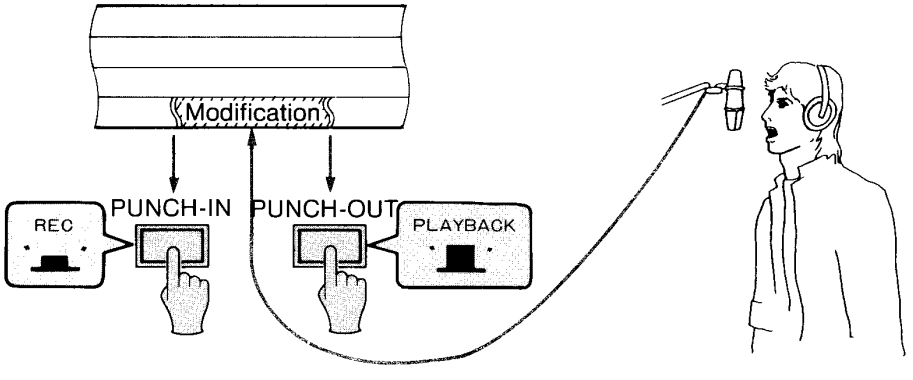
Recording tracks "A" through "J" using the ping-pong process.



• Punch-In/Punch-Out Recording

One of the nice things about multitrack recording is that if a mistake is made on one track, only that track needs to be re-recorded. If the mistake is only on a short section of the track, it's even possible to get away with re-recording only that section.

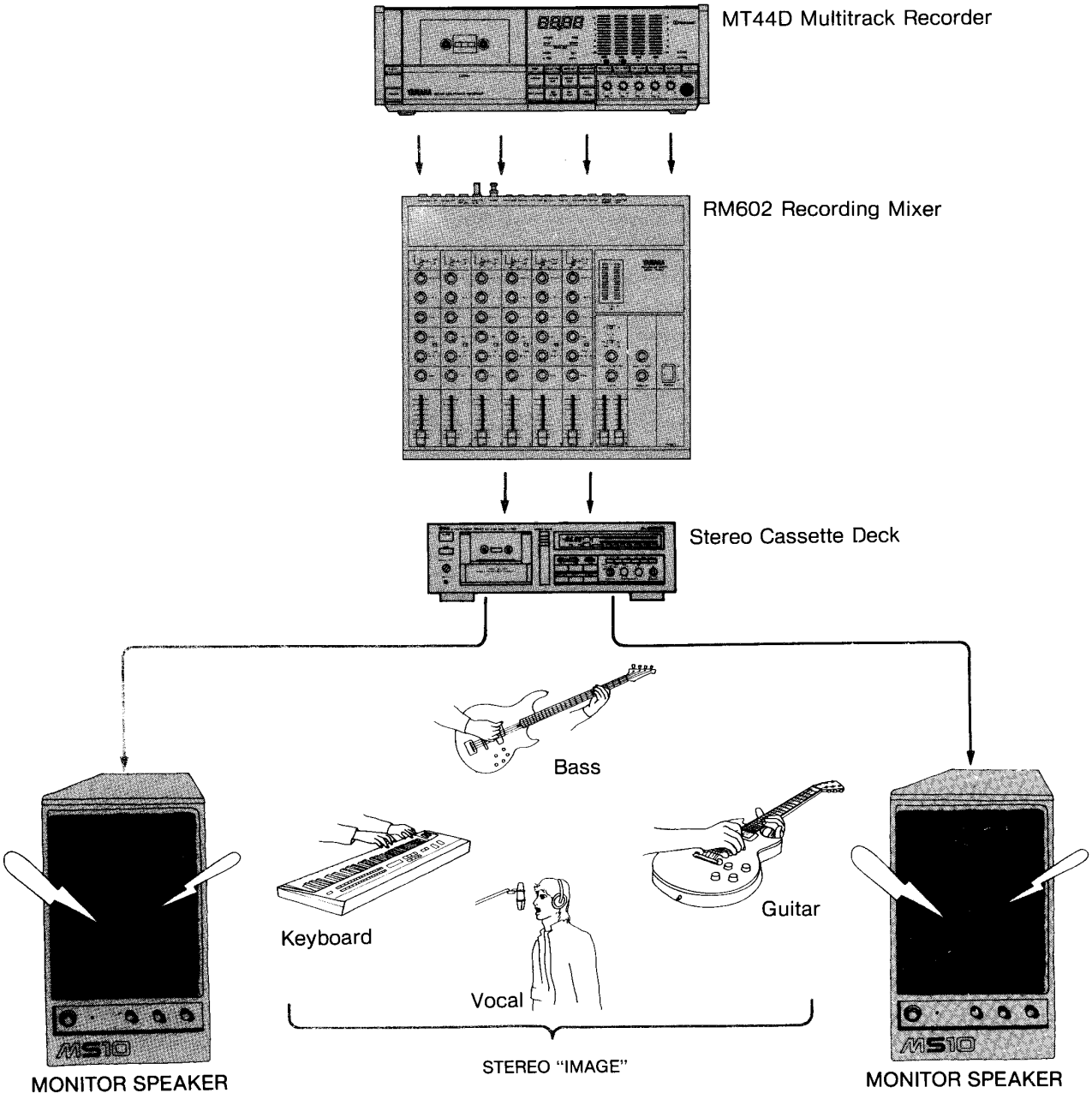
Suppose you have a really nice vocal track but one of the chorusses in the middle just isn't "inspired." Start the deck running in the record-ready mode a little way before the chorus, with all the tracks in the playback (monitor) mode. Then, at a convenient break in the vocals—ideally, just before the chorus, switch the vocal track to the record mode (punch-in by pressing the RECORD MODE selector on the MT44D) and have the vocalist start singing. At the end of the chorus (also in a convenient break) switch the vocal track back to the playback mode (punch-out by pressing the RECORD MODE selector again) and the job is done. In fact, it's a good idea if the vocalist starts singing *before* you punch-in, so that he or she is "warmed up" by the time you reach the punch-in point.



The timing can be tricky, but in many cases the effort is worth it to avoid re-recording an otherwise perfect take. The MT44D even has an optional footswitch (FS-1) for punching in and out, so that you can have your hands free for playing, if you're one of those musical geniuses who like to engineer their own recordings! You'll also be able to make good use of the optional remote control unit for the MT44D (the RC10B) which allows you to carry out all of the tape transport operations (play, rewind back to "zero", record, etc.) from any location.

• Mixing Down (or Mixdown, or Remix)

This is where the true art of multitrack recording comes into full play. Mixing down is the art of transforming your multitrack master tape into a mono or stereo master tape that is the final creative product. The process involves re-recording the multitrack tape via a mixer onto a conventional stereo tape deck, while you finely balance the tracks for just the right sound, fading-in or fading-out certain tracks as required, using the mixer's faders. Equalization can be applied to create effects or simply to improve the overall tone of the tracks. Each track can be positioned at an ideal location in the stereo "image", and you might even want to "pan" a sound from one channel to the other for dramatic effect.



There's an amazing amount you can do while mixing down, and this is the perfect time for adding effects to your recorded sounds. For example, you can use a Yamaha R1000 Reverberation Unit to add a delicate touch of reverb to a vocal track and give it full, rich sound (of course, you could also add lots of reverb so the singer sounds like he or she is in outer space!). You can also use a vast range of other exciting effects such as flanging, vibrato, digital delay, compression, etc., providing you have the right effects units. We'll discuss some of the possibilities in Chapter V, 'SOUND PROCESSING".

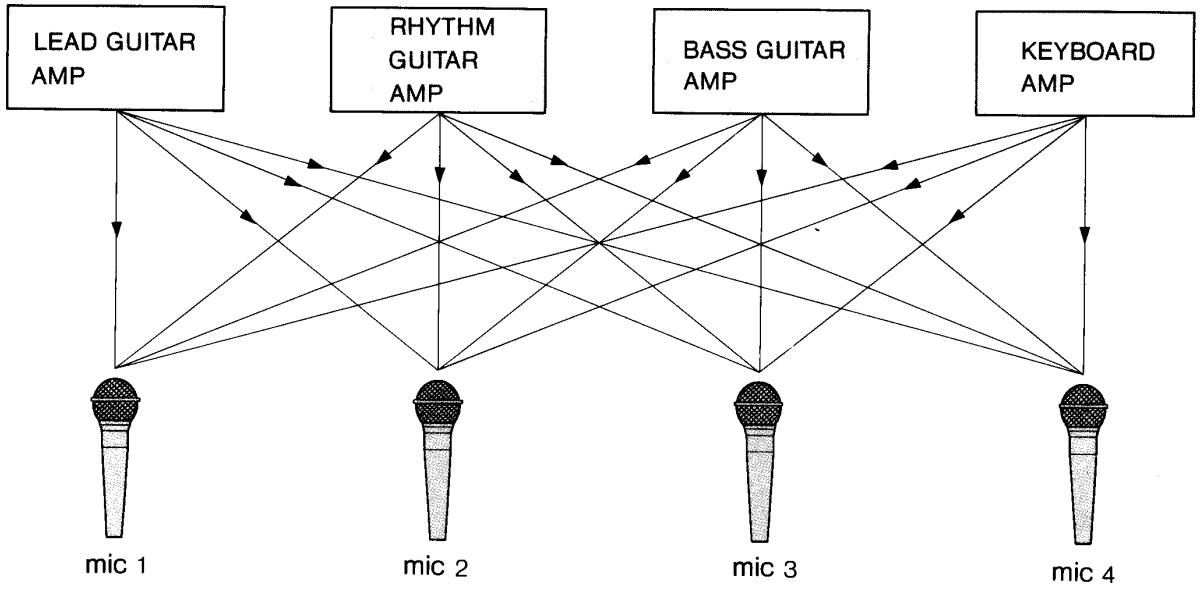
Once you do have a really great stereo master tape, assuming you have mixed down onto a good quality stereo cassette deck such as the Yamaha K-1020, you can play it back on any standard cassette deck. You might want to keep this master tape safe, and have copies made of it for playback, and for distribution to your friends and music business associates.

Of course, you still have the original multitrack master tape so you can go back and remix it later, or even re-record parts of it if you get new ideas about the arrangement, or want to try for a better guitar solo or change the lyrics on the vocal track—multitrack recording is really a very versatile creative tool.

THE IMPORTANCE OF SEPARATION

Separation keeps the sound on one track totally independent from those on the other tracks. And we should bear this in mind from the moment we begin recording.

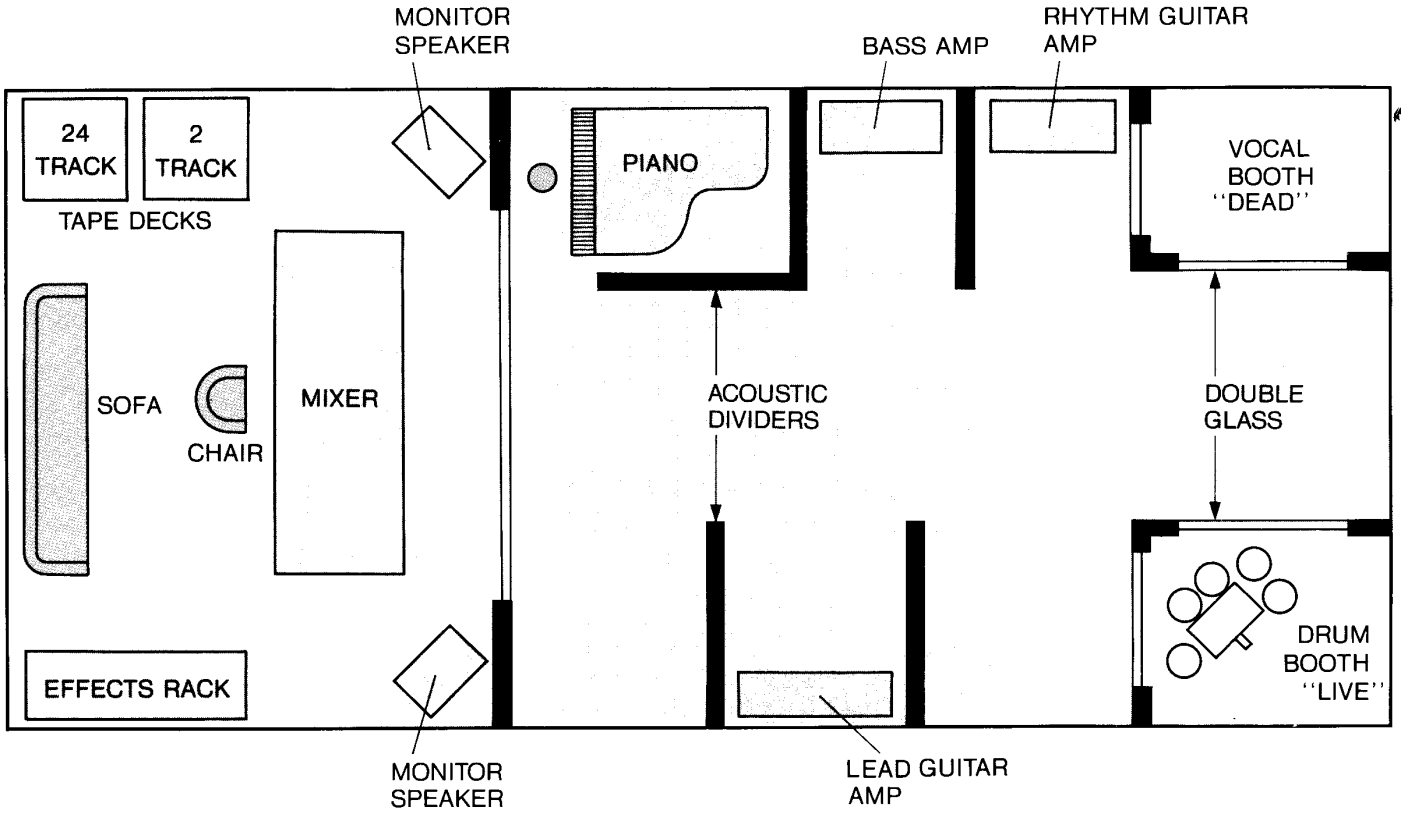
Suppose, for example, we set up four microphones and aim them at four high-powered instrument amplifiers all playing in the same room. Each microphone will pick up some sound from all the amplifiers.



an acoustic mess!

Even though each microphone feeds a different track on the multitrack tape machine, it will be impossible to control the balance when the tape is played back because the whole acoustic mess has been recorded on each track. Might as well go back to the one-mic one-take system.

Measures have to be taken to ensure that the sound of each instrument will not "leak" into all the other microphones. In the case of high-powered instrument amplifiers, achieving good separation can be difficult. In fact, professional recording studios go to great lengths and expense to solve this type of problem, by using acoustic dividers, and even building separate rooms, or "booths", particularly for drums and vocals. Incidentally, the vocal booth is usually well lined with absorbent material to produce a "dead" room sound with no ambience or natural reverberation, so that you can add reverberation or echo afterwards, when mixing down. The drum booth, on the other hand, is often a "live" room, with reflective materials adding a rich ambience and body to the drum sounds.



Floor plan of professional multitrack recording studio

Here are some ways of achieving maximum separation in your own home:

A common studio separation technique is to use movable acoustic dividers. These are sound absorbing panels that can be placed so as to reduce direct leakage from one instrument/ mic setup to another (see the previous Studio Floor Plan illustration). There are a number of items around the home that could be used to good effect—a sofa, a mattress, or even heavy curtains. If you're miking an amplifier, draping a blanket over both amp and mic can help a great deal. Of course you could go all out and build your own panels. Just remember that only *mass* can actually stop sound—particularly bass frequencies, so your panels should ideally be fairly solid and heavy.

This is essentially the perfect solution, and is often

known as "direct injection". Instruments like electric guitar, electric bass, electric piano, and electronic instruments such as synthesizers can be fed to the mixer's input directly "on line." Just plug the instrument's output into the appropriate mixer input. No mics, and no possibility of acoustic leakage.

When microphones must be used on more than one source at the same time, separate the sources as much as possible. Sound level falls off fairly rapidly with distance, so the greater the distance between sources, the greater the separation. In fact, if you can place one source in a different room and close the adjoining door you have the at-home equivalent of a studio isolation booth. Of course, in this situation, the performers will need to listen to each other on headphones.

The closer you place a microphone to its source, the less chance there is of unwanted sounds being picked up, especially if you use a directional microphone that is less sensitive to sound arriving from the rear. The situation is improved further if amplifiers can be turned way down and close miked. Of course, sometimes you need to crank up that amp to get the right sound. Another simple aid to separation is to turn the amp speakers to face the wall.

When using close-miking on a vocalist or flute player, it is advisable to use a "pop-shield" (or windshield: a foam rubber or synthetic shield which fits over the end of the mike) to avoid pops or bumps caused by sudden breaths or accents.

As we mentioned earlier, overdubbing means recording one part *after* recording another part, and it's the only way to get total separation when using microphones without locating your sources in different cities. Of course, if you're a solo musician this is the only way to record, and a well-rehearsed band can also use this technique, though it's not too conducive to spontaneous interplay between the musicians!.

If you are recording a combination of acoustic and line instruments at the same time, the musicians should ideally wear headphones, so that they can hear each other clearly. The use of speaker monitors will cause more sound to leak into the microphones. The monitor output of the RM602 mixer can be connected to a power amp, linked to a splitter box which feeds several pairs of headphones. You can adjust the monitor output levels, and even pan the monitor, independently of the recording outputs.

CHAPTER III

MAKING A RECORDING

In this chapter we'll go through each step in the making of a multitrack recording, and we'll introduce some of the techniques you can use to get the most out of your multitrack recording system. For the sake of illustration we'll assume you have your band together for the session—a drummer; a bass player; a keyboard player; and yourself, the guitar player and lead vocalist.

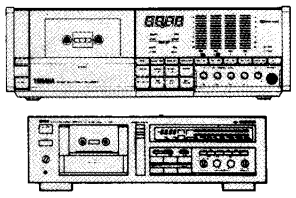
The Yamaha equipment we'll be using is as follows:

- MT44D Multitrack Cassette Recorder
- RM602 Recording Mixer
- RB35B Rack (to house the recorder and mixer and provide a convenient patch bay signal routing system)
- A pair of MS10 Self-Powered Monitor Speakers (operating at 20 watts each)
- A pair of MH10 Monitor Headphones.
- Yamaha K-1020 (or similar) stereo cassette deck, for mixing down.

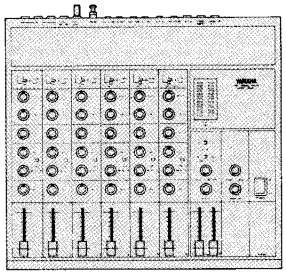
If you like to monitor your recording at a higher level, we recommend the Yamaha P2050 Professional Power Amplifier (45 watts per channel) with the Yamaha S10X or S20X Compact Speakers. And if you're recording your own performances, you may find it really handy to use the MT44D's optional remote control unit (the RS10B, which reproduces all the tape transport controls) and footswitch (the FS1, which allows you to punch in and out without using your hands).

Refer to the owner's manuals of the respective equipment to see how to make all the connections. You'll almost certainly need at least one microphone, but we'll cover that subject in some detail later, in Chapter IV.

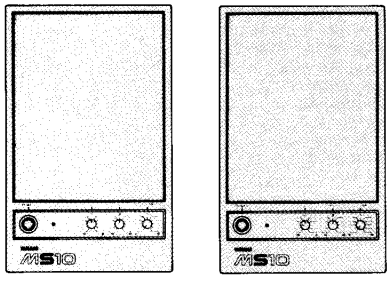
MT44D Multitrack Recorder



K-1020 Stereo Cassette Deck



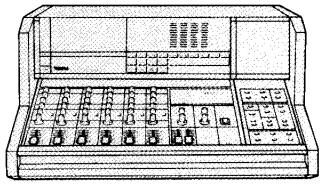
RM602 Recording Mixer



MS10 Self-powered Monitor Speakers

MH10 Monitor Headphones

MT44D and RM602 mounted in RB35B Rack/Patch Bay



• Plan Your Recording

It's a good idea to have your musical arrangement worked out in advance, and a clear idea of what kind of sound you want to create, but as you've got your very own 4 track recording system—no expensive studio fees to pay—you're free to change your plans at any time. Multitrack recording is a great opportunity to find that delicate balance between planning and spontaneity that lets you create memorable music.

What is important, however, is to plan your recording—what order the parts will be recorded in, what instruments will go on which tracks, etc.—before actually starting. It is surprisingly easy to record yourself "into a corner."

In professional studios, track charts are almost invariably used, and there's no reason why you shouldn't follow this good example, and create your own track charts. The illustration shows a 4 track recording chart that allows for one ping-pong and overdubbing sequence—later in this chapter you'll see how it looks when it's filled out. You could of course make the chart longer, if you're planning to do a lot of ping-ponging and overdubbing.

	Track 1	Track 2	Track 3	Track 4
Step 1				
Step 2				

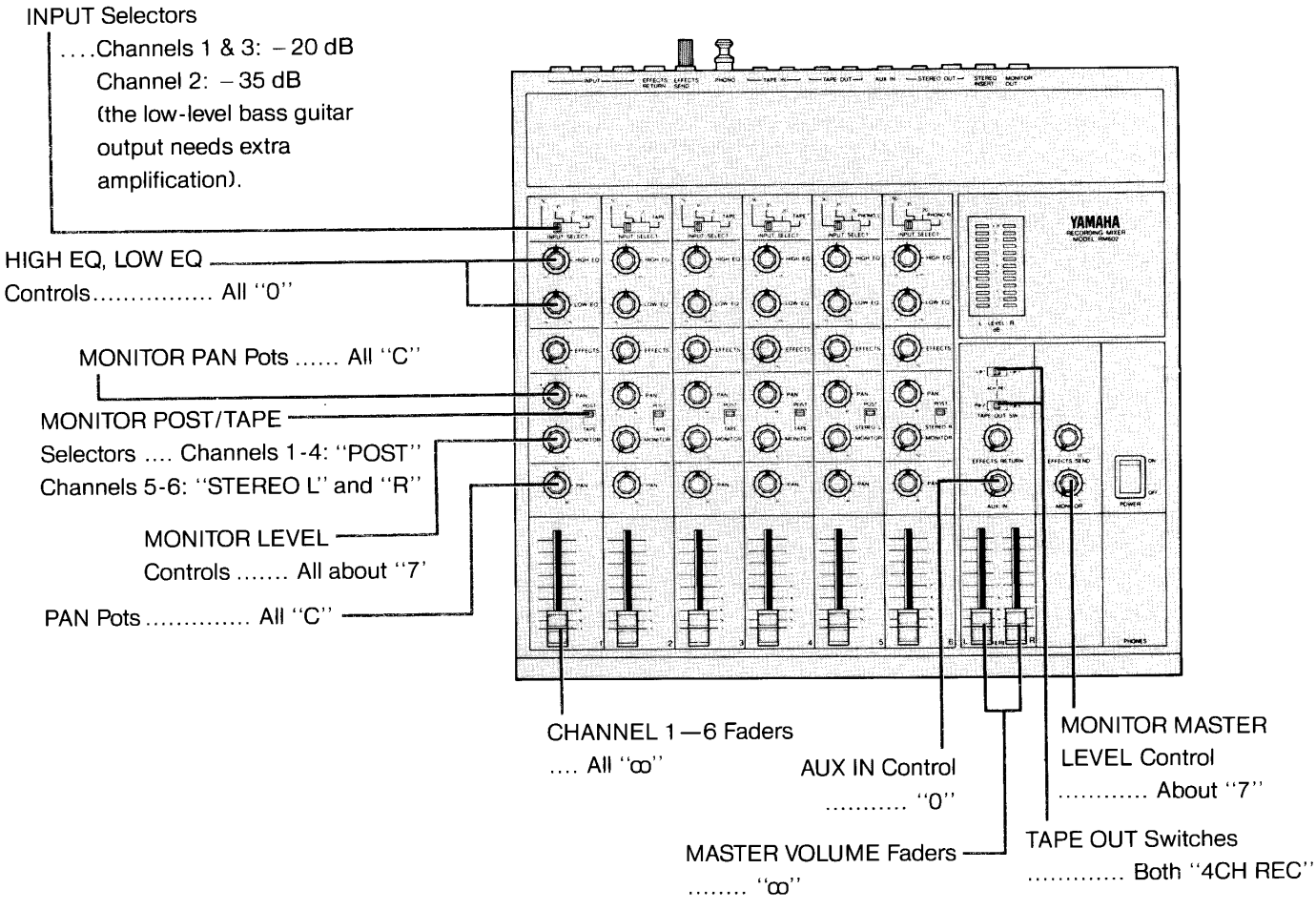
• Recording the Initial Tracks

In most cases it's wise to record the rhythm section first. The most obvious reason for this is that it provides a solid foundation on which to build your lead lines, harmonies, and solos. It's pretty hard to record a guitar solo and *then* add the drums and bass to match! If you're recording alone, you might want to record the drums first on track 1, then the bass on track 2, and then a keyboard rhythm part on tracks 3. This would form a basic rhythm section which could be ping-ponged to track 4. Since we have a band together, though, we'll record the entire rhythm section all at once. We'll still record drums on track 1, bass on track 2, and rhythm keyboard on track 3, and ping-pong to track 4. It's good to remember that ping-ponging can add a little noise and cause a slight loss in the high frequencies, and mellow, sustained sounds like flutes or organs might not stand up to ping-ponging quite so well. In the present case—drums, bass and rhythm keyboard—there should be no problem.

The next thing to do is to set up for recording the rhythm section. We've decided to eliminate the problem of miking a live drum set by using a drum machine—for example, the Yamaha RX15 Digital Rhythm Programmer. The RX15 contains incredibly realistic digitally recorded drum and percussion sounds, and you can program it to play a repeating pattern, or an entire song, complete with intro, breaks, and an ending.

The RX15 is plugged into INPUT 1 on the RB35B patch bay (for now we'll use the RX15's Left—Mono output, although it does have stereo outputs). Next, we plug the bass guitar directly (on line) into INPUT 2, and the electronic keyboard plugs directly into INPUT 3. The TAPE SYNC switch on the RB35B should be switched OFF.

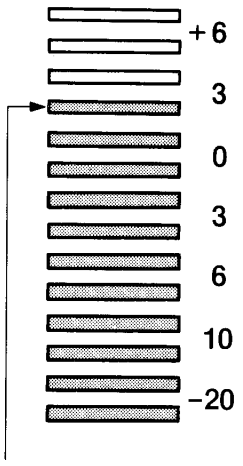
The RM602 mixer controls should be set as follows:



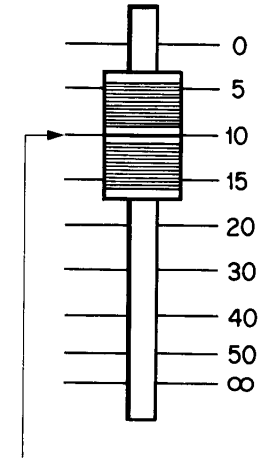
The following text will explain the reasons for these settings, so don't be worried if you're not sure why the settings are as they are. Just—read on!

We're ready to set record levels for each instrument. Of course, you'll need to be able to hear what's going on, so plug a pair of headphones into the PHONES jack on the front of the RM602. A nice monitor system for the players can be set up with one or two Yamaha MS10 Self-Powered Monitor Speakers plugged into either or both of the MONITOR OUT jacks on the RB35B patch bay. Since all the sources are being recorded on line at this point, there's no need to worry about the sound from the monitor speakers leaking into any microphones. This will be something to be aware of later when we're overdubbing the vocals, however.

First raise the track 1 REC LEVEL control on the MT44D to about the "3 o'clock" position (8 on the scale), set the track 1 RECORD MODE selector to REC, and press the REC/PAUSE button. The red REC indicator will light and the track 1 RECORD MODE LED indicator will light, indicating that track 1 is in the record standby mode. Now, have the drummer play the RX15 while you gradually raise the channel 1 fader. You'll begin to hear the drum sound and see the track 1 level indicator on the MT44D come to life. Adjust the channel 1 fader so that the maximum reading on the meter is between 0 and +3 dB. Ideally, you want to set the fader at about 10 on the scale. This gives you plenty of plus and minus leeway for fine fader adjustment later.



maximum level between "0" and "+3" dB



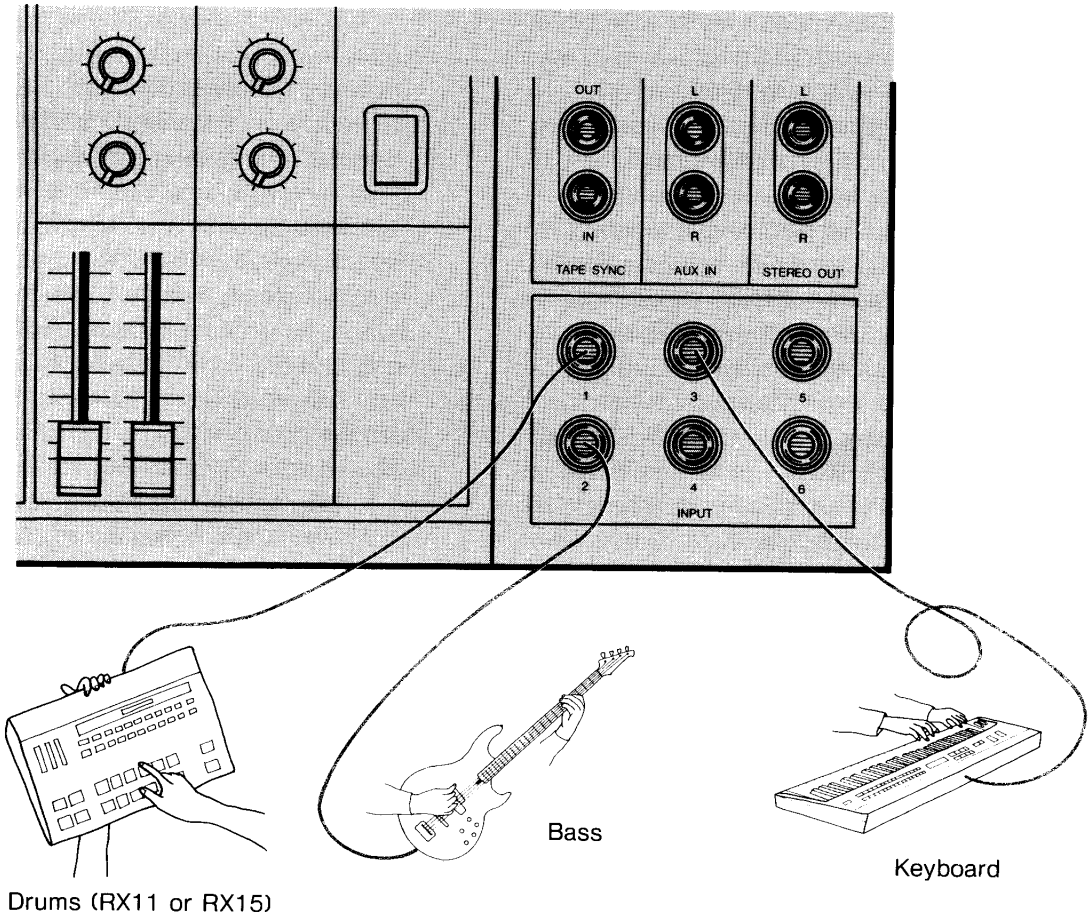
RM602 Fader at "10"

The REC LEVEL control on the deck can be used to optimize the fader setting, as can the level control on the instrument used—in this case the RX15.

Once the track 1 recording level is set, we can go on to set the record levels for the bass on track 2 and the keyboards on track 3 in the same way. Basically, we're ready to go ahead and record the rhythm section. There's one more thing, we can do, however, that can improve the overall sound of our final recording.

Remembering that the tracks we are about to record will be mixed and ping-ponged to track 4, we can use the HIGH EQ and LOW EQ controls on the respective mixer channels to individually tailor the sound of the instruments. The general rule is to use as little tonal variation as possible. However, a little extra brightness is sometimes desirable prior to the final mixdown, and of course you're free to use the EQ controls to create special tonal colors.

Now we're ready to roll. We suggest you use Dolby C noise reduction on all your recordings, so make sure that the DOLBY ON/OFF switch is ON and the DOLBY C/B switch is set to "C". Press the PLAY key on the MT44D transport control panel and recording will begin. Cue your players and away you go.



If you weren't careful to set the record levels for the *maximum* levels likely to be encountered during the recording—e.g. the bass player gets excited and plays *really* loud—you might end up with levels exceeding +6 dB on the deck's meters. If this happens you'll more than likely notice a dirty, distorted sound on that track when you play the tape back. The only cure is to go back and re-record that track. But, supposing everything went well you'll want to listen to your work. Set the mixer's channel 1 through 3 MONITOR POST/TAPE selectors to TAPE.

Rewind the tape to the beginning of the piece—did you reset the tape counter to "0000" before starting the recording? If you did, all you have to do is turn the ZERO SET and START/STOP functions ON and press REWIND. The tape will rewind to the beginning of the recording and begin playback automatically. When the music starts you can adjust the MONITOR LEVEL controls for a "monitor mix" of the rhythm tracks. With the POST/TAPE selectors set to TAPE, the faders and EQ controls are bypassed, so you hear exactly what's on the tape. If everything sounds OK you can go on to the next step. If there is a problem on one of the tracks—for example, the keyboards—you have two options: either re-record the entire rhythm section or re-record only the unsatisfactory track. Here's how you do the latter. Basically, the process is the same as for recording the initial tracks except that the keyboard player will record his part on track 3 while monitoring the drums and bass from the already-recorded tracks 1 and 2. You simply set the track 1 and 2 RECORD MODE selectors to PLAYBACK, the track 3 selector to REC, and the mixer channel 3 POST/TAPE selector to POST. Set channel 3's level and EQ as required, and start the MT44D running in the record mode (press REC/PAUSE and then PLAY). The keyboard player plays along with tracks 1 and 2 just as if they were the live drummer and bassist. This, is actually overdubbing. Remember that if there's only a short section of the original keyboard track that bothers you, you may be able to re-record only that section, using Punch-in recording as we described in Chapter II.

OK, now the rhythm section is all nicely recorded on tracks 1, 2, and 3, and to make room for a few more tracks we go on to...

• Ping-Ponging

The most important point to keep fimly in mind here is that the three tracks to be ping-ponged must be mixed *perfectly*. Once they're ping-ponged and new material has been recorded on the first three tracks, their balance cannot be changed unless you go right back and record the entire rhythm section over again. Ping-ponging requires several controls on the mixer to be altered, but you'll soon be able to carry out these changes without thinking, so your session goes smoothly and efficiently.

Switch mixer channel 1 through 3's INPUT selectors to TAPE, and POST/TAPE selectors to POST. This allows you to EQ the recorded tracks again, and adjust their levels with the faders. As the tracks were EQ'd when you recorded them, they should need very little additional EQ now—just whatever's needed to blend them together nicely.

To ping-pong to track 4 we set the lower TAPE OUT switch on the RM602 mixer to "R▶4". This means that the mixer's right tape output is feeding into track 4 on the MT44D. The channel 1 through 3 PAN controls are conveniently set to the center position, so these channels are all feeding equal levels to the right tape output. If you want to ping-pong to another track at any time, the TAPE OUT switches allow you to connect the tape outputs to any of the four tracks on the MT44D. In order to accurately assess the balance of the ping-pong mix (via headphones plugged into the mixer, or your MS10 Monitor Speakers connected to the MONITOR OUT jacks on the patch bay) the RM602 lets us use channel 6, which is already switched to monitor the right tape output. So we'll need to turn the MONITOR LEVEL controls of channels 1 through 3 to zero, so that we hear only what is sent to track 4. We'll also have to use the right STEREO MASTER fader to hear the mix, so set it to about "10".

Finally, set tracks 1 through 3 on the MT44D to PLAYBACK, and now you can play back the tape repeatedly, adjusting the balance between tracks, and the HIGH and LOW EQ of each track, until you get exactly the mix you want.

Once you're satisfied with the mix, you're ready for the actual ping-pong process. Set the track 4 RECORD MODE selector to RECORD. Then start the record mode. Watch the track 4 level meter and adjust the mixer's right STEREO MASTER fader for the optimum reading. Rewind to the beginning of the piece and enter the record mode again. Now you're actually ping-ponging, and during this process, you may want

to make adjustments to the levels of each instrument —it's not always possible for three musicians to maintain a perfect balance throughout a song!

When the job is done you can go back and verify the results by listening to the playback from track 4 only. This is simply done by switching the channel 4 MONITOR POST/TAPE switch to TAPE, and also remember to return the channel 6 MONITOR selector to POST, so you don't hear tracks 1 through 3 and get a confused balance. Everything should be there on track 4, and assuming you've mixed it all right it should sound pretty good. If not, you can repeat the process as often as you like until you're completely satisfied—it's worth getting it right!

As we said in Chapter II, it is actually possible to add one more instrument to this mix while ping-ponging. Simply plug your instrument into INPUT 4 on the patch bay, switch channel 4's POST/TAPE selector to POST, its INPUT selector to the appropriate setting for the instrument, and adjust the channel 4 fader and EQ controls accordingly. NOTE: DO NOT, while ping-ponging, switch the channel 4 INPUT selector to TAPE: this will route the tape output to the tape input, and could result in a nasty feedback sound which could damage the equipment, not to say your ears!

• Overdubbing

There are three tracks spare. To hear what we're overdubbing, we'll need to raise the MONITOR level controls of channels 1 through 3 to about "7". We'll put the guitar part on track 1, lead vocals on track 2, and chorus vocals on track 3. Of course, with more ping-ponging we can add many more tracks, but we want to keep our sound relatively simple. This is usually a good idea if you're looking for a clean, open sound. In fact, for some types of music the best results can obtained by limiting yourself to a maximum of four tracks—no ping-ponging. This results in the best sound quality, and if done with taste the results should be perfectly satisfactory. Of course, there's no harm in experimenting, but there's no need to use everything available just because it's there.

Back to the recording. Overdubbing the guitar part is basically very straightforward. We'll avoid the need to mic a guitar amplifier by plugging the guitar straight into INPUT 1 on the patch bay. Then switch channel 1's INPUT selector to −35 dB, and adjust its fader and EQ controls. Now you can record your guitar part, while listening to track 4. To playback, switch channel 1's MONITOR selector to TAPE.

Now for the lead vocal and chorus vocal parts we'll need to record using a microphone. Microphones and miking techniques are subjects that are really worth investigating, if you plan to do a considerable amount of microphone recording. Some useful hints are given in Chapter IV, but for now we'll assume that we have the ideal microphone already set up to record the lead vocal part. The mic is plugged into INPUT 2 on the patch bay and the mixer's channel 2 INPUT selector is set to −50 dB. All other mixer and deck settings should be easy by now. There is one catch, however: the recording is being made with a microphone. That means that any sound other than that of the vocalist in the room will also be picked up and recorded. The problem can be minimized by using a directional microphone and placing it as close as possible to the singer (don't get too close, though, or you'll get a lot of breath noise and "pops"). That way, low-level sounds will be "masked" by the much-closer-and-louder vocal sound, and sound arriving from the rear of the microphone will be greatly reduced. Remember the MS10 monitor speakers? They will be pumping a considerable amount of sound into the room and should be turned off. That means that the only way for the singer to hear what's going on is via headphones. The same will apply to the chorus track coming up. The main difference between recording the vocal tracks and previous tracks, therefore, is that the singer(s) will be wearing headphones. If anybody else wants to hear what's happening you can plug another pair of headphones into the MT44D phones jack or use a Y-adaptor in the RM602 phone jack. In a pinch, it may be OK to use the monitor speakers at low level, as far from the mike as possible, if the singer(s) can perform under such conditions.

The vocal and chorus tracks are both recorded in the same way; then we're ready to go on to the vital mixdown stage. Creative engineers sometimes use the PITCH control on the tape deck, to bring the range of the backing track within that of the singer, if she or he is having a problem reaching a high or low note. This can produce rather odd-sounding vocals when played back at normal speed, but this is just

another effect that you can make use of when you wish!

We hope you've been writing down the recording procedure on your track chart as you go along. In the example given, you should end up with a chart that looks something like this:

	Track 1	Track 2	Track 3	Track 4
Step 1 (RHYTHM SECTION)	DRUMS (RX21)	BASS	KEYB'D	PING-PONG RHYTHM TRACK
Step 2 (OVERDUBS)	GTR	VOCAL	CHORUS	»

• Mixing down

The importance of this vital phase in the recording process simply cannot be stressed too much. On the other hand there are no hard and fast rules. We'd like to offer a few simple hints, however, that might help you along the way.

First, set all tracks for playback, and mixer channels 1 through 4 to TAPE input, with their MONITOR LEVEL and EQ controls zero'd. On the RM602, you can easily monitor the mix on channels 5 and 6, so set them as follows:

Channel 5: MONITOR switched to STEREO L, MONITOR PAN to the left, and MONITOR LEVEL about "7".

Channel 6: MONITOR switched to STEREO R, MONITOR PAN to the right, and MONITOR LEVEL about 7—it should be the same as channel 6's monitor level, for accurate stereo balance.

Set the TAPE OUT switch to "4CH REC".

Now get comfortable in a position that will enable you to evaluate the sound as accurately as possible —this means sitting in the a central position in front of your monitor speakers (unless you're mixing on headphones). Next, we want to listen to, evaluate and adjust the sound on each track. In this case we'll start with the rhythm section on track 4. Play back track 4 only (channel faders 1 through 3 set to minimum, channel 4 and the STEREO MASTER faders set for a good listening level).

This track should be basically OK. We already made tonal adjustments before everything was mixed in the ping-pong. There's no way to change the sound of just the bass part, for example, at this point. (There are exceptions to this rule: if two instruments combined on one track have different frequency ranges, we could use a graphic equalizer to alter the response in the range of one of the instruments without affecting the other. We'll discuss this later in the guidebook). However, if you've ping-ponged carefully there should be no problem.

Track 4 is fine, so we bring its fader down and turn our attention to track 1. The guitar on track 1 sounds fine, but it may be a good idea to emphasize the high frequency range here a little so that the guitar doesn't get swallowed up by the overall sound. Listen to the guitar together with the rhythm track to get a feel for this. Turn the guitar channel HIGH EQ control up just enough to give the guitar the zing it needs to come through clearly. Now listen to the lead vocal track alone. The necessity for the vocal track to come through clearly is obvious, so a touch of high boost might be useful here, too. If we chose our vocal mike carefully, however this might not be necessary (remember, we want to get away with as *little* equalization as possible).

Now that each track is set for the best sound, we can begin to set up the overall mix. Bring all the channel faders up to about "10" on the scale and play the

piece back. Adjust the faders as you go for the best overall balance. Vocals still don't cut through enough? Go back and add a little more high boost, but be careful—too much boost can result in some pretty unnatural sounds. You might also find that you need to vary the level of one track during the piece—pick up the level of the guitar track during the solo, for example. And of course the PAN controls allow you to position each track in the stereo image. The obvious course would be: vocals and rhythm track in the center, chorus slightly left, guitar slightly right. But then, great music doesn't always happen by taking the obvious course, does it?

It's a good idea to run through the recording a number of times, adjusting the balance and practicing any fader changes that are necessary. Then, when you're completely satisfied, go ahead and try actually recording your mix. The STEREO OUT jacks on the patch bay should be connected to the line inputs of any your stereo cassette deck for this purpose. The mixer's STEREO MASTER faders control the overall level of the track—which should peak at around 0 dB, and you can use them to fade out at the end of a track if you like. A steady, slow fade at the end of a song can sound really professional!

Even *slight* differences in the mix can make a big difference to the overall sound. You can prove this to yourself by making completely new mixes of the same piece on different days, for example. Record each one and compare them later. You'll be surprised at how different they will sound; and more than likely each one will sound right—in a different way.

You're the creator. The final sound depends entirely on you.

CHAPTER IV

MICROPHONES

The importance of the humble microphone is often overlooked by the amateur multitrack recordist. And even if you will be recording almost entirely on line from synthesizers, etc., you'll probably need at least one mic, for vocals, percussion, etc., and it's important to choose carefully when buying one. A cheap mic sounds like a cheap mic even if you play a solid gold flute into it. A high-quality mic can produce surprisingly rich sounds even from that battered old guitar with one string missing. And every mic sounds different. Make sure you buy microphones from a reputable store, made by a reputable manufacturer, and designed specifically for music recording or, at least, sound reinforcement applications. CB mics or the ultra-cheap mics supplied with budget portable cassette recorders simply will not do. Of course, you don't necessarily need a precision thousand-dollar studio mic either.

In the end, it's your ears that will tell you whether a mic is right for you—so go to the store, try the mic, and LISTEN! However, here are some basic facts to help you choose and use microphones.

• Microphone Types

Several types of microphones are available. They are as follows:

1. Dynamic Microphones

This is the most widely used type of microphone today, featuring a voice coil coupled directly to a metal or synthetic diaphragm, whose movement in a magnetic field generates an output signal. Dynamic mics produce a soft, natural sound.

Features:

- Rugged construction.
- Stable operation.
- No power source required.
- High durability.
- Can safely be used with high sound pressure level sources.
- Non-critical handling and easy maintenance.
- High resistance to feedback.

Applications:

- Excellent for high-level, wide-dynamic-range, percussive sources.
- Vocals
- Drums
- Electric Guitar
- Natural Sounds
- Interviews

2. Condenser Microphones

In condenser mics, the diaphragm itself carries a DC voltage, and its movement over a fixed electrode causes capacitance variations which produce an output signal.

"Phantom powered" condenser microphones require an external 48 volt power supply, while some models are powered by a replaceable 9 volt battery.

Crisp sound is the mark of the condenser mic.

Features:

- Condenser microphones are capable of providing the broadest, flattest frequency response of any available type.
- Exceptionally high overall performance.
- Power source required (Specialized power supply or battery).
- Easily affected by high temperature and humidity.
- Extremely thin diaphragm is highly susceptible to shock and requires extra care in handling.

Applications:

- Not suitable for high sound pressure levels.
- General instrument pickup.
- Vocals

3. Ribbon (Velocity) Microphones

The operation of ribbon microphones is similar to that of dynamic mics except that the diaphragm is in the form of a ribbon (usually made of aluminium) stretched between the poles of a magnetic circuit. The design of these microphones makes them naturally bidirectional.

The ribbon mic has excellent frequency characteristics but is fragile and easily damaged.

Features:

- Susceptible to shock and vibration.
- Easily affected by wind.

- Excellent low-frequency reproduction (human voice)
- Low sensitivity.

Applications:
- Interviews.
- Speech.
- Acoustic String Instruments.

4. Electret Condenser Microphones

The electret condenser microphone works on exactly the same principle as the condenser microphone except that the voltage is supplied by a permanently polarized dielectric material known as an "electret." A specialized power supply is therefore not required.

Same sound as condenser mics, but without the need for a power supply.

Features:
- Same as condenser microphone except that power supply is not needed.

Applications:
- Same as condenser microphone.

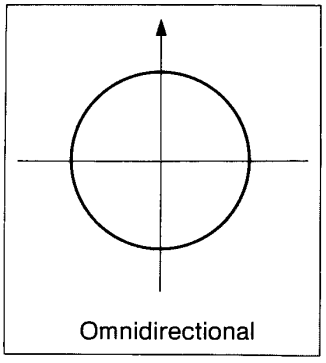
• Directivity

In addition to choosing the best type of microphone, it is necessary to choose the most appropriate "directivity pattern" for your recording needs.

A microphone's directivity pattern shows you to what extent it can pick up sound in every direction, and is often represented on a polar graph as a 360 degree response pattern.

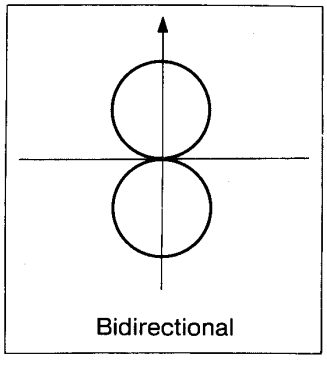
1. Omnidirectional

Sensitivity is equal in all directions. With this type of mic feedback can occur quite easily and pickup of unwanted sound can be a problem. In situations where sounds covering a broad area must be picked up the omnidirectional mic is ideal, e.g. in the middle of a choir.


Omnidirectional

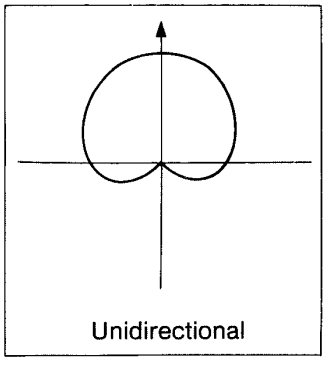
2. Bidirectional

Also known as a "figure 8" directivity pattern, this type of mic is most sensitive to sound directly to its front and rear. Sensitivity is extremely low at the sides. This pattern is perhaps best suited to pickup of a discussion between two people facing each other, or two singers or instrumentalists.


Bidirectional

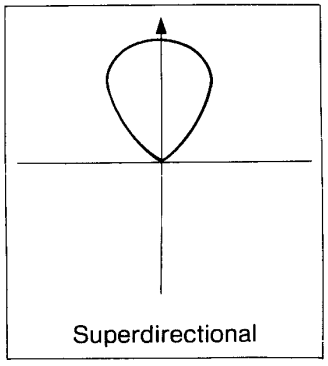
3. Unidirectional (Cardioid)

Unidirectional mics are only sensitive to sound from the front, and the sharpness of the directivity pattern usually increases with an increase in frequency. Sounds other than the desired source are effectively excluded, resulting in cleaner overall reproduction. This kind of mic can be effective when picking up a low-volume instrument such as an acoustic guitar. It's called Cardioid simply because the response graph looks like a heart.


Unidirectional

4. Super Directional

Sometimes called a "shotgun" pattern, sensitivity is even more sharply directional than the unidirectional pattern. The effectiveness of this pattern in excluding unwanted sound when picking up single sources at a considerable distance from the microphone makes it ideal for film or television dialogue on location.



• Frequency Response

This phrase indicates how accurately a microphone can pick up the entire audible sound spectrum. A "flat frequency response" is often desirable, and manufacturers compete with each other to produce a mic that responds equally to all frequencies. Condenser mics generally have the flattest frequency response of any mic type. When you're comparing different mic models, have a look at the specification sheet and check out the frequency response graph.

• Proximity Effect

This is an important microphone effect that you should be aware of when recording—especially when close-miking instruments. If a microphone is brought very close to a source, its sensitivity to bass frequencies increases. A good example of this is that if you speak with your mouth too close to a microphone, the sound will be unpleasantly muddy and boomy. Because of its relationship to distance, this is known as the "proximity effect."

To reduce this problem, some microphones incorporate a "low-cut" switch, usually with 2 settings marked M (Music) and V (Voice). When set to the Voice position the low-frequency range is rolled off minimizing, in addition to proximity effect, wind and breath noise. Condenser microphones, on the other hand, have a tendency to emphasize sibilance (the "s", "z", and "sh" sounds in speech, hissing sounds) and some have a "high-cut" switch that can be used to reduce this effect.

CHAPTER V

SOUND PROCESSING

Sound processing falls into two basic categories: (1) Using devices to obtain a high quality recording, with a more natural sound. (2) Using devices to add extra "color" or special effects to the sound. Most sound processing devices can be used in both of these categories—it's up to you.

For example, a microphone, however good, never picks up quite the same sound as the one you hear, because your ears are capable of receiving far more of the ambient (environmental) sound—the multiple reflections of sound from the surrounding surfaces. With a device such as Yamaha's R1000 Digital Reverberation Unit you can add a touch of just the right type of reverberation to give a realistic, warm acoustic effect. Adding more reverb enables you to create exciting effects which can give a real lift to a guitar, or make a voice sound mysterious, or a sax sound even sexier.

You can use effects at any stage of the recording: while recording a performance, while ping-ponging, overdubbing, or during your final mixdown, but be aware that once the effect is recorded, it can't be removed. The RM602 Owner's Manual explains in detail how effects units may be connected into the recording setup, so we'll concentrate here on the actual uses of some of the most important sound-processing devices.

• Reverberation and Delay

First—what's the difference between these two effects? People often interchange the two names at the head of this paragraph, but in general they are accepted to indicate the following:

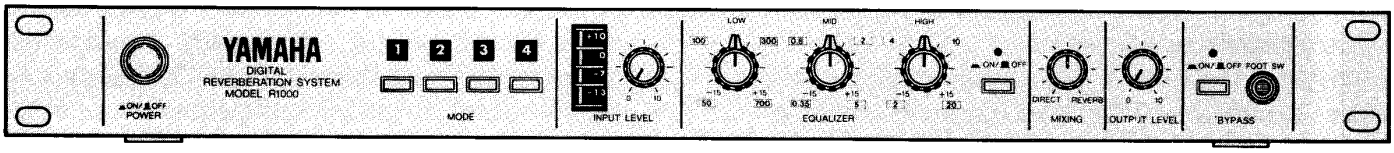
Reverb indicates the natural ambience of a room or hall, which gives the sound of any instrument a roundness and richness that it does not have when you play it the "dry" environment of a studio, or in the middle of a field. It's caused by a multitude of sounds, reflected from the walls, floor and ceiling of the room. There are actually thousands of these reflections, so it's impossible to hear them individually—the result is a kind of sonic afterglow that rings on after the sound has stopped, and its length depends on the size of the room and the type of surfaces therein. If you've ever sneezed in a church, you'll know exactly what reverberation is!

Echo, when used as a recording term, means an individually discernible delayed sound image. An obvious natural example is the guy who stands on a Swiss mountain and yodels, then stops to hear the echo sent back to him from the French mountain across the border. An echo can have a "single repeat" or a several repeats that fade away gradually in a reverberation-like effect. Echo is often called "delay", especially in the case of a single repeat.

Both these effects are extremely useful and it would be fair to say that at least 99% of all contemporary music recordings use at least one of them. Yamaha make a variety of devices to create these effects, including two versatile, low-priced, easy to use units: the R1000 Digital Reverberation Unit, and the D1500 Digital Delay unit. Digital technology enables the signal produced by mike or electronic means to be converted to a digital state (in effect, a series of numbers) where it can be simply processed by microprocessors, to create special effects.

The R1000 features four different length reverbs, to create the impression of different size rooms, and you can use its sophisticated EQ section to color the reverb, for a wide range of effects. Vocals are the obvious choice for adding reverb—you can literally make any singer sound twice as good with the right touch of reverb. Any acoustic instruments can sound fuller and richer with a little reverb, and drum machines can sound far more realistic. Be careful not to add too much reverb to low frequency sounds such as bass guitar—the resulting "wash" of reverb can spread across the entire track, and mess up an otherwise good mix. So in general, use reverb more on high- and mid-range sounds.

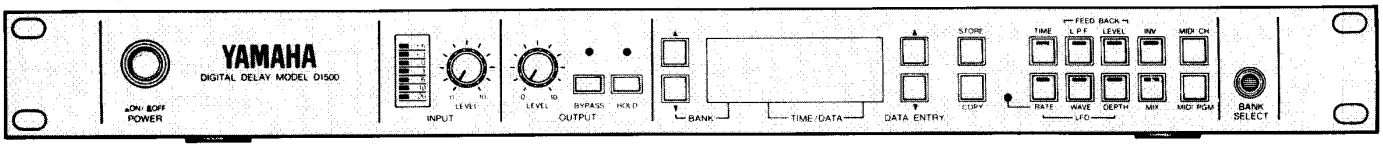
R1000 Digital Reverberation Unit



The D1500 Digital Delay Unit is an extremely versatile device that not only produces single or multiple delays, but also a variety of flanging or vibrato effects (see the D1500 Owner's Manual for details). Delay effects add a particularly modern echo effect to any instrument—not as natural as reverb, but often far more exciting. You can add multiple repeats that are "in sync" with the rhythm of a song—the "dub mixes" mentioned in Chapter I often use extremely long delay effects that can actually create rhythms and make a song more danceable. Rapid multiple repeats can simulate reverb, a single short delay can make one instrument sound like two in unison (also known as ADT—Automatic Double Tracking); a very quiet long delay can give a soft, spacious effect.

A performer can often be inspired to greater heights if he can hear his voice or instrument with the effect on it while he's performing. A little reverb on any instrument gives the player the feeling that he's on stage, and you can even use effects as a compositional device. More than one hit has been created by a riff that was played through a delay device set to give a loud eighth- or sixteenth-note delay, so that one note sounded like two, two like four, and a relatively simple phrase on, say, a bass or synth came out as a complex and exciting riff.

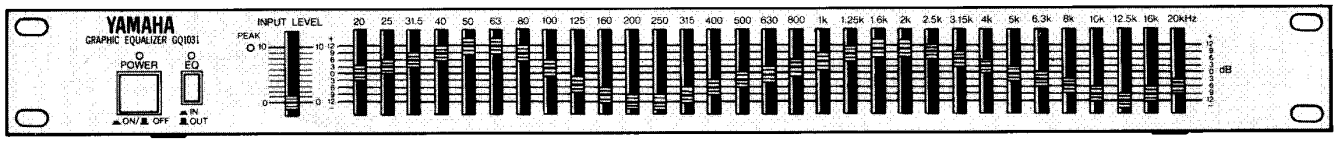
D1500 Digital Delay Unit



• Graphic Equalizers

Graphic equalizers help you to "fine tune" the tone of an instrument, a voice, or a complete mix. You'll have noticed that many mixers and amps divide up the sound spectrum into three ranges for equalization purposes: High, Mid, and Low. Graphic equalizers take this a lot further. For example, Yamaha's GQ1031 Graphic Equalizer (and the Q2031 stereo model) offers you no less than 31 equalization bands, ranging from 20 Hz to 20 kHz, at 1/3 octave intervals. The EQ level of each band is controlled by a vertical fader. A look at the front panel of a graphic equalizer shows you why it got its name:

GQ1031 Graphic Equalizer



The 31 faders immediately show you what kind of EQ you are applying—a graphic representation of an audible phenomenon. "Equalizer" comes from the original function of these devices—to make the recorded sound "equal" in tone to the original sound, though nowadays the aim is often to make it better than the real thing!

So—how can you enhance your multitrack recording with a graphic equalizer? Without further ado, here are some suggestions:

1. The human voice is one of the richest, most complex sounds you'll record. Apart from the obvious special effects that you can get by boosting one frequency an extreme amount (for example, at 2 kHz you'll get a megaphone or "telephone voice" effect) more subtle use of the equalizer can give the voice a different emotional quality: muted and restrained, or wild and forceful. It can even make the voice sound closer or further away. And as a kind of "reverse EQ" method, reducing the EQ of all the backing instruments between about 3 and 4 kHz creates a kind of "dip" in which the voice can sit nicely, and be clearly heard. One tip: for a natural sound, its good to arrange your EQ faders

in a gradual curve such as we've illustrated above, rather than move individual faders a large distance from their neighbors.

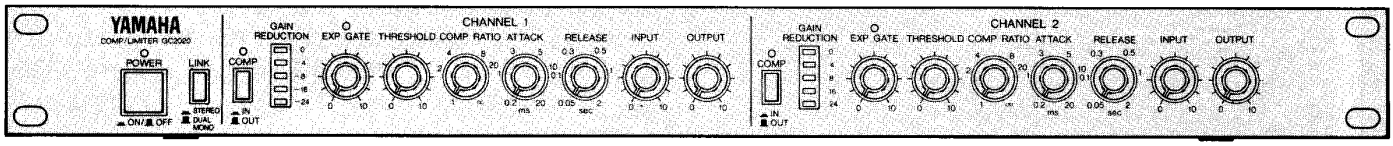
2. Say you've done your ping-ponging of three instruments as we described earlier, and you feel the snare drum is rather overshadowed by the bass and keyboard. The graphic equalizer enables you to boost a portion of the sound of one instrument, without affecting the others, if you select your frequency wisely. The bass is lower in pitch than the snare, and chances are you've a bright-sounding electronic keyboard whose pitch is largely above the snare. So try boosting the EQ somewhere in the middle range. It's always a question of trial and error, even for the most experienced engineer, because every recording is different, and in this case it's a question of finding those "loopholes" where a particular frequency forms a large part of the tone of one instrument as compared to the others, so boosting just that frequency will appear to make that instrument louder.
3. A graphic equalizer as sophisticated as the Yamaha GQ1031 can be used to reduce various unwanted noises such as tape hiss, microphone pops, amplifier buzzes, quantization noise on digital synthesizers, and good old AC 60 cycle hum. Again, its a question of finding the right frequency range at which to reduce the EQ level, so as to eliminate the noise without unduly changing the tone of the instrument. It's rather like taking one slice of bread from a loaf with 31 slices—it shouldn't alter the overall look too much!
4. Finally, with a stereo graphic equalizer such as the Yamaha Q2031 you can finely match the left and right channels of a stereo mix. In this case you'd patch the Q2031 to the Stereo Insert terminals on the RM602 mixer. This really gives you the opportunity to add a final polish to a mix. It's only too easy to "lose sight" of the overall tone of a mix when you're building it up overdub by overdub, and a good method is to give your ears a break prior to doing your final mix, so that when you come to do it you can really discern the subtle sound-shaping capabilities of your graphic equalizer.

• Compressors and Limiters

Compression and limiting are the kind of effects that are not consciously heard by the listener (unless he happens to be a pro recording engineer) yet they can enhance a recording tremendously. In a nutshell, here's what the two terms mean:

Compression is where the "dynamic range" of a signal (i.e., the difference in level between its quietest and loudest parts) is reduced. In effect, the quiet parts can be made louder, and the loud parts quieter. The compressor does it by reducing its gain (amplification level) as the signal's level increases, and vice versa. What's the point of this? Well, one instrument that often needs compression is a bass guitar. No bass player is a machine, and his playing level is bound to change, especially if he plays over the full range of the instrument. In concert, this isn't so noticeable, but in the studio, it can often happen that a bass guitar can seem to disappear occasionally, then leap out and drown everything else out (we're exaggerating a little here, for impact!). As you probably want your track to have a solid, consistent bass foundation to it, compression is the answer.

GC2020 Compressor/Limiter



Using a high-quality unit such as the Yamaha GC2020 Compressor/Limiter, you can exactly adjust the sensitivity of the compressor to match your bass track and bring its dynamic range to within more usable limits. Further, you can add punch and attack to a sound (particularly useful for percussive synth tones) or increase its sustain (great for long guitar notes, sustained piano chords, or cymbal crashes that can seem to expand when compressed—sounds contradictory, doesn't it?!).

Compression is also used to bring lead vocals within a "manageable" dynamic range—this is very common practice. In general, compression is used constantly in studios to make multitrack tapes more mixable, by "taming" the level variation of each track. Once you've had a taste of it, you'll be surprised that

you ever recorded without it.

Limiting is in fact a specialized type of compression. As its name suggests, it means restricting the maximum level of a track. This is done by applying extreme compression at a certain selected signal level, so that any louder signals are brought down virtually to that level. This is useful for controlling those over-the-top notes in the middle of a guitar solo. You can limit an entire mix, so that the overall level does not go wild and distort your stereo mixdown machine. This is easy with the GC2020, as it is a stereo unit (and by the way, it also features an efficient Noise Gate, a device which completely eliminates tape noise and other noise during quiet passages between notes). When mixing a multitrack recording, it's a great temptation to bring up the guitar a little, then—how about a little more synth, then—oops! now the bass is too quiet, etc., etc., until by the end of the song the level is twice what it was when you started. Limiting, when used judiciously, allows you to make changes in individual instrument levels without making the whole mix dangerously loud.

FURTHER HINTS

Once you've made a serious start in multitrack recording (and we don't mean that you can't have fun all the way!) you'll start to see limitless opportunities for improving your recordings—and for being more creative with your equipment and the environment in which you're working—even if it's only your garage. We could fill several dozen guidebooks with more advice and ideas (and maybe we will at a later date) but right now we'll content ourselves with mentioning a few more useful tips which will help you to make impressive high-quality recordings with your compact, budget-conscious equipment.

Pre-Emphasis

The MT44D enables you to use Dolby C noise reduction, which greatly assists you in making a clean, noise-free recording. However, it can also help if you use a simple technique called "pre-emphasis". This is easily done, and simply involves making sure that the recorded sound of your instrument is bright and clear—perhaps a little brighter than you'd normally use—by adjusting the tone controls on your instrument and/or turning up the HIGH EQ control on the RM602 mixer. Then, when you come to mix or ping-pong, you reduce the HIGH EQ setting on the mixer. This will return the sound of your instrument to its original timbre (tone color) and at the same time reduce the amount of tape noise that you hear.

It's worth keeping in mind that your ears can quickly get accustomed to the unusually bright "pre-emphasized" tone of your initially recorded tracks, and hear it as "normal". Then, when you come to mix, you may not want to reduce the high EQ because it will seem to sound dull. Your friends, however, may disagree when you play them your mixed masterpiece, and leave the room rapidly with fingers firmly in their ears (digital muting!). So, we'll repeat our friendly warning—give your ears a rest before doing your final mixdown—it's well worth it!

You can look upon the acoustics of a room as a problem—or as a usable asset. Sometimes a live (reverberant) room, one with a tiled or wood floor or walls, can enhance the recorded sound of a voice or acoustic instrument. An omnidirectional mike will pick up more of the room acoustics, and the further away from the sound source it is, the more the effect will be apparent. It's good practice to place a piece of carpet under both the mike stand and the performer, to eliminate any reflected sounds that could cause phasing problems. When a sound reflected off a surface combines with the direct sound at the mic, differences in the phase of the two signals can do nasty things to the fine tone you're working so hard to achieve. The shorter the path of the reflected sound, the more severe this problem is likely to be. For the same reason, it's not a good idea to have the singer face a wall, as the reflection off the wall can also cause phasing problems. This is lessened if the wall is absorbent, but the center of the room is a better situation.

A room containing many heavy furnishings (sofas, thick carpet, heavy curtains) will have a "dead" quality which may also be desirable if you want a clean recorded sound, to which you can later add reverb or echo effects. It's also good to break up the shape of the room so that sounds cannot bounce repeatedly between parallel walls and cause resonance (or "standing waves", for you technical buffs). This can be done by opening all your closet doors and drawers (if they contain clothing, that will help to absorb more reflected sounds) and even by scattering cushions, pillows, rugs and mattresses around the room. Don't forget to close any curtains too.

For a really dead sound, you can fix up a clothes line across the room above head level, then drape a blanket over it like a tent. The singer or player stands under it, with a mic This really reduces reflected sounds, which will have to pass through the blanket at least twice (once on the way to the wall—once on the way back) before reaching the mic.

Entire books have been written on this subject, so here we'll simply say that this is an area where experimentation will prove highly rewarding. For example, you can try using two mics to pick up the sound of an acoustic guitar—one pointing towards the sound hole, and one right over the bridge. This will produce two quite different tones which you can mix together. A saxophone doesn't necessarily sound best with the mic pointing into the horn—try pointing it from the side at the lower valves. An upright piano sounds more full if you angle it away from the wall, then point the mic into the angle between the back of the piano and the wall—this will pick up the bass frequencies much more efficiently.

It's good to have full size, "adjustable boom" mic stands, so that you can place the mic in the optimum position, with plenty of space around it. If a mic is placed on a desk using a small table-top mic stand, you can easily get phase problems due to the reflections from the surface of the desk. A mic placed on a sofa or chair may well have a dull sound, as the high frequencies will be absorbed by the surrounding material.

The RM602 has, as you must have noticed by now, six input channels. When you're doing 4 track recording, how can you make use of six channels? Well, it's simple. By using the TAPE OUTPUT switches on the RM602, you can route any input signal to any track on the MT44D. For example, when we mixed down our recording in Chapter III, we switched the TAPE OUTPUT to "R ▶4", which sent all signals leaving the Right stereo output to track 4 of the MT44D.

You can also switch the TAPE OUTPUT to "L ▶1", "L ▶3" and "R ▶2". So it's actually possible to send all six input channels into one track on the MT44D. When would this be useful? Well, imagine you've got a group of horn players, each with a completely different tone on their instrument. With this method, you could individually adjust the level and EQ of each horn, for a perfect instrumental blend. Then you record all six horns on track 1, say. Now you can monitor track 1 via input channel 1, and use the other five channels to send five violins to track 2. And so on. You can also connect a further two line instruments to the auxiliary inputs.

More conventional uses of this feature would be to use channels 5 and 6 for extra inputs when recording your band: two mics on a piano, for example, or for the stereo feed from a synth or drum machine. When you use these channels—say you've got the TAPE OUTPUT switch set to "L ▶1" (left stereo output sent to track 1) you'll have to ensure that these are the only channels panned to the left (the PAN controls, not the MONITOR PAN controls). All other channels should be panned to the right, or they will be sent to track 1 too. Then you use the Left stereo fader to set the overall level of whatever is going to track 1.

You could even add a different amount of reverb to each instrument, using the effects controls on each input channel. Which brings us to another possibility: additional effects. The RM602 lets you connect one effects unit to the mixer. However, you could easily use two more effects units in the following manner:

Connect the MONITOR OUT jacks (left and right) to the inputs of your two effects units (you can still monitor the recording on headphones). Connect the outputs of these units to inputs 5 and 6 respectively on the RM602. What happens now is that you can send any signal from the other four input channels to your effects units by simply turning up the MONITOR LEVEL control on the input channel, and adjusting the MONITOR PAN control—to the left for one effect, to the right for the other, in between for a blend of both. The effects are then "returned" to the mixer via channels 5 and 6 respectively, so you adjust their faders for a suitable general level.

There's more—by adjusting the MONITOR LEVEL controls of channels 5 and 6, you can actually send one effect into another—or even feed it back into itself. If you have three high quality effects units, such as the Yamaha R1000 Reverberator, the D1500 Digital Delay Unit, and a CH-01 Chorus Pedal, the possibilities are literally infinite!

"Walkman" style headphones, although comfortable and clear-sounding, are not recommended for overdubbing. The backing track will leak out of these headphones and into the microphone. It's better to wear closed headphones—the type that have a cushion that fits right over the ear, for this purpose.

CHAPTER VI

MIDI AND TAPE SYNC

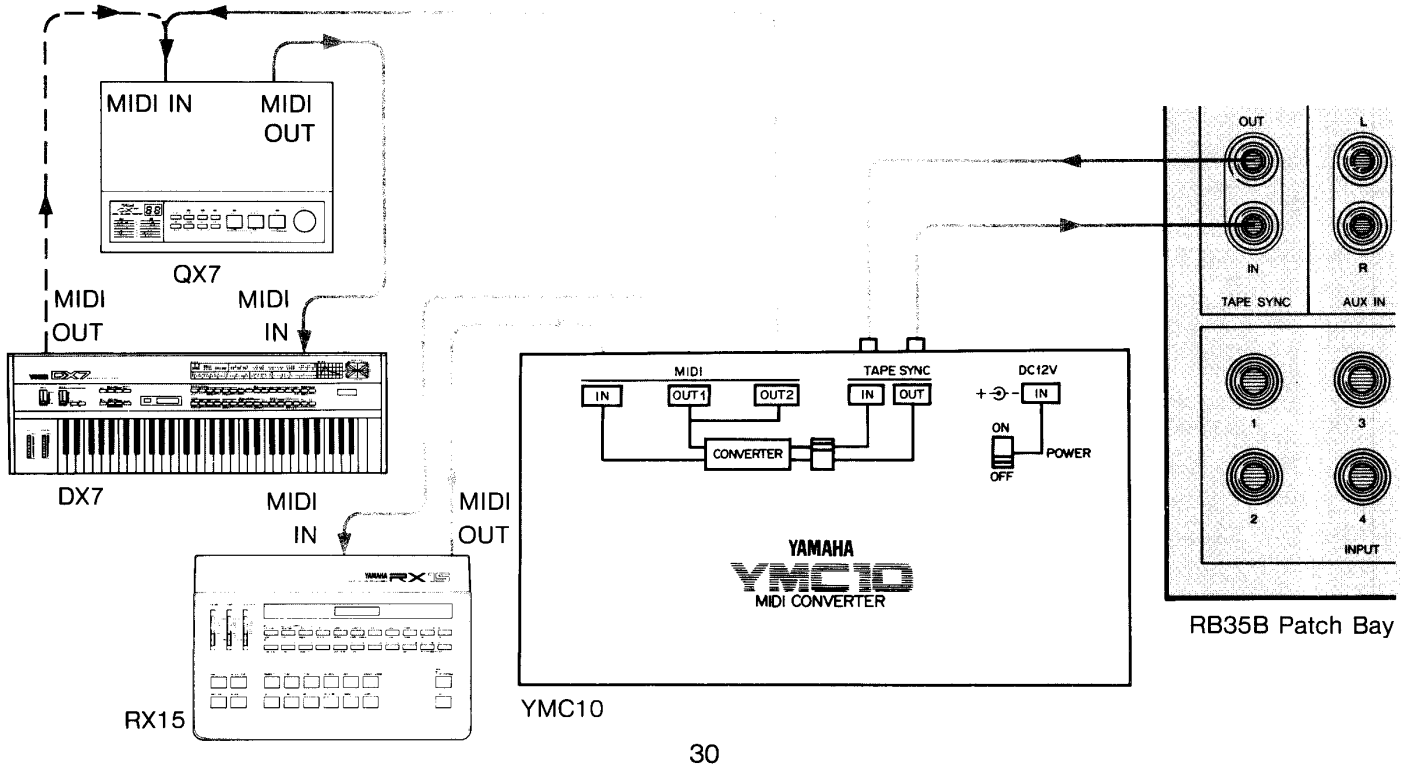
In music technology these days the key word is communication—communication between electronic instruments, and even between instruments and tape machines. Even on a compact setup such as the Yamaha MT44D, RM602 and RB35B, it's possible to make use of this state-of-the-art technology in your own home, so that you're right up to date with the hit-makers in the top professional studios.

MIDI stands for Musical Instrument Digital Interface. It's the recognized standard system for control of digital synthesizers and other devices. These days, a surprisingly large number of recordings feature MIDI technology. Many contemporary musicians are becoming more and more interested in the possibilities of MIDI.

MIDI allows you to play a synthesizer, and have the same music simultaneously played on another synth, which is receiving MIDI signals from the first synth. Each time you hit a note, MIDI signals are sent out to indicate such information as: (1) when a note has been pressed, and released; (2) the pitch of the note; (3) the key velocity (loudness) of the note. In addition, MIDI signals can be generated by other devices such as drum machines and sequencers. These devices can transmit a MIDI clock signal—a pulse that can control the triggering (starting/stopping) and tempo of another MIDI instrument, for automatic playback of programmed rhythms, sequences, and even entire songs or groups of songs. The MIDI Clock signal can easily be converted into an audible signal that can be recorded on tape as a Tape Sync Pulse, which is utilized in many modern recordings. The pulse is laid down on one track of the multitrack tape deck, and is used to control the clocks of all the MIDI instruments that are overdubbed, so that they remain perfectly in time with each other.

Yamaha is a prime mover in this field, and a recent development is a range of budget-conscious, yet sophisticated, MIDI instruments in a price range comparable with the recording system we're describing in this guidebook. The system illustrated shows you what you can do with a setup that includes the Yamaha RX15 Digital Rhythm Programmer, the QX7 Digital Sequence Recorder, and the DX7 Digital Programmable Algorithm Synthesizer. Finally, a vital part of this system is the YMC10 MIDI Converter, which converts MIDI Clock signals into Tape Sync Pulses, and vice versa. Of course, this setup will work perfectly for other MIDI devices such as Yamaha's RX11 Digital Rhythm Programmer and DX1 Digital Programmable Algorithm Synthesizer.

The operation of this system is very simple, and



enables you to produce complex song arrangements that can be changed and edited at any time.

The first thing you need to do is to record your Tape Sync Pulse. This will be the foundation and the tempo control for the whole recording. This is done as follows: Switch the TAPE SYNC ON/OFF switch on the RB35B Patch Bay to ON. This automatically sends the Tape Sync signal to track 1 of the MT44D. Switch the RECORD MODE selector of track 1 on the MT44D to RECORD, and press the REC/PAUSE button. Switch the CONVERTER switch on the YMC10 MIDI Converter to TAPE SYNC OUT (the lower position). This enables the Tape Sync signal to be sent to the input on the patch bay. You should now see, on the INPUT LEVEL LED of channel 1, that the signal is present. The YMC10 will be sending out a constant tone, and you should adjust the recording level on track 1 to read about 0 dB.

The RX15 Digital Rhythm Programmer enables you to program a repeating pattern of realistic digitally recorded drum sounds, or an entire song sequence. We'll assume that you've programmed it with a simple song sequence—verses, choruses, and an ending. The RX15 clock should be set to "Internal".

Put the MT44D into record (don't forget to reset the counter first, so you can return to zero automatically at the end of the take) then press the START button on the RX15. Note that we're recording the Tape Sync Pulse only here, NOT the audio signal, so if you want to hear the RX15, you can connect its Audio Output to INPUT 5 on the RB35B patch bay. Set the INPUT Selector to −20 dB, switch the MONITOR SELECT switch to POST, and adjust the Channel 5 MONITOR LEVEL controls and MASTER MONITOR Level controls accordingly.

Once the sequence has finished, stop the MT44D and rewind it. For playback, switch the YMC10 CONVERTER switch to TAPE SYNC IN, and the RX15 clock to "MIDI". The tape, when played back, will trigger the RX15 and you will hear the entire drum sequence exactly as you programmed it. What the tape sync signal does is to memorize the START and STOP signals of the RX15, and its clock rate, so you can stop and start the RX15 in the middle of a song, or alter its tempo, and this will be stored on the tape.

So now you've got your drum track together. What's the difference between this procedure and simply recording your drum track onto tape, as we did in Chapter III? Well, you can now go back to your RX15 and change the rhythm pattern at any point, to add a little more interest to the song. The basic structure of the song is recorded onto the tape, so that won't be lost, and whenever you play back the tape sync signal into the YMC10 and RX15, the song will be played as before, but with the new breaks that you've programmed in.

A lot of top line artists not only record but compose songs in this way, laying down the sync pulse, then using a basic rhythm pattern to inspire them to compose, then going back and putting in different patterns for the chorus section, drum breaks, coda, etc., while the Tape Sync Pulse holds everything together in perfect tempo. And you can do just this, with the equipment we're using here.

The next thing is, once you've figured out your million-selling chord sequence, to overdub a guitar track and bass track in the way we described in Chapter III, onto tracks 2 and 3 of the MT44D. You'll then have track 4 free for your vocals. But wait, what about the keyboard part?

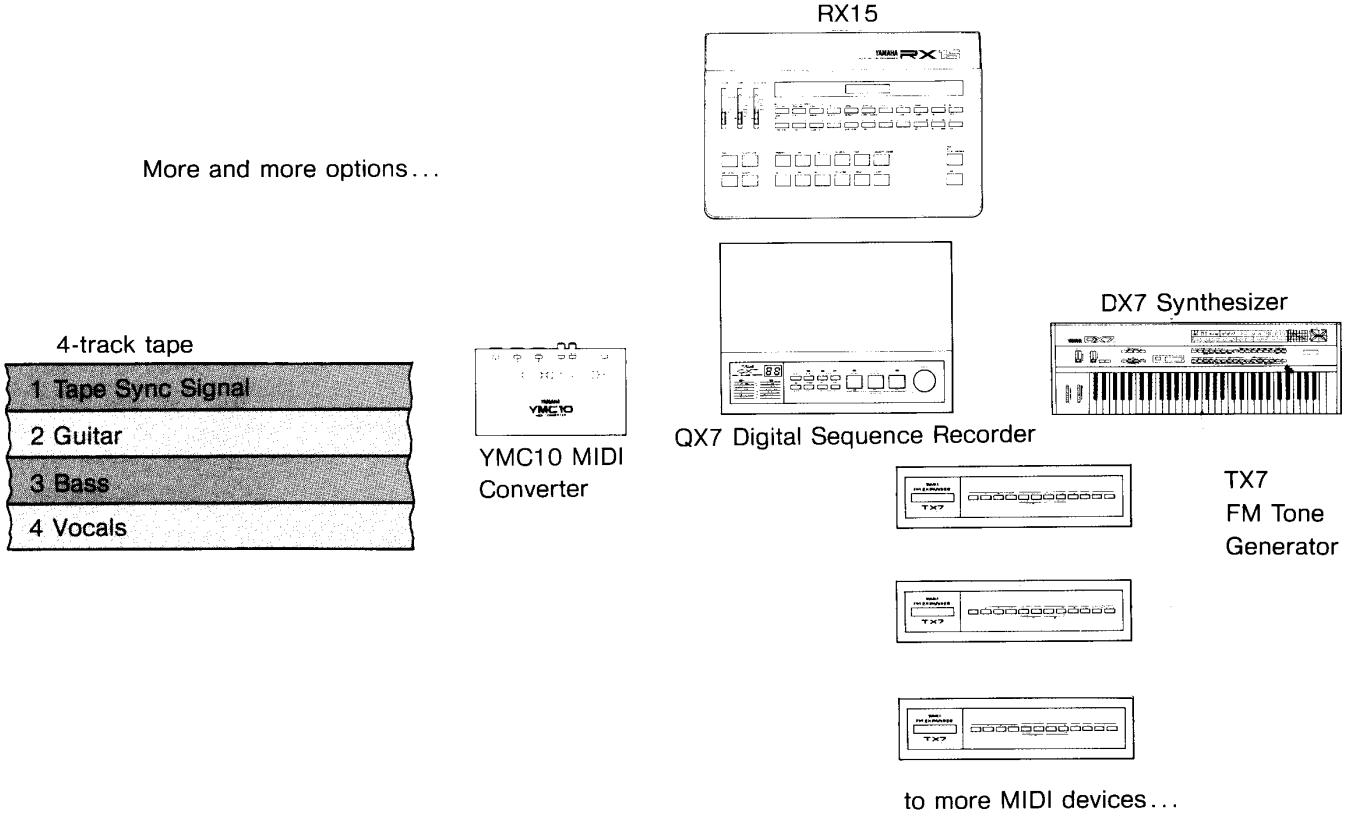
The DX7 synthesizer part will be stored on the QX7 sequence recorder, which can digitally memorize your performance (up to 8100 notes) in the form of MIDI data, which includes such functions as Pitch Bend, Modulation, Sustain, and so on—and it allows you to overdub virtually as many times as you like! The MIDI OUT of the DX7 should be connected to the MIDI IN of the QX7 for this purpose, and the QX7 clock should be set to "Internal Clock". Play back the guitar, bass, and drum machine parts, and put the QX7 into Record. Play the DX7 part while listening to the tape—you can connect the DX7 to channel 6 on the mixer, for monitoring purposes. Having done a satisfactory take on the DX7, you can then overdub more tracks of DX7 into the QX7, in the manner explained in the QX7 Owner's Manual.

Now, when you're ready to play back, all you have to do is connect the YMC10 MIDI OUT 2 to the QX7 MIDI IN, set the QX7 clock to "External Clock", then play back the tape, and not only will you hear the recorded guitar and bass tracks, but also the RX15, QX7 and DX7 playing, in a sense, "live". Now you can record your vocals on track 4 of the MT44D.

The beauty of this system is that it really aids composition and arranging: at any time, you can go back and completely alter the drum track or the synth track, without losing the overall structure of the song. You can even re-record the guitar, bass, or vocal, and of course at any time you can mix down all five tracks (three on tape, and the two "live digital" tracks which, incidentally, will be completely free of tape noise) onto a stereo tape deck.

What's more, you can use the QX7 to transmit individual parts to even more instruments—up to 16!—these can be other DX synths, or Yamaha's TX7 FM Tone Generators, which are basically the same tone generators incorporated into the Yamaha DX7 synthesizer, and an ideal way of expanding your MIDI system dramatically, and at low cost.

In this way the modern era of total communication between instruments and tape is yours, to create sophisticated, expressive music with incredibly compact, easy to use recording and performance equipment.



CONCLUSION

We sincerely hope that the information presented in this guidebook will help you on your way to producing some very fine recordings. The right equipment, techniques, care and resourcefulness are all that is needed to achieve some very impressive results.

Although most of the guidebook has concentrated on straightforward music recording, the same techniques and procedures apply to virtually any situation. For example, recording a live performance has its own particular problems and pitfalls, but a thorough knowledge of this guidebook will enable you to handle this kind of recording project with confidence. And we certainly haven't covered all the possibilities available with the Yamaha Recording System and of course the astounding MIDI and Tape Sync equipment, because the possibilities are literally infinite. You are freer than ever before to use your imagination and ingenuity to make the maximum creative use of this sophisticated technology. The world of recording in the computer age is a new one, and you are in on it at the beginning...this is your chance to be a pioneer in this field!

And when you're ready to expand your system, Yamaha offers an extensive range of products designed for every conceivable type of music.

Once again, good luck and GOOD RECORDING!

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NIPPON GAKKI CO., LTD. HAMAMATSU, JAPAN

CM6-11 8565 Printed in Japan