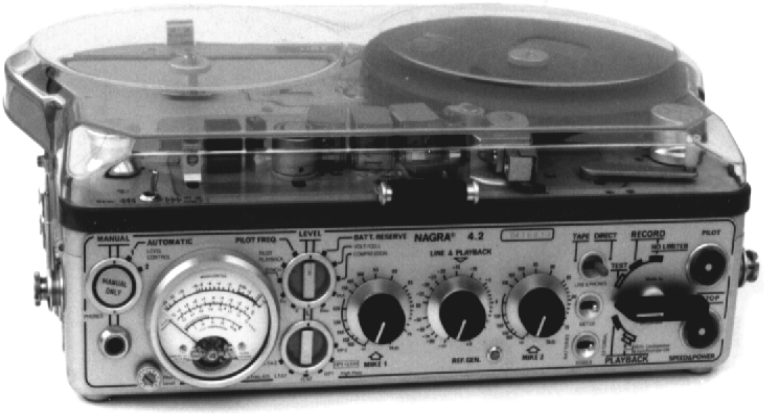
UNDERSTANDING AND OPERATING THE NAGRA 4.2 SYNC RECORDER

written by Fred Ginsburg, C.A.S.



The Original Standard for Film Production

The Nagra audio recorder has been a worldwide standard for use as a portable tape recorder for sync dialogue. Since the early sixties, the Nagra has been the recorder of choice for motion picture production, and has been unchallenged until the introduction of timecode digital recorders. In 2002, Nagra recaptured a portion of the digital audio market with its introduction of the Nagra 5 digital timecode recorder with removable hard-drive.

Although digital recorders have better audio recording specs than the basic Nagra, the current crop are nowhere near as dependable under diverse conditions and lack many of the convenient features that the Nagra offers, such as **confidence head monitoring** (you can listen off of the tape that was just recorded a moment before to insure that what you heard is what you got); **excellent microphone preamps** (the mic pots on a Nagra are as good as any found on a mixing panel; something that cannot be said for most recorders); and **long play battery life** (days on one set of D batteries as opposed to an hour or so offered by digital recorders).

Despite the Nagra's compactness, it rivaled full blown studio machines for recording quality. More importantly, the Nagra recorder is extremely **rugged** and continues to operate in perfect spec even under arduous location conditions! (Something that cannot be said for most digital recorders.)

Unlike the older studio recorders that required daily adjustment, the Nagra is able to maintain its high quality of recording with but **minimal maintenance** once or twice a year. Nagras have been known to go for several years without any maintenance and still function almost perfectly, although it is a poor professional practice to be so negligent in the care of one's equipment.

The Nagra was so much the industry standard for motion picture production that the brand name has literally become synonymous with the term "portable sync recorder".

It was not uncommon to be asked, "What are you using for a Nagra?" Which means, what type of Nagra are you going to use for sync sound, or are you going to use a sync cassette recorder, etc.

Nagra, by the way, literally means *record* in Polish. Stephan Kudelski, the inventor of the Nagra, is Polish. The Kudelski/Nagra factory is located in Switzerland.

As an aside, during the preparations of the 1984 Olympic Games, when it seemed like every company under the sun was the official this or that sponsor, we used to kid the local Nagra staff that they should commission a poster proclaiming "Nagra, the official Nagra of the 1984 Olympics!"

Various models of the Nagra

Historically there have been three significant models of monaural machines, and two models of stereo recorders.

The first practical Nagra was the **model III**. The Nagra III was very reliable, and to this day is still found in many sound studios as a transfer deck to sprocketed mag film. The III relied upon external sync reference (umbilical cords from the film cameras), but most machines have long since been modified with crystal sync.

In the early days of Eclair NPR and Arriflex 16BL film cameras, sync between the camera and recorder was maintained by a "**sync cable**" that linked the two together. A **60 cycle sync pulse** was generated by the camera motor, and this signal was recorded on the Nagra as an indicator of the exact film speed. Due to motor and battery variances, the film speed tended to vary slightly, and the 60 cycle sync pulse would reflect these speed changes.

The eventual advent of crystal controlled camera motors eliminated any film speed variance, and so the physical linking of camera and sound recorder became unnecessary. The Nagra took its sync reference from its own crystal regulated sync pulse generator.

The model III offered only one mic input, plus one line level input (adaptable to mic level), and required an external resolver for sync playback. It also required a dual banana jack adapter for headphones.

The next generation of Nagra was the **model IV-L**. The IV-L looks somewhat similar to the model 4.2, and features two microphone inputs plus one line input. The IV-L features internal crystal sync and also accepts an internal resolver circuit board.

There is a "dangerous" position on the main control switch of the IV-L which activates the **RECORD** mode, but at very reduced levels. This unlabeled **FADE RECORD** position is between **TEST** and **RECORD**. This was intended as some sort of "fade in" mode for European users, to create a soft start for their recordings (Why?). Many Nagra users have made the horrible mistake of thinking they were in the regular **RECORD** mode when actually they were only in the **FADE RECORD** position, thus rendering their recordings unusable.

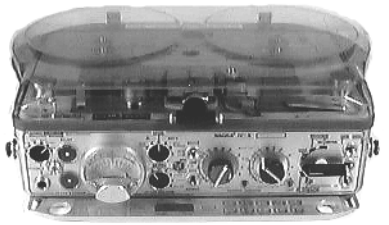
If you own a Nagra model IV-L, have a technician permanently disable that switch setting and jumper it for regular RECORD.

The **Nagra IV-S** was designed for stereo recording, but still utilized a 60 cycle sync pulse. However, the sync pulse system on a stereo is very different than that found on a monaural machine, and the formats of recorded tapes are not interchangeable between mono and stereo machines.

Tapes recorded on any of the mono Nagras are fully interchangeable with any other model mono Nagra.

The Nagra IV-S requires an external resolver, and special input cables for line level input (with 47K ohm resistors). Almost no one uses a IV-S these days.

The stereo Nagra of choice was the **model IV-STC**, which is a Nagra IV-S that has been designed to record SMPTE time code in the track area formerly used for 60 cycle sync pulse. The model IV-STC is more complicated to learn and operate, and will not be dealt with in this chapter.



Other models of Nagra recorders include the **E** (a non-sync recorder); the **IS** (stands for idiot simple; European idiots must be of a higher mental caliber than American idiots since it never caught on in the U.S.); and the **SN** (a miniature recorder originally developed for the cloak and dagger crowd, rendered obsolete by radio mics and miniature DAT recorders). The model **T** is a large, studio timecode stereo recorder, compatible intended for use with telecine transfers and post-production. The Nagra **model D** is a

four-track reel-to-reel digital timecode machine. The newest Nagra is the model **5**, which is a digital stereo timecode portable recorder that utilizes a removable (expendable) hard-drive.

By far the most common Nagra in filmmaking is the model 4.2L. This is the pinnacle of the mono machines, and is the standard to which all portable sync recorders are compared.

The Nagra 4.2 offers two microphone inputs, plus one line level input, and features internal crystal sync and internal resolver. It is still used by the majority of television series as well as many independent feature films.

Weighing under fifteen pounds including batteries, and measuring approximately 13" x 10" x 4.5", the Nagra 4.2's recording specifications at 7 ½ ips are:

Wow and Flutter: 0.03%
Freq. Response (at 20 dB below peak level): 30 Hz to 15 kHz +/- 1.5 dB
Signal to Noise: 73 dB

Bear in mind, of course, that these specifications are both conservative and applicable to full spectrum music recording. When used for the recording of simple speech (dialogue), the results are even more impressive!

What is Sync Sound?

In **single system** filmmaking and video, the location audio track is physically recorded on the same piece of film or videotape as the picture. In essence, the camera or VTR serves records both picture and sound simultaneously.

Double system filmmaking involves the process of **recording audio separately from the picture**, by means of an isolated audio recorder. Dailies, screenings, and editing take place with picture and audio on separate physical reels, projected and played back in "sync" by means of interlock. Double system provides the editors with a great deal of creative options. At the completion of all post-production, the separate reel of audio is physically merged to the picture in the form of a composite print (single system), featuring picture and sound adjacent to each other on the same reel.

Double system recording is not just limited to motion picture production. Sometimes in video production it is preferable to record the audio separately from the video, and a sync recorder such as a Nagra, DAT, or multitrack is used for that purpose. Rationale for double system recording in video includes: concert recording, protection backup tracks, audio only interviews & sound effects, and closer physical placement of the audio recorder/microphones than where the camera might be located. When dealing in terms of older camcorders whose technological achievements were limited to picture at the expense of audio, double system recording has very obvious benefits.

Talking about sync and achieving it are two different things!

In the old days, sync between camera and sound recorder was maintained by electromechanical means. Sound was recorded directly onto sprocketed magnetic film, with one frame of picture corresponding to one frame of sound. Tape recorders were the size of telephone booths and had to be kept outside of the soundstage either in another building or in a large truck. Large 3-phase power cables connected the recorder with the camera, and literally drove it sprocket for sprocket in sync with the sound.

Later systems utilized synchronous motors, with both the camera and sound recorder running locked to the 60 Hz frequency of common AC electrical current.

In the sixties, Stephan Kudelski and Loren Ryder introduced Hollywood to a new way of doing things. Location sound could be originally recorded onto a lightweight ¼-inch tape recorder, and then later transferred to sprocketed magnetic film for editing and rerecording (mixdown).

Sync between the film camera and the tape recorder was achieved by a system known as **neopilotone**. Again, both the camera and the sound recorder took advantage of the 60 Hz frequency provided by running off of common AC electrical current.

But since the Nagra did not utilize sprocketed tape, it had to rely upon neopilotone to achieve sync. The way the system works is that a 60 Hz sync pulse (in actuality a sine wave) is recorded onto the center of the

audiotape. When the recording is later played back for transfer, a special device known as a **resolver** compares the **sync frequency** (sync pulses) on the tape against an external reference (another 60 Hz signal). The resolver speeds up or slows down the tape speed so that both 60 Hz signals match up. The resolving process compensates for errors such as tape stretch, slippage, and minor motor fluctuations.

We do not normally hear the 60 Hz sync pulse (hum) on the Nagra tapes because a second 60 Hz sine wave is simultaneously recorded onto the tape. This second sync pulse is a mirror image twin (180 degrees out of phase) of the first sync pulse. When the two sync pulses are played back over the head together, they cancel each other out.

That is why you ***will hear*** the sync pulse if you play back a full track Nagra tape on a quarter-track or half-track recorder.

If you attempt to razor blade edit a tape recorded with a Nagra, you will hear noise at the edit points when you make a diagonal splice, since the diagonal cut eliminates part of the mirror sync pulse that otherwise functions to cancel out the primary sync pulse. When using a Nagra for non-sync recording, such as radio interviews, merely **remove the crystal jumper plug** from the right side of the machine to prevent a sync pulse from being recorded that might interfere with any future (razor blade) editing.

It is very important to realize that Nagras do not run at 24, 25, nor 30 *frames* per second! They run at 7 1/2 *INCHES* per second. It is the FILM CAMERA that runs at frames per second, and then later it is the MAG FILM RECORDER that will record at frames per second to match the film camera. But as far as the Nagra is concerned, there are NO FRAMES per second, only inches per second **IN REAL TIME**.

What this means is that the crystal sync pulse system is intended to replicate or **reproduce a recorded event in precise real time** — no longer and no shorter than the actual elapsed time.

If we were to film a scene that ran 10.00 seconds with a crystal controlled film camera running at 24 fps, and then projected that same strip of film at 24 fps, we would re-create an event of 10.00 seconds duration.

During the same production, if we were to record audio of that 10.00 second event, we would require that the audio recorder be able to play back that sound in precisely 10.00 seconds. Any longer or shorter — due to tape stretch, slippage, or motor variation — would result in a loss of lip sync.

The Nagra is capable of reproducing those 10.00 seconds by means of recording a sync pulse (generated by a crystal clock) onto the original tape, and then comparing (resolving) that sync pulse to a reference sync pulse (such as that same crystal clock). The tape speed is minutely adjusted so that the sync pulses match up. The end result is an audio event of 10.00 seconds. Real-time.

So where do the frames come in? At the same time that the Nagra plays back the audio in real time, a sprocketed MAG FILM recorder is running at the same frame rate as the camera originally did. The audio (10.00 seconds) is recorded onto a film strip with sprocket holes that is running at frames per second.

Question: If the Nagra is running at crystal controlled real-time, what is governing the speed of the mag recorder during the transfer?

Some mag recorders are crystal controlled, but many of them take their speed control by the 60 Hz frequency generated by our AC electrical system. Since the mag recorder and film projector are both referencing the same AC frequency, any variations in that frequency that may occur in the power line affect both machines the same, so lip sync is maintained. When audio is transferred from a crystal Nagra to a mag recorder locked to AC, we use a special AC power adapter (called the **ATN**) to both power the Nagra and to provide an external sync pulse reference taken from the AC line. This external reference locks the Nagra to the same (possible) fluctuations that may affect the mag recorder and projector.

The resolver in the Nagra will adjust the play back speed of the tape to match any variations in the frame rate of the mag recorder. Real time has now been superseded by projection time. For example, our 10.00 second scene may end up projected at 10.09 seconds, a slight variation of 24 fps. However, the mag recorder is locked to the same AC line, so it too would be running slightly off from 24 fps to match the projector. Our Nagra, locked

to the same AC line, would be adjusting its speed so as to match 10.09 seconds of "real time".

The Nagra deals with record duration and play back duration. Seconds, not frames.

It does not matter what frequency sync pulse is used during the record process, so long as that same frequency is used during the play back process. 60 Hz is the norm in the United States, and 50 Hz is the norm in Europe. Most Nagras have an internal switch to change from 60 Hz to 50 Hz.

But if a mistake is made, and the Nagra crystal is left on 50 Hz during one's shoot, it is not a major problem. British film cameras may run at 25 fps, but the audio still runs in real time! As long as the Nagra is resolved to a 50 Hz crystal reference, it will play back in precise real time, and lip sync is preserved during the transfer!

If a Nagra crystal goes sour, and records a 47.8 Hz sync pulse, there is still no problem. Just make sure that you use the same machine to transfer from, and let the Nagra use its same (albeit defective) 47.8 Hz internal crystal for reference. Real time will be maintained! Ten seconds of picture will equate to ten seconds of sound.

The only time that transferring becomes complicated is when we alter the real time relationship between the film camera and the recorder, such as when we transfer negative film (shot at 24 fps) to video via a telecine that slows the film down to 23.97 fps. If the audio is being transferred directly to video (instead of to a sprocketed mag recorder), then we need to fool the Nagra into slowing down by the precise same percentage. We do this by feeding the Nagra an external sync reference slower than the original 60 Hz we used during recording. In the case of film to video, we would feed the Nagra a 59.94 Hz reference, and that would adjust for the film speed slow down.

The key item to remember is that as long as the film camera is crystal controlled, it does not matter what the frequency is of the sync pulse that is recorded on the Nagra, just so long as that same frequency is used during resolve play back.

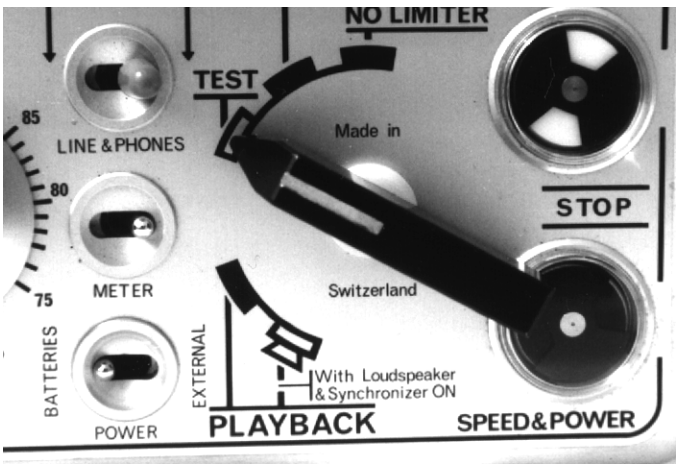
Operation of the Nagra 4.2L

Turn it ON and check the Batteries

The first thing to do is to turn the Nagra ON. Do this by flipping the power switch on the front of the machine from **EXTERNAL** (off) to **BATTERIES** (on).

Next, we want to verify the condition of the batteries. Turn the main selector switch up to **TEST**. Turn the **METER SELECTOR** to **BATT RESERVE** and look at the lower line of the meter. If the needle rides in the rightmost portion of the thick black line, you have good batteries. If the needle rides in the left third of the black line, you have weak batteries. If the needle is somewhere in the middle, you have "somewhere in the middle" batteries!

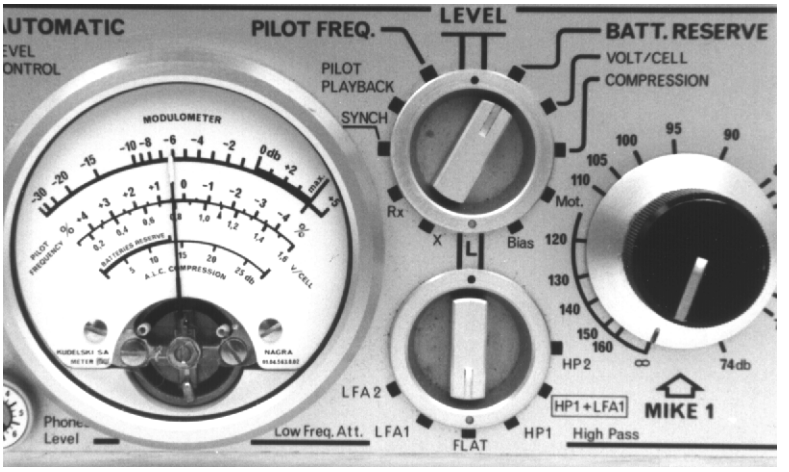
Okay, you're saying, "Cut the sarcasm. What do you mean by *'somewhere in the middle batteries*?"

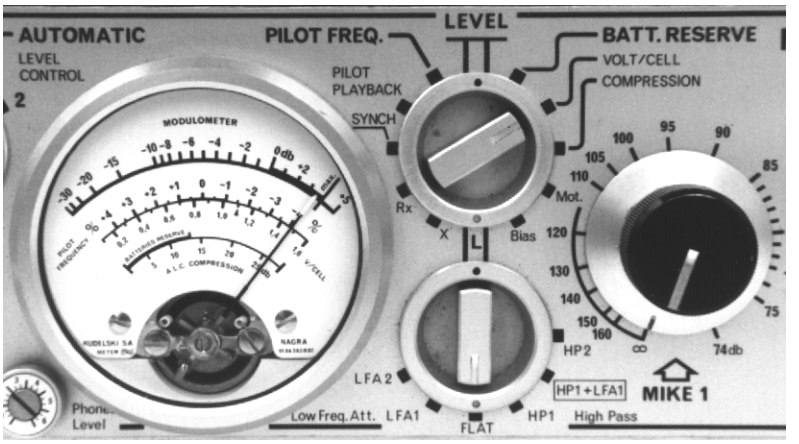


Well, that's the problem. The **BATT RESERVE** indicator is only good as a quick check, and does not really tell you very much.

But the next click down is the **VOLT/CELL** indicator. This is the position to use for checking batteries. It will display a very precise readout of the average volts remaining per battery, and is read on the middle scale of the meter. Markings range from 1.6 downward. Brand new D batteries should read around 1.5 or higher.

Note that there is a **caret** (triangle) at the 1.1 marker. This is the lowest voltage that will still operate a Nagra. At this point, the motor speed will begin to fluctuate, and lip sync may be lost.





The 1.1 marker is not a warning, but a **PROMISE** of bad things to come. Do not ever allow your batteries to get that low. If the producer is paying for the batteries, change them at 1.3 volts per cell. If you are really trying to stretch the budget, you can go down to 1.2 volts. No lower! Batteries wear down gradually up until 1.2 volts, then they deplete rapidly to 1.1 volts. Never press your luck; you will lose!

Batteries that have been resting for a few hours will read higher at first. **Check your battery level often, especially in cold weather.**

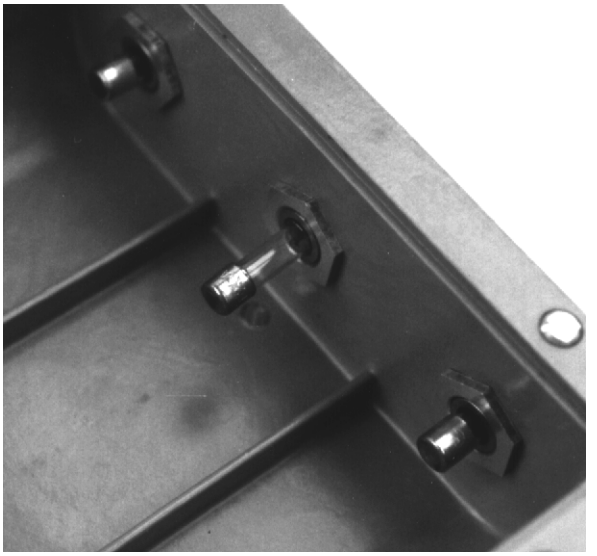
To replace your batteries, turn the main selector to OFF (nine o'clock position) and flip the power switch to EXTERNAL (just for extra protection). Turn the Nagra upside down, and use a coin to unlock the battery compartment.

Remove all of the old batteries and get them out of your sight! Give them to the crew for use in flashlights, or dispose of them safely. Do not put them back into a battery carton, lest they be mistaken for fresh ones later on!

While you have the battery compartment open, take note that there are three fuses located in the positive battery terminals. These fuses can be removed with your fingers and inspected. If they need to be replaced, use **2.5A 5x20mm**. These fuses will blow if batteries are inserted wrong, or if a battery reverses its own discharge. The sign that a fuse may be blown is if you turn on the machine and nothing happens. (Even weak batteries should make the needles move.)

Insert twelve NEW D cell alkalines (Duracell or Energizer are recommended). Be careful that all of the batteries are facing the proper direction! If the engraved battery icon on the floor of the battery compartment is hard to see, outline the plus and minus signs with a Sharpie marker.

Always use fresh, new batteries of the same brand and batch. Never intermix different brands, as the batteries will deplete at varying rates and cause electronic noise. I prefer Duracell coppertops because of their quality and



the ease of visually ascertaining that all of the batteries are facing the same direction.

Replace the battery lid. Activate the power switch, go to **TEST** position, and check your **VOLTS/CELL**. Should be reading around 1.5 volts.

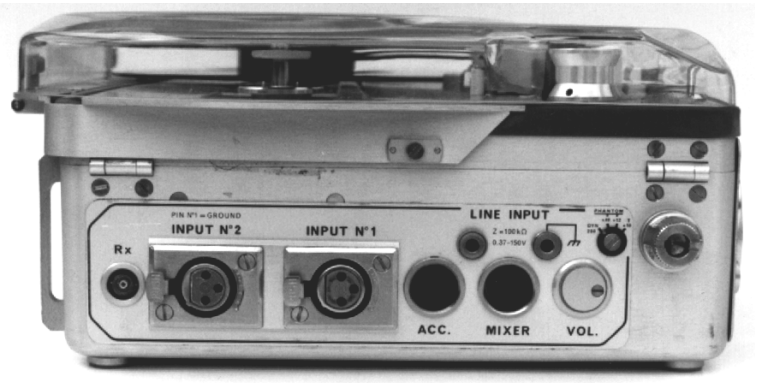
Nagra Input Side (left side)

Rx Socket

This was intended for some sort of European radio slating device that flew as well as the Spruce Goose. The socket is not wired to anything. Ignore it. Or mark it with a piece of tape to remind you to stop at the drugstore on the way home to pick up some more sunscreen!

Microphone Inputs

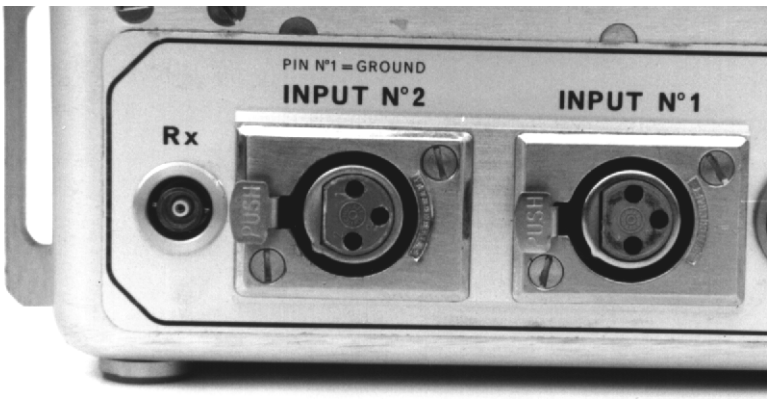
There are two mic level inputs. The levels from both connectors are controlled by the two **pots** (knobs) on the face of the machine. Both inputs are mixed together onto the samesoundtrack because this is a **MONAURAL** recorder. It does not matter which input you prefer to use.



Always keep the unused pot turned all the way off to avoid hiss.

The **MIC inputs** accept professional, low impedance, balanced microphones with standard XLR 3-pin mic cables.

Nagra recorders can be equipped with a choice or selection of different microphone preamps inside the machine to interface with different types of mics. Make sure that you know which type of mic preamps your machine is equipped with, or else some mics will not work with your Nagra!



The basic mic preamp is known as the "**QPSE-200-XOYO**" and is found in most of the older machines. This preamp is designed for low impedance, dynamic (or self-powered) microphones. This preamp works with dynamic mics, electret condenser mics (that power from their

own battery), and condenser mics (powered from an external battery power supply). The **XOYO** preamps do not provide any direct powering to mics.

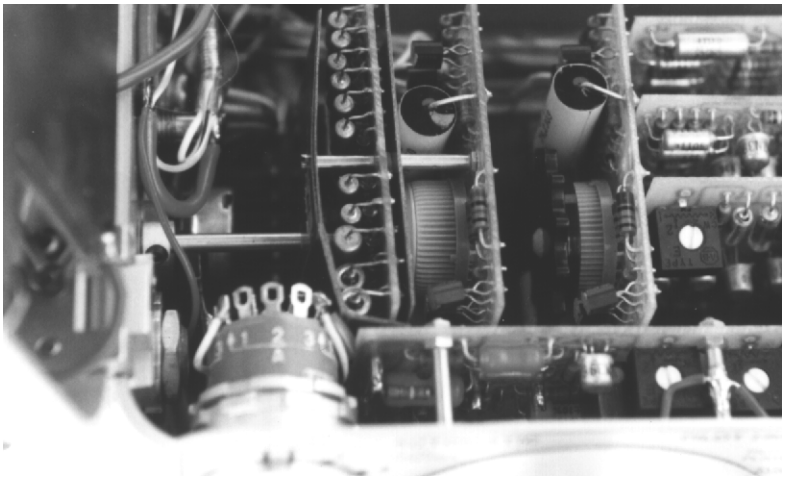
The next preamp commonly found in older machines is the "**QPM 3-5**". This preamp is designed to provide **12 volt T** powering to condenser mics such as **Sennheiser MKH416/816** shotguns. This preamp is incompatible with dynamic or self-powered mics! So although it may be convenient for powering the shotgun mic, the **3-5** limits the soundperson from using a lavalier or radio mic.

I do not recommend using a 3-5 preamp because of this limitation. It makes better sense to use the XOYO preamp and just tape a battery power supply onto the strap to power your condenser shotguns.

Newer vintage Nagra 4.2's may be equipped with one or two **UNIVERSAL** preamps. These preamps are user selectable for use with any microphone (dynamic, 48 volt Phantom, or 12 volt T). The "**QPAUT**" preamp is reserved for use in Mic Input One. It is controllable (and identifiable) by a selector screw located near the strap mounting screw and above the speaker volume control. Clockwise across the selector will read **DYN 200**, **Phantom +48**, **Phantom +12**, and **T +10**. The DYN setting is for dynamic and self-powered mics. Phantom +48 is for 48 volt Phantom condenser mics. Phantom +12 is for 12 volt Phantom mics, which you probably will never use. The T power setting is for condenser shotguns that use 12 volt T, such as the 416.

If, and only if, there is a Universal preamp in Mic input One, it is possible to install a second Universal preamp (known as the "**QPUT**") in Mic input Two. **The control for this second universal preamp is located inside of the Nagra, just behind the meter.** You will see a black plastic thumb wheel, with notches all the way around. This black wheel controls the second universal preamp. The position of the wheel (unmarked) corresponds to the labels on the selector for Mic preamp One (the screw selector on the side of the Nagra). Completely counter-clockwise would be DYN. Completely clockwise would be T power. The two Phantom settings are in the middle.

One last word about Nagra preamps. Although the configurations for DYN and Phantom are normal, Nagra uses its own variation of 12 volt T power. Most T-powered mics, as they come from the manufacturer, require 12 volt positive on Pin 2, and 12 volt negative on Pin 3. **Nagras produce 12 volt positive on Pin 3 instead, and negative on Pin 2**. So to power a shotgun mic from a Nagra, it is necessary to switch pins 2 and 3 inside of the mic (known as "**red dotting**"), or to use a phase reversing cable that accomplishes the same thing. This is definitely confusing, but that's the way life is. If you are not sure which way your mic is wired, make sure that you bring a **phase reversing cable** with you!



ACC Socket

The next item on our guided tour of the Nagra 4.2 is the **Accessory Socket**. This socket is a 6-pin Tuchel connector (a real pain to find in an electronics store and a bigger pain to solder). The **ACC** socket provides a **line level input** to the

Nagra, and the input level can be controlled by the center pot on the face of the machine. In addition to being a line input, the ACC socket also provides **10 volts output** for the powering of accessories.

This socket is normally used for connecting a mixing panel to the Nagra.

The ACC socket can also be used to **convert the line input into a third microphone input**. Accessories such as the **Nagra BS-II cable adapter** and the **Sennheiser KAT-15U** adapter plug in to this socket and provide an XLR input. The KAT-15U can also provide T powering for shotgun mics.

Mixer Socket

Contrary to its name, we **do not use the Mixer socket to plug in mixing panels!** This 7-pin Tuchel socket is intended for line level input of **calibrated level**. There is **no means of adjusting the input level** when using this socket. It was originally intended for a custom mixing board to be built by Nagra.

However, the Mixer socket does have its uses. It provides a **source of power out** for use with accessories. It can be used to **remote start/stop** the Nagra with a simple switch. The Mixer socket can also provide an **audio output** (monitor return) to a mixing board.

Banana Line Input

The two sockets located on either side of the Mixer Socket are the same line input as found in the ACC socket. Although some people mistake banana style sockets for a pair of RCA or Mini connectors, both of the banana jacks constitute only ONE input. Positive audio goes into one hole, and negative audio goes into the other.

Banana plugs are inexpensive to purchase and idiot simple to solder. One lead, one plug. For this reason, many mixers prefer to use the banana inputs rather than the ACC socket for connecting their mixing boards.

The input level of the banana jacks is controlled by the center pot on the face of the Nagra.

Warning: Use either the ACC socket or the Banana jacks for line input; but do not use them both at the same time!

Volume

This knob controls the **volume of the internal loudspeaker** of the Nagra. The speaker itself is located on the other side of the machine (the output side). The loudspeaker only functions when the Nagra is in the Loud-speaker Playback mode (the lowermost playback setting of the main selector switch).

Universal Preamp Selector Screw

On those machines equipped with a Universal mic preamp, a selector screw with labels will be located just above and to the right of the volume control. See the section on Mic preamps for details.

Output Side of the Nagra (right side)

Loudspeaker

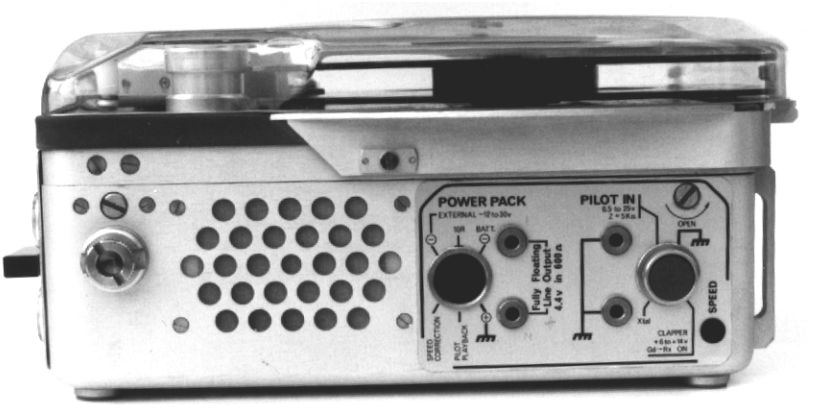
The loudspeaker is controlled by the volume control located on the other side (input side) of the machine. Loudspeaker is only activated during Loudspeaker Playback, which is the lowermost playback setting of the main selector switch.

Power Pack Socket

This is a 6-pin Tuchel connector. The external AC power supply for the Nagra, known as the ATN, plugs into this socket.

The Nagra can accept regulated external power of 12 to 30 volts, although 18 to 24 volts is preferable.

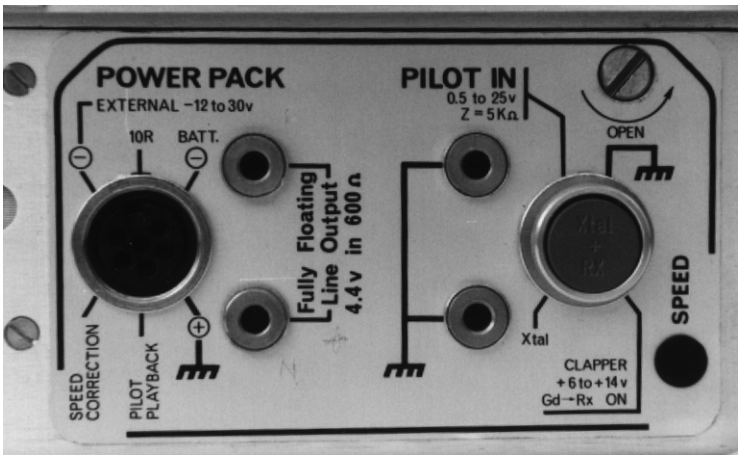
External speed varier plugs in to the Nagra here. Frankly, no one uses an external speed varier on a sync Nagra anymore.



It is also possible to tap into the battery supply of the Nagra. We know of an engineer who builds his remote start/stop switch by taking power out of the batteries, going through a switch, and then rerouting the power into the external power input.

Note: I do not recommend operating the Nagra in the field off of the ATN power supply or any other mains power supply. Anytime the Nagra is linked to common AC voltage on a film set, one risks power surges as well as noise coming down the line. (How do you think those plug-in room intercoms work?)

Also, should the ground isolation of the power supply fail, your Nagra may go up in smoke if there is any other AC powered equipment in contact (including audio/video connections) with the recorder. **Nagras are positive ground which is opposite ground of everything here in the U.S.**



Reserve the use of the ATN mains power supply for use in the post-production studio where power is clean.

Line Output

These banana jacks provide the audio line output from the Nagra. These are **floating outputs**, so plus and minus doesn't matter. One jack goes to Pin 2, the other to Pin 3 of an XLR connection. Grounding

points, if you want them, or located to the right of the line output jacks, just under the label "Pilot In". If you are connecting to an unbalanced plug, such as an RCA or phone plug, just connect the center or tip to one banana jack and the shield or sleeve to the other.

The line output jacks are used when we transfer from the Nagra to another recorder, or when we want to feed a studio amplifier for playback. The output level is 4.4 volts, which is pretty hot, so use your meters to level things off. Remember, that 0 dB on a Nagra is equivalent to around +10 VU on other recorders. Set -8 dB on the Nagra to 0 VU on other recorders.

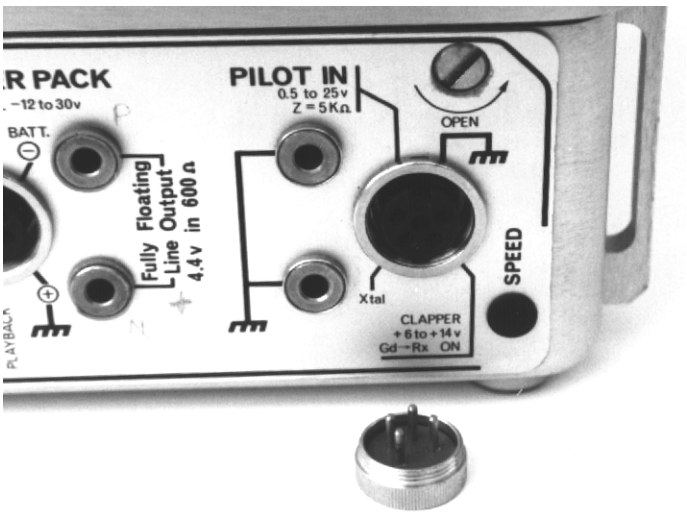
The line outs are functioning during record, and can be used to feed a video assist system during the take. However, be forewarned that switching the headphone **TAPE/DIRECT** monitoring switch will also affect the output signal from these jacks. Monitoring off of **TAPE** lets the soundperson confirm what has just been recorded on the tape, and is a split second delay from live sound. Feeding video while in the TAPE mode will result in the audio on the VTR being delayed and thus out of sync.

Pilot Socket

Pilot is short for neopilotone, which is Nagra-speak for sync pulse.

Normally, there should be a capped jumper plug screwed into this socket at all times. This "**crystal jumper plug**" performs the following function: it redirects the sync signal from the internal crystal back into the Nagra system.

What? Remember, the Nagra was designed to accept sync pulse directly out of a camera or any other device. The crystal sync generator acts like a surrogate camera feed. During record, the Nagra outputs the crystal sync to the jumper plug, which then redirects the sync pulse into the pilot in of the Nagra.



During normal resolve, the output of the crystal becomes the external sync reference.

But sometimes during the record or playback process, it is necessary to use a different sync signal for the Nagra to lock up to, such as 60 Hz from an AC line, or 59.94 Hz for transfer to video, or camera sync from a special effects/process photography system, etc.

The internal 60 Hz crystal is disengaged by removing the jumper plug, and a different sync signal can be fed to the Nagra via this socket.

If the crystal plug is removed (or becomes loose) from the Nagra, and no other sync cable is plugged in to replace it, then no sync pulse will be recorded by the Nagra. This situation will become apparent to the operator because the pilot indicator flag on the face of the machine will not turn white, or may flicker!

Once sync on a take is lost, it cannot be added later. As my computer would say, "Fatal Application Error"!

If the crystal jumper plug is lost, it is possible to makeshift a substitute by securing a wire or paperclip between the pins labeled Xtal and Pilot In. Be careful that the repair is not intermittent.

The Nagra internal bloop slate is activated by passing 7 to 14 volts across the clapper pin and ground. Presence of DC current will make the Nagra record an audible bloop on the soundtrack for slating purposes.

In the old days of umbilical cord sync cables, cameras such as the Eclair NPR were capable of producing their own version of clapstick markers internally. Every time the camera was started, an internal light would flash the first few frames of film. Simultaneously, a current would be sent to the Nagra to activate the internal bloop generator, putting an audible start mark on the soundtrack.

After the invention of crystal sync, documentary filmmakers began to use a silent clapstick known as a bloop slate or flashlight slate. These were small boxes that the soundperson wore. Depressing a button on the device would trigger a bright light that could be photographed by the camera at the same time that a bloop signal was recorded inside of the Nagra.

Transport Lid Screws

Located just above the strap lug and on the rear upper corner of the Nagra are the lid screws. Loosening these screws allows the upper Nagra deck to be opened, such as for accessing the second universal preamp. **Do not over loosen these screws, or their retaining nuts will fall into the machine.** Just turn them enough so that the lid will open upward.

Make sure that you are authorized to open up the Nagra. Some universities and rental houses frown against their machines being opened, and seal these screws with enamel.

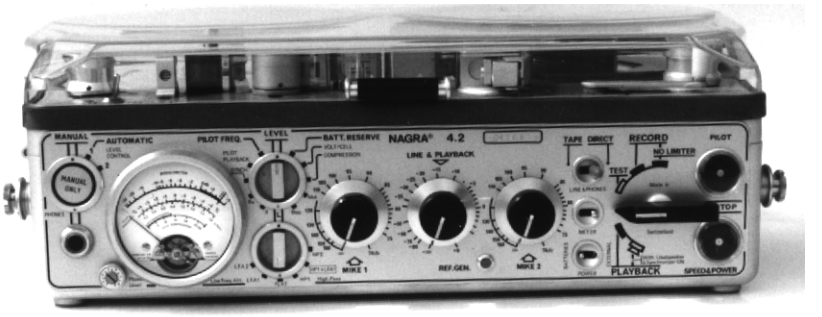
Facing Panel of the Nagra

Automatic Level Control

Most machines do not have the **ALC** installed, and this socket is filled with a spacer plug. But there are some machines so equipped.

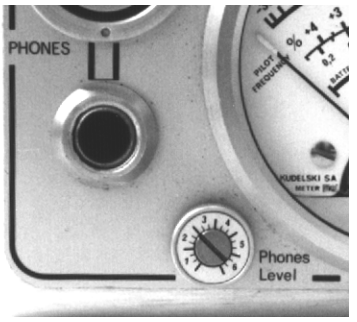
The ALC is **automatic gain control**. The Nagra will adjust the volume of either Mic 1 or Mic 2 automatically.

I do not recommend using the ALC for anything other than surveillance applications. ALC tends to search for the optimum recording level of whatever the dominant sound is. It will aggressively ride gain on dialogue, which will make the backgrounds very distracting. When there is no speech, the ALC will raise the background noise trying to bring it up to the level of dialogue.



Headphone Jack and Headphone Volume Control

For best results when monitoring a Nagra, use a pair of high quality, closed-ear headphones such as the **Sony MDR7506** or V6, or the **Audio Technica ATH-M30**. Impedance of headphones should be between 35 and



75 ohm. **The Nagra headphone jack is monaural, so you will have to modify the plug on stereo headphones or use a mono adapter.**

Do not monitor with the headphone volume set too high, or fatigue and possible hearing damage may occur.

To find the ideal listening level, begin with your headphones around your neck but off of your ears. Depress the REF GEN button in the center of the Nagra to activate a -8 dB reference tone. Turn the headphone volume control all of the way down. Place the headphones over your ears and then gradually bring up the volume.

When the volume in your headphones reminds you of an uncomfortable telephone conversation (like someone chewing you out), the volume is correct.

The key word is **uncomfortable**, as in "move the telephone handset" a half-inch away from your head. Not painful, as in a heavy metal concert.

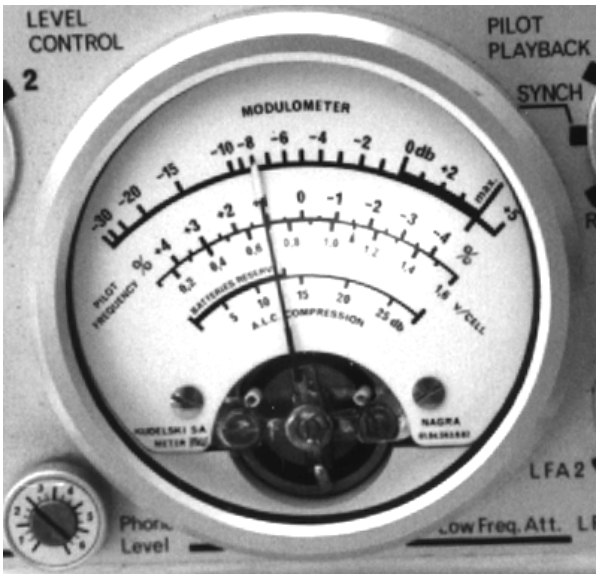
The level you have just set in your headphones represents loud conversation. (Remember, the -8dB setting on the Nagra is equal to 0 VU, which is pretty close to maximum volume for mag film or video.) Normal recording levels of regular dialogue should seem like a pleasant telephone chat with a friend. Not too loud, not too quiet. Recorded shouts and screams should be irritating, but not painful. Whispers should make you want to turn up the mic gain.

The ideal headphone level will vary from person to person due to differences in hearing and perception, so do not rely upon the volume setting that someone before you may have chosen. Similarly, do not rely upon the engraved numbers around the headphone volume control, since their value will vary from machine to machine.

If you are serious about working in the media, then make an investment and purchase your own pair of headphones. It is important to become consistent in your monitoring habits. Using the same pair of phones, at the same personal volume settings, is essential in being able to evaluate the quality of your sound.

The Meter

The audio meter on a Nagra is a **modulometer**, which is a **PEAK reading** meter. Unlike the common VU meters that measure the AVERAGE level of sound, the modulometer only concerns itself with the PEAK or loudest part of the sound.



It is sort of like the difference between an averaging light meter that reads middle gray compared to a spot meter that reads the highlights. The averaging meter guesses at the range the film can handle and provides an F-stop based on that assumption. The spot meter reads the brightest part of the scene and gives you a precise measurement.

In sound recording, we **need to be more concerned with peak levels** than averages, because it is the peak level that will distort if recorded too hot. The modulometer lets us know just how close to the edge of recorded distortion we can venture.

Think of it this way: the VU meter tells us **how far it is to the warning signs** and safety fence near the ravine, but the modulometer tells us **how far we are from the edge** itself!

Although a modulometer and a VU meter will react differently to pure tone than they will to dialogue, for the sake of simplicity **the industry settled on an 8 dB difference** (**tone**) when lining up the two types of meters.

Therefore, and this is important to memorize, a **meter value of -8 dB on a Nagra equates to 0 VU** on other recorders.

A reading of 0 dB on the Nagra would be nearly +10 VU on other recorders, which is a very hot signal!

When we transfer from the Nagra to mag film or video, we use a playback level of -8 dB on the Nagra to be rerecorded at 0 VU on the mag or video machine.

Conversely, if we connect a mixing panel or another recorder to the input of the Nagra, we will align 0 VU on the incoming source to -8 dB on the Nagra.

When you are recording dialogue, try to **keep normal conversation in the -8 dB to -6 dB range** (around 12 o'clock on the meter). Reserve the range near **0 dB only for extremely loud** shouts, screams, or chairs crashing through windows! If you record dialogue up near zero, it will be too hot (and distorted) after you transfer to mag or video.

The exceptional recording and playback capabilities of the Nagra can be deceiving. Tracks that sound absolutely great on the Nagra may easily distort after being transferred to an inferior medium such as mag or video.

Audio on the Nagra will not distort until around +4 dB or higher on the modulometer. But you should never get that loud unless it is a momentary sound effect.

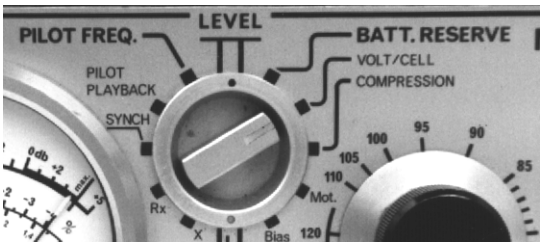
The meter on the Nagra can also provide other data to the operator besides audio level. These will be discussed later.

Meter Selector Switch

The meter selector switch is located to the upper right of the main meter. Think of it as a window to the workings of the machine.

Selecting any of the meter "views" does not affect anything being recorded nor played back. The switching process is silent and will not produce any pops or clicks on the track, so it is okay to play with this knob during recording.

The default position is **LEVEL**, which reads the audio level. During RECORD, the meter will read the incoming signal. During playback, the meter will read the signal off of the tape.



The **BATT RESERVE** position gives us a quick check on the condition of our batteries.

The **VOLT/CELL** position gives us an **accurate check** on the condition of our batteries, and is the best way to check your batteries.

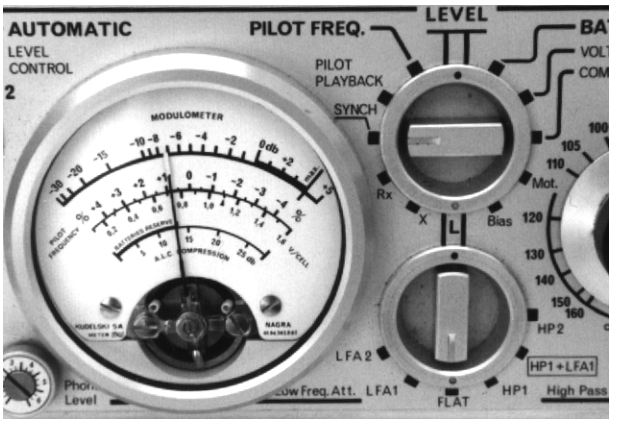
COMPRESSION applies only to the ALC, which you should not be using anyway. I think only the service technicians have any use for this data.

MOT and **BIAS** are also for the service technicians.

PILOT FREQ is used in conjunction with the (optional) **QFM** frequency indicator circuit board that may or may not be in your Nagra. A deviation of up to plus or minus 4% is indicated comparing the pilot signal versus a 60 Hz crystal. In the old days, this was used to check the stability of camera fed sync pulse. I have used this position to check that the internal crystal is set to 60 Hz and not 50 Hz.

PILOT PLAYBACK measures the sync signal on the tape. Mainly for the techs.

SYNCH is a very useful position. When a tape is played back on the Nagra, and the Nagra is equipped with an internal resolver, this allows you to check the sync playback of your tape. When the resolver is engaged (Loudspeaker playback position only), you can check how well the Nagra is resolving the tape by watching the meter needle swing. If the needle remains steady and at 0 % deflection, then the tape is rock solid. Slight deflection indicates that the Nagra is adjusting speed to maintain sync. If the needle drifts and does not return, then there is no sync resolve.



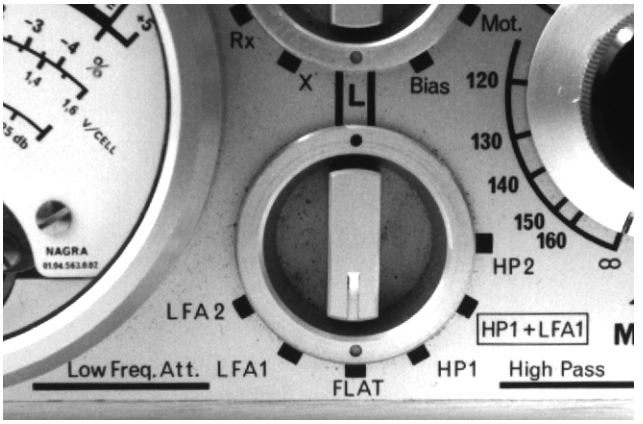
Test your tape by slowing the reel with your thumb while watching the meter. Release the tension on the tape reel and watch how the needle bounces back, as well as listen to the audible wow as the resolver locks up. Compare this performance to one with the resolver OFF (use the first playback position).

RX and **X** positions are not currently used by the Nagra.

Filter Selector

Located to the lower right of the meter is the low frequency filter selector switch. This switch allows you some control in filtering out the lower frequencies (such as wind noise and rumble) during recording.

There are two types of filters, **LFA** (low frequency attenuation) and **HP** (high pass). The LFA have more of a gradual slope. The HP are steeper and more severe. Listen with your headphones to the subtle differences.



Most mixers just use two settings. **Flat is fine for interiors**. The **combination setting** (**HP1 + LFA1**) which is boxed is good for exteriors. By just using these two settings only, it is easy to achieve consistency throughout the entire shoot.

Input Pots

The three knobs in the center control the input level for Mic 1, Line, and Mic 2. Keep these pots closed if you are not using them to avoid hiss.

The Line pot controls the line level input from the ACC socket and the banana jacks. Do not use the ACC and the banana jacks at the same time!

A word of advice. When using a hissy mixing panel with the Nagra, it is quieter to raise the gain of the mixer by increasing the input level of the Nagra than by amplifying the mics or output at the mixer. Remember, mixer output lower and Nagra input higher.

Reference Generator

Located beneath the input pots is a small button labeled **REF GEN**. Depressing this button activates an internal tone generator that produces a **1000 Hz tone at -8dB** level.

This tone is used as a reference for lining up (adjusting the input levels) of various pieces of equipment, such as other recorders. Remember that a tone of -8dB coming out of the Nagra corresponds to a level of 0 VU on other recorders, such as a mag recorder or conventional reel-to-reel audio recorder. When transferring to digital, -8dB on the Nagra equates to approximately -20 on the digital meter. But the metering systems vary a lot depending on the digital device that you are using, so you may need to experiment to determine the best settings.

When you begin recording, a **head tone** of at least thirty seconds duration should be recorded at the head (front) of every reel of fresh tape. While recording this head tone, monitor off of the TAPE position so as to check the quality of the recorded signal. The tone should remain steady as you listen in the headphones. Major fluctuations in level are indicative of dropouts on the tape, which probably means that the tape stock is defective.

Every time I open up a fresh case (20 reels) of tape for a production, I record and listen to one full minute of head tone in order to quality check that particular emulsion batch. The presence of a dropout problem on one reel of a batch leads me to suspect the rest of the batch. If I cannot replace the entire carton, then I do a full minute check of every "suspect" tape roll.

During playback transfer, the playback level of the Nagra should be set so that the -8 dB head tone on the tape plays back at -8 dB on the Nagra, and is rerecorded at 0 VU on the mag or other recorder.

The REF GEN is also used to **mark the end of every recorded take**. After the Director calls to "Cut!", the mixer should wait another second or so (the editors appreciate the extra tail length to work with in case of fade-outs), and then depress the tone generator twice to mark the end of the take.

The presence of the two beeps makes it easy to delineate between takes when fast forwarding or rewinding. (I have been known to record series of beeps to indicate the take number on sequences of very short takes. e.g. one beep, two beeps, three beeps, four beeps, five beeps.)

However, two beeps after a take is the norm for studio production. Note that while two audio beeps denotes the end of the take on the Nagra, two blasts of the stage bell indicates a "cut" when using a "flashing red light and bell" soundstage warning system.

Tape/Direct (Line & Phones)

This switches both the headphone feed as well as the line output between **DIRECT** and **TAPE**. Direct means monitoring the signal as it enters the Nagra system. TAPE refers to monitoring off of the just recorded audiotape itself. This is possible because the record head is before the playback head, so the operator is able to literally “play back” the tape moments after it has been recorded.

Monitoring off of **TAPE** is useful for verifying that a clean signal has indeed been recorded. Just because an incoming signal makes it into the Nagra is no guarantee that the sound has been recorded. Listening to TAPE allows you to make sure that you actually have something on the tape!

The drawback to monitoring off of TAPE is that the audio heard in the headphones is slightly delayed, meaning that what you are hearing has already occurred in the past. **This also means that you may be reacting (mixing) to something that has already happened.**

For this reason, most professional mixers will **listen off of TAPE during the clapstick** of the scene to verify that their Nagra is working, but during the scene itself they monitor off of DIRECT so as not to be a beat behind reality. During a long (technically boring) take, a mixer may flip in and out of TAPE briefly just to check on things.

Expect to hear much more in the headphones in DIRECT than in TAPE, since the range of the incoming signal is not subject to the signal-to-noise limitations of a signal already on the tape.

There is **one professional exception** to the rule of not monitoring the entire take in TAPE. If there is a chance of extremely loud, sudden noise such as a crash, explosion, or gunshot, monitoring off of TAPE will protect your eardrums. There is a physical limitation to how loud a signal can be played back from tape, and that is a lot lower in volume than the actual sound. That is why gunshots shown on the nightly news end up sounding like mild caps instead of the deafening roar of a real firearm.

Remember, accidents on the set are not scripted nor planned. But the potential for accidents can be obvious, and all precautions taken. I personally know of two Hollywood mixers who lost their eardrums because their super sensitive mics amplified accidental gunshots that were not supposed to take place until later in the schedule. A sincere "sorry" from the Assistant Director did not make up for their hearing damage!

The TAPE/DIRECT switch also plays a special role during playback. In the tape position, the Nagra will playback audio at a factory set, fixed output level. In the DIRECT position, the output level of the Nagra can be user controlled by means of the middle (Line Input) pot on the face of the machine.

Tape/Direct Meter

Directly beneath the headphone Tape/Direct switch is a spring loaded toggle for Tape or Direct reading on the meter. Normally during record, the meter always indicates the incoming or Direct signal.

But if you wanted to meter off of the tape, you could hold this switch on TAPE. Personally, I can't think of a situation where you would want to.

Power

As previously discussed, this switch indicates whether the Nagra is taking its power from internal batteries or external powerpack, such as the ATN mains power supply.

In the real world, this switch is used as a **master ON/OFF** control. External, when there is no external power present, serves as the power OFF setting.

Main Function Selector

When the main function switch is pointing to the **nine o'clock position, the Nagra is OFF**.

The **TEST** position activates all electronics except for the record circuitry. All meters and mic preamps are active. This is the usual rehearse or preview mode.

The next two positions are for RECORD.

The first **RECORD** position stands for RECORD WITH LIMITER. There is an excellent audio limiter built into the Nagra that will prevent you from accidentally over modulating (i.e. "recording way too hot"). This limiter does not kick in until around +4 dB, so it should not affect normal recording levels (if your are anywhere near +4 dB, you are way too hot!).

The second record position is **RECORD NO LIMITER**. It is preferable to record without the limiter on loud sound effects such as gunshots, since the distortion is part of the sound that audiences expect. Also, there will be a slight recovery time after the limiter releases its hold on the audio, and that may affect backgrounds on the soundtrack. The effect of the limiter on backgrounds may be more distracting than an occasional and very brief shout or utterance that blows out on account of too much volume.

There are two **PLAYBACK** positions on the Nagra. The first PLAYBACK mode is used for non-sync playback in the headphones or line out. The internal loudspeaker does not function in this mode. The **internal resolver does not function** is this mode. This playback mode is used for private quick checks of the audio by the operator, or for locating cue points for playback.

The second playback position is **PLAYBACK LOUDSPEAKER**. The speaker in the Nagra is now functional (if you do not want it on, just adjust the speaker volume control on the left side of the machine all the way off). **The internal resolver is automatically activated in this playback mode, providing that there is one installed in your machine.** (Not all Nagras come equipped with resolvers, since they are not needed for sync recording.)

Fast Forward is only available in the **PLAYBACK LOUDSPEAKER** mode.

Pilot Indicator Flag

When this dial turns white, it indicates the presence of an incoming sync signal. This signal can come either from the internal crystal sync generator or from an external source such as a camera.

This flag will function in the **TEST** as well as **RECORD** modes. Flickering or complete loss of the white flag indicates a bad sync signal, and lip sync has probably been lost.

If there is a problem with your sync, **check the crystal jumper plug** on the right side of the machine. It may have come loose and needs to be tightened. Or it may have fallen off and needs to be replaced.

Speed & Power Indicator

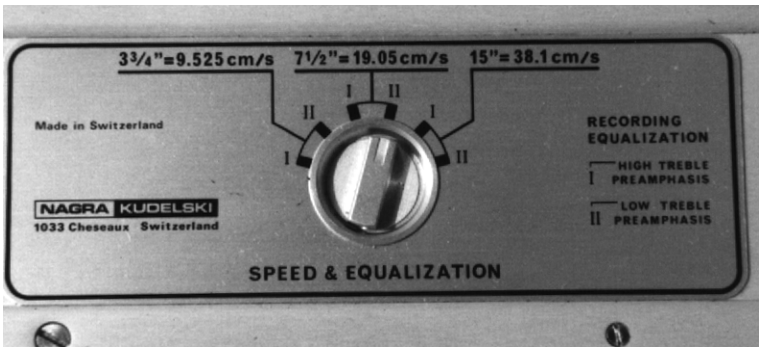
This flag should come on and remain steady during RECORD. If this flag flickers or goes out, you have lost lip sync.

The usual cause for loss of speed & power is low batteries! Check your volts per cell on the meter. Change them if the reading is below 1.2 volts.

If the batteries were not your problem, then cease using the Nagra until a trained service tech can check it out.

Transport Deck of the Nagra

Speed and Equalization Switch



Located between the tape reels, this switch controls the tape speed and bias type. **The normal tape speed in our industry is 7 1/2 inches per second.**

The **slow speed of 3 3/4** is usually for surveillance (or some documentary) and results in longer record time per tape reel but at reduced audio quality. The **higher speed of 15 ips** yields a shorter record time per reel, but improved audio quality.

However, before using the other speed settings, make sure that your Nagra

has been calibrated for optimum performance at the slower or faster speeds. Many machines are only set up (economy maintenance) for use at the 7 1/2 ips setting.

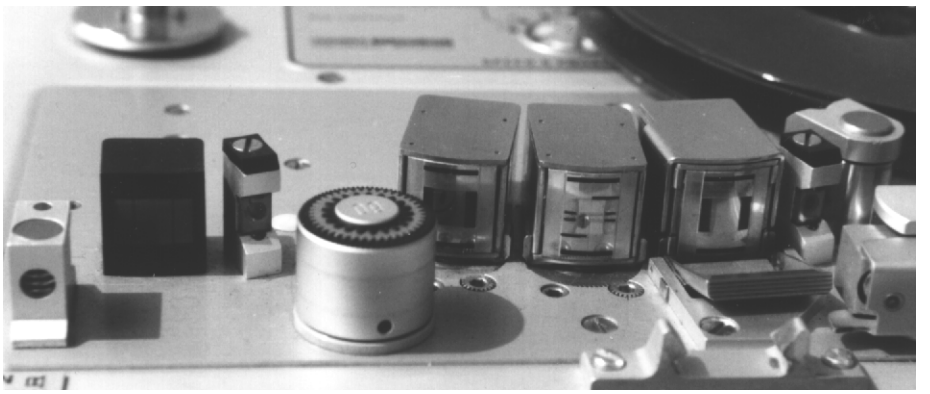
There are two bias settings available for each speed: **LN** and **STD**. LN refers to low noise, high output and is the normal setting for today's tape stocks. Some machines have been calibrated so that both STD and LN are actually LN.

A brief word about tape stocks. Most of the audiotape companies have stopped manufacture of 1/4-inch stock. Currently there are only two brands available: Quantegey 406 in five-inch reels (recently discontinued, but some is still out there) and the EMTEC/BASF SM468 in seven-inch reels. The bias setting for the SM468 is similar to the old Quantagey 480, but is different from the old 406 setting. Although you could use SM468 on a machine set for 406, optimum recording would require having a technician calibrate the Nagra for the SM468 stock. ***(of course, by the time you are reading this, audiotape selection & availability may have changed)***

A five-inch reel of tape (600 ft) will run for 15 minutes at 7 1/2 ips. Some tape reels offer 900 ft on a five-inch reel, so the stock is thinner and a five-inch reel will run for 22 1/2 minutes. However, the thinner stock is subject to more noise (print-thru) so it should not be your first choice unless documentary conditions require a longer record time.

A seven-inch reel (1200 ft) will run for 30 minutes at 7 1/2 ips and is the standard for professional feature and TV applications. A seven inch reel of thinner stock will run for 45 minutes, but be wary of print-thru).

Seven inch reels will fit on the Nagra with the plastic lid cover kept open. Nagra offers an oversize plastic reel cover that will accommodate seven inch reels; virtually all machines in Hollywood are so equipped. When using the seven inch reel cover, be careful that the back edge of the cover does not press up against the reels (there is very little margin of clearance and even slight forward pressure can cause a problem). A Hollywood trick is to remount the lid on the rear hinges so that the hinge itself is inside the lid and the retaining bar is outside; the lid is now forced rearward and away from the tape reels.



Head Stack

There are four audio heads on the Nagra: **ERASE, RECORD, PILOT, and PLAYBACK**.

The **ERASE** head is on the left, situated in between the tension roller and the stabilizer roller (strobe wheel). The ERASE head looks like a black cube. It erases the entire width of the tape (anything and everything!).

Centered on the transport deck are the three main tape heads. The left head is the **RECORD** head, and this head records full track audio.

The center head is the **PILOT** head. During record, this head records two sync tracks down the center of the tape (each sync track is exactly out of phase with the other, so that they cancel each other out when played across a full width playback head).

On the right is the **PLAYBACK** head. This is a full track head and will not hear the twin sync tracks. Newer machines are equipped with a hinged, playback head shield that guards the playback head from stray radio interference. When threading the Nagra, make sure that the tape goes in between the shield and the head itself, and then simply close the shield over the tape.

Nagra heads and all metal rollers/guides along the tape path should be **demagnetized periodically** (before any major shoot). Ask a technician to show you how to do it if you are not familiar with demagnetizing heads.

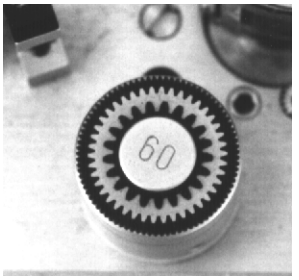
Heads and everything along the tape path should be gently CLEANED (wiped) at the beginning of every shooting day (or as frequently as flying dust conditions warrant). It is okay to **use common 70% isopropyl rubbing alcohol** even though denatured alcohol is technically better. If you use the isopropyl, allow several seconds for the alcohol to fully dry before threading your tape. Try to use a **lint free** piece of very soft cloth or a foam tipped video cleaning swab rather than loose cotton "ear" swabs.

A number of professional sound mixers use the **pre-moistened alcohol pads** that the medical profession uses for sterilizing injection sites. These pads are sold nonprescription in drug stores over-the-counter, and only cost a couple of dollars per box of 100 individually wrapped packets.

The **pads are more convenient** than carrying around a bottle of alcohol. The pads can also be used for cleaning your headphones, brightening connectors, prepping the skin prior to rigging a lavalier, and for first-aid.

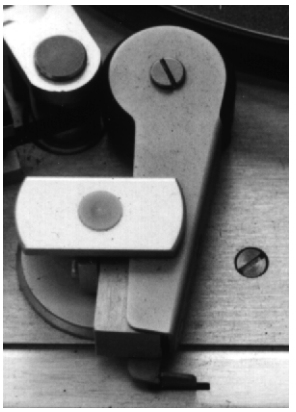
Tension Rollers

Located just in front of either tape reel are the two tension rollers. The tape threading path goes around the outside of either roller. During RECORD or PLAYBACK, these rollers should settle down and cease wobbling after only a moment. If the rollers continue to vacillate more than a second, your Nagra probably requires adjustment.



Stabilizer Roller

Just to the right of the erase head is the stabilizer roller. On the top of this roller are strobe wheel markings marked 60 Hz. When the Nagra is running, if you view this strobe wheel under a household AC lightbulb and squint kind of funny, the marks will appear to hold steady if the Nagra is running true to speed. A slow drift of the strobe markings indicates that the machine is running fast or slow and may be an indication to have the machine checked.



Any time that I use a Nagra that has just completed a long journey to the location, I do a quick strobe test in my hotel room.

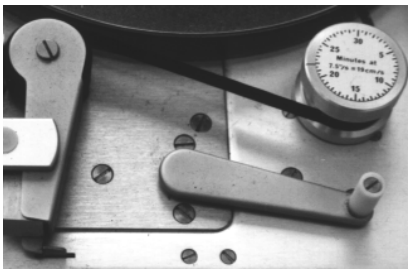
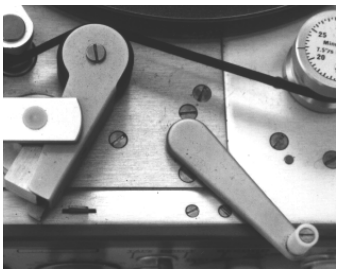
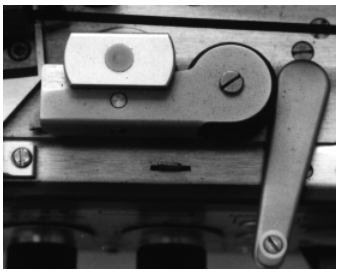
Pinch Wheel Lever

The pinch wheel lever provides tension and holds the tape between the spinning metal capstan and the rubber roller pinch wheel. When the Nagra is at rest, the pinch wheel is slightly away from the capstan.

Tape motion can be halted or paused by "pinching" this lever with your fingertips. Releasing the pinch lever will result in an "instant start" of the tape. This feature is useful for searching cue points.

Three Position "Clutch" Lever

This lever controls the pinch wheel and has three positions.

The lever should be pushed all of the way in for forward tape motion.

When the lever is pulled outward all the way to the left, the tape can be threaded. Rewind is possible in this position by activating the REWIND switch.

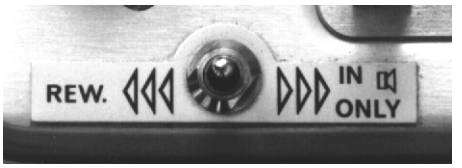
The mid-position "rides the clutch" and will prevent the tape from moving.

If you need to PANIC STOP during forward motion, it is better and easier to simply squeeze the pinch lever than to jerk this clutch lever.

When this lever is pressed all the way in, there should not be any noticeable slack or play of the lever. So if the lever exhibits some freeplay before "engaging", the set screw on the inside of the deck needs to be tightened. Ask a service tech to do it or to show you how.

Rewind/Fast Forward Switch

To rewind a tape on the Nagra, pull the clutch lever all of the way to the left and then flip this switch to rewind. To slow down the rewind process, just toggle the rewind switch between rewind and neutral (off).



To fast forward, the Nagra must be in LOUDSPEAKER PLAY-BACK. To slow down, toggle between fast forward and neutral. To panic stop, just squeeze the pinch lever.

Do not rewind the tape when you are finished recording a reel. Turn in your tapes TAILS OUT (which should be marked on the reel box) and let the transfer people do the rewinding on their heavy duty studio machines.

General Notes on Threading the Nagra

Unscrew the reel lock nuts and store them on the clutch lever so they won't get lost. Nagra reel nuts are a special thread and very expensive to replace!

Open the clutch lever all of the way.

The supply reel of tape goes on the left, and an empty take-up reel goes on the right. The tape path is U-shaped: from the outside edge of the supply reel, the tape runs along the outside edge of the Nagra and then along the outside of the tension roller, then straight across between the tape guides and audio heads, around the outside of the other tension roller, and up along the outside edge of the Nagra to the take-up reel, where the tape is taken up in a counterclockwise direction.

Hold the tape in the tape slot of the take-up reel, or lick the end of the tape emulsion to make it stick against the hub of the reel. Cut off any excess tape that may be protruding from the tape slot. Wind the take-up reel several turns with your finger.

Close the clutch lever and replace the reel nuts.

If your Nagra is equipped with a playback shield, make sure that the tape is threaded between the shield and the head, then close the shield over the tape.

Voice Slate Your Tape

After your tape has been threaded properly on the Nagra, you should put a verbal head slate announcement on the tape containing pertinent information for future reference.

"Roll number...
"Production number/working title...
"Production company/studio...
"Date...
"The following is a -8 dB headtone recorded at 7 1/2 ips on the Nagra 4.2 with a 60 Hz sync pulse."
(followed by 30 seconds of continuous reference tone) *While recording the tone, you should switch your monitor to the TAPE position, so you can listen to the tone as it was recorded, in order to detect tape drop-outs.*
(beep, beep to indicate end of headtone)

Pre-slate your take numbers

To conserve expensive motion picture film, we do not read the slate aloud on camera prior to hitting the clapsticks.

Record the scene and take number of the upcoming take as "wild sound" (no camera running) ahead of time. Most professional mixers voice slate the take in between turning the Nagra on after the command "roll sound" and their responding with "speed".

For instance...

The Assistant Director calls to "**put us on the light & bell, please**". The Sound Mixer activates the red light and bell system (one long blast of the bell or buzzer to warn everyone to cease making noise).

Then the A.D. will shout to "**roll sound**". The Mixer turns on the Nagra and announces into the slate mic "**Scene 101 baker, take 4**" or whatever. Note that letters are announced as words (alpha, baker, charley, david, edward, frank, etc.) so as to eliminate confusion. You can make up your own words, it does not have to conform to military standard.

After the voice slate, the Mixer responds with "**speed**". By that time, the Nagra should have stabilized.

The A.D. will then call for "**camera**". Since the camera comes up to speed almost immediately, the camera operator will call out "**mark it**" to the clapstick holder.

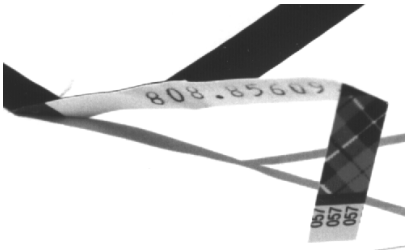
The clapper person calls out "**marker**" and strikes the sticks. In the event that camera or sound did not record the clapstick, they would shout for "**second stix**".

Then the Director would call for "**action**".

Log Your Data

Always **note the serial number of your Nagra** on the audio log sheets. In case of some sound problems (such as crystal frequency error or head alignment error), you may need to transfer the tape off of the same machine it was originally recorded on.

When you open a fresh roll of audiotape, you will note that there is a colorful, sticky tab on the beginning of the tape holding it closed. Cut off this adhesive endpiece and affix it to the inside of the tape box, or put it carefully with your production notes.



This endpiece contains the emulsion batch number of the tape stock you are using. In the event of dropouts, you will want to know what tape batch is of questionable quality. Avoid using any more tape from that batch number, or at least check the tape carefully for the presence of dropout.

You can do this by recording at least a full minute of reference tone on the tape while monitoring in the TAPE position (so the tone you hear in your headphones is coming off of the just recorded tape). If in doubt, don't use the reel! Return it for refund or exchange.

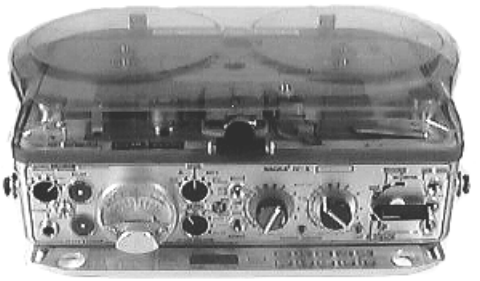
Conclusion

The Nagra 4.2 recorder is a remarkable piece of engineering that has withstood decades of professional application in the realm of motion picture production. Consider the quality and speed accuracy that this very portable recorder offers. Realize that it is almost maintenance free (compared to studio recorders), and that it can continue to function under the most adverse environmental conditions.

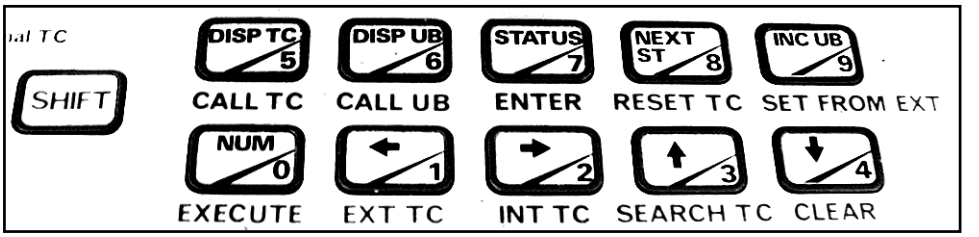
Use the Nagra the way it was intended. Read these instructions carefully. Practice with the machine to become familiar with it. You will discover that the Nagra is not as complicated to operate as it looks, but proper operation is something that you need to take the time to learn.

Don't be afraid to ASK QUESTIONS. No matter how dumb you think you're question might be, it's far better to ask it than to risk jeopardizing a project (and your professional future) by making a critical error on a shoot.

Special thanks to all of the folks at **Nagra** for all of their support in the development of this instructional guide.



Simple Instructions for programming the Nagra IV-STC to time of day and date (User Bits)



To check timecode status, press **STATUS**. There should *NOT* be any marker under where "**Drop Frame**" is engraved on the display. Presence of a marker indicates Drop Frame Timecode, which is not what is normally used for film. Press **NEXT STatus** to check frame rate (should read "**30 Fr**").

To reset frame rate and/or drop/non-drop frame, turn function switch to **STOP**. Open deck and set frame selector knob to desired frame rate. **30 fps NDF** (non-drop frame) is the industry standard for film cameras running 24 fps or 30 fps. *Do not use other settings without WRITTEN INSTRUCTIONS from your production company, or they may complain to you later when they can't get stuff to sync!*

Turn Nagra function switch back to **TEST** and repeat **STATUS** and **NEXT STatus** check to verify settings.

To clear machine of previous programming: **SHIFT**, ENTER, **0,2,0,0,** SHIFT, EXECUTE.

To program the user bits for use in the date format, press **0,1,0,6**, SHIFT, EXECUTE.

To enter the time of day, press **5,0,** (HOUR, HOUR, MINUTE, MINUTE), **0,0,0,0,** SHIFT, ENTER.

To enter the date, press **6,0,** (DAY, DAY, MONTH, MONTH, YEAR, YEAR), **0,0,** SHIFT, ENTER.

To display the new Time Code, press **5.**

To program the Nagra for RECORD RUN timecode (code advances only during Record), press **SHIFT**, **ENTER**, **0,1,0,0,** SHIFT, EXECUTE. Note that this feature is only available on machines with software Version 1.95 or above. To check software version, press **STATUS**, and then repeat pressing **NEXT STatus**. To return machine to regular timecode mode, follow the above instructions for CLEARING the machine and then setting time of day.