

Robot 400

Scan Converter Details

- - conventional TV as SSTV monitor

If you ask experienced SSTV operators what the major barrier to widespread acceptance of slow scan television might be, you will almost always get the same answer — the display system! Most amateurs are now familiar with the major aspects of the slow scan system first developed by Copthorne MacDonald in the late 1950s. SSTV involves the transmission of a 128 line picture which is transmitted over a period of approximately 8 seconds. This

extended frame time, coupled with the modest number of scanning lines, results in a picture format that is compatible with voice bandwidth signals and thus can be transmitted on the high frequency bands using normal SSB phone equipment. At first glance one might assume that the 128 line picture with its limited resolution might be a problem, but most amateurs on seeing a photograph of an SSTV image are quite impressed by the quality of the pictures. The real problem

arises when a convert sees his first SSTV demonstration. In order to view a picture that requires 8 seconds for transmission, a conventional monitor must employ a cathode ray tube with a long persistence phosphor, usually a P7 CRT. The long persistence component of this phosphor is not very bright and the pictures can only be viewed effectively under subdued light, hardly the conditions that exist for most demonstrations. The phosphor is quite bright

where the screen is actually being scanned, but fades rather rapidly, resulting in a pronounced "window shade" effect as the picture is scanned from top to bottom. Another disturbing feature is that the phosphor is yellow, resulting in black and yellow images rather than the familiar black and white of monochrome TV.

Slow scan experimenters have long recognized that a conventional TV set represents a very effective display system if there were some means available to convert the slow scan image into a conventional TV picture. This conversion process is known as *scan conversion*. In theory, scan conversion requires some means of storing the incoming SSTV picture and then repeatedly reading out the stored video information at scanning rates compatible with conventional television display. The two most promising approaches to this problem to date have been *analog* scan conversion and *digital* scan conversion, and amateurs have pioneered in the development of each. The analog process involves the storage of the picture by means of a vidicon-like tube with a special silicon target. The picture is painted electronically on the target by scanning at the SSTV rates and, once it is impressed on the target of the tube, it is retained for a considerable period. The charge distribution resulting from the SSTV image is then scanned repeatedly at fast scan rates to produce a conventional TV video signal. The first SSTV analog scan converter was produced by W9NTP and displayed at Dayton several years ago. W2DD and a number of other amateurs successfully experimented with modifications of commercial analog scan converters with some success, and Robot Research of San Diego eventually introduced their Model 300 analog scan converter. This was an effective unit that could not only



Fig. 1. The Robot Model 400 digital scan converter and the Sony TV-770 which has been modified to serve as a video monitor. A set of this size is ideal for viewing at the distances encountered in most installations. The 400 is very compact and generates essentially no heat, allowing it to be placed anywhere that is convenient.

provide fast scan display of an SSTV picture, but it was also capable of storing a single frame from a fast scan closed circuit TV (CCTV) camera that could then be transmitted in the SSTV format. There were several major restraints to both amateur and commercial efforts in the analog area. The first was cost, due almost entirely to the expense of the special storage tube. Secondly, because such converters are analog devices, the scan converters had a great many interacting level controls that took some practice to use effectively. Finally, the image storage in the tube is not perfect, and the image begins to fade after 10-20 minutes of display. Although the retention factor is not important in some applications, it does limit the device.

The other alternative — digital scan conversion — appeared to offer the greatest long-term promise, but development was impeded by the sheer complexity of the circuitry required. One of the major problems was the sheer size of the digital memory. A 128 line SSTV picture consists of 128×128 picture elements or *pixels* — a grand total of 16,384. The solid state memory (in the form of shift registers or later RAM) would have to have a capacity of at least 16,384 bits to store an SSTV picture without loss of resolution. Digital storage, however, is in the form of low or high data bits so that even a 16K bit memory could only store a picture of either white or black pixels with no intermediate gray scale values! Storing gray scale values requires still more memory. Too few gray scale shades and the picture will have a crude paint by numbers appearance known as *video contouring*. Video contouring is essentially unnoticeable on a standard TV display if 32 gray shades are employed, but the memory requirements are excessive. 16 gray scale

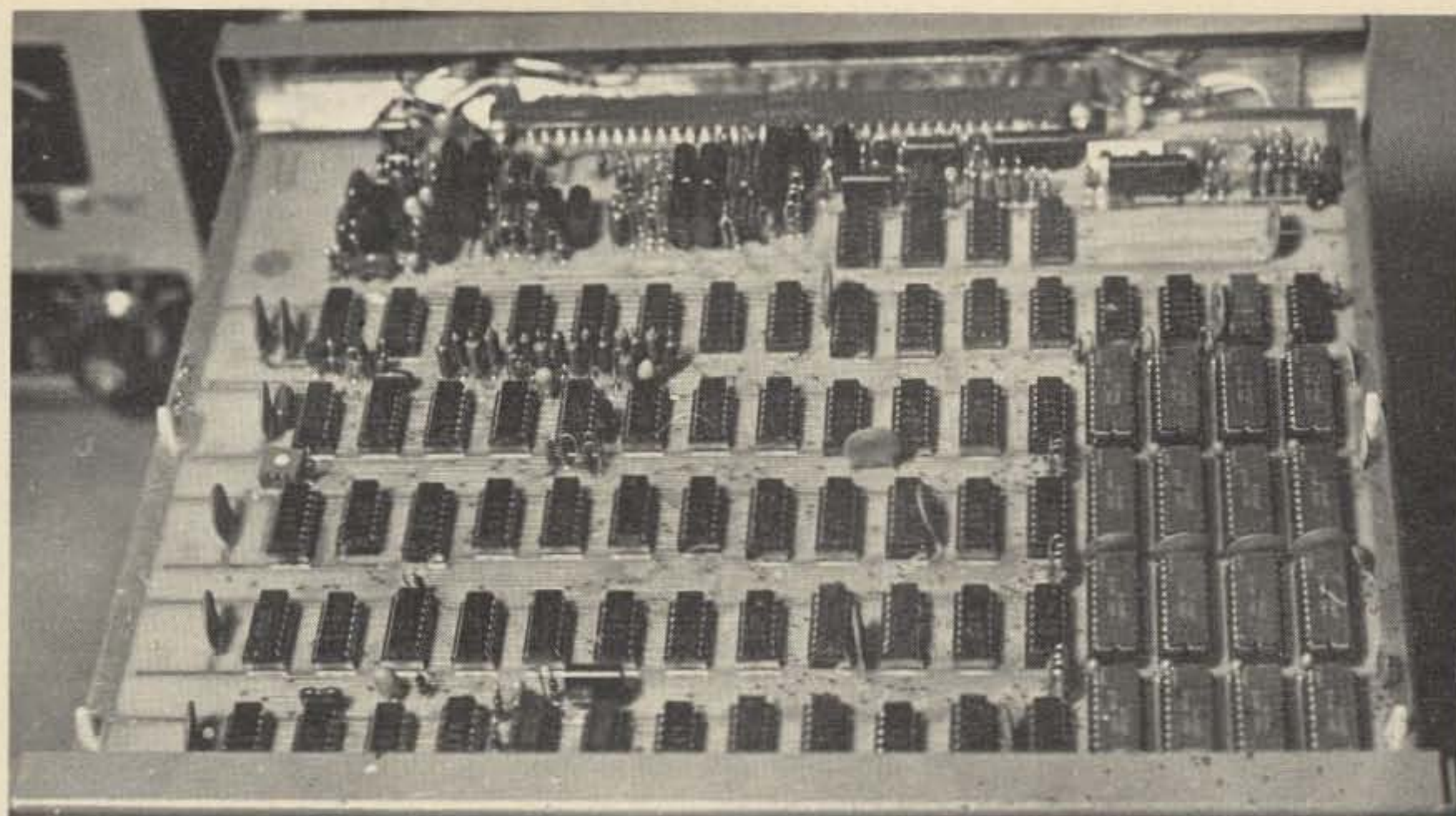


Fig. 2. Internal view of the Model 400 with the top cover removed. Virtually all of the active circuitry is confined to the single large plug-in circuit board. The 16 large ICs in the lower right are the 4K RAM chips that comprise the main memory. All of those other little packages are required to address the memory, perform A/D and D/A conversions, and process both SSTV and fast scan video. Cabinet space below the circuit board is devoted to power supply components. Controls are mounted on the front panel with I/O jacks on the rear panel. The controls and jacks have few discrete components associated with them, and those which are present are used mostly for rf bypassing, resulting in excellent resistance to RFI. Note that sockets are employed for all ICs, easing any problems with servicing and making it relatively easy to experiment with the unit.

shades (requiring four bits of memory for coding for each pixel) appears to be the best compromise between memory size and picture fidelity. The memory must therefore consist of $16,384 \times 4$ bits — a total of 65,536 bits. If the memory is in the form of 1024 bit shift registers, as it is in most current amateur designs, a total of 64 shift register chips are required for the main memory alone. To this must be added the SSTV signal processing circuits, analog to digital conversion (A/D) to convert the analog video to a digital format, slow scan clocks, clocks to circulate the main memory, fast scan clocks and sync circuits, the D/A converters to convert the digital video back to analog form, and finally a series of input and output line buffers (more memory) to clock the video in and out of the main memory. Needless to say, a digital scan converter is a complex project. Beginning just a few years ago, the design and building efforts of WØLMD, W9NTP, and

WB9LVI produced working scan converters that were displayed at the annual Dayton extravaganza. Anyone who viewed the clear, non-fading, black and white images displayed by these units could not help but realize that digital scan conversion of SSTV pictures was the wave of the future. Other amateurs worked up PC board layouts for such projects, the LVI unit was described in *QST*¹ and, despite the complexity of undertaking such projects, the home brew SSTV exhibit at Dayton last spring consisted almost entirely of digital scan conversion units. What was needed to bring such technology from the experimenters to the average ham shack was the introduction of comparable commercial equipment. Robot Research, true to its position as a pioneer in the area of commercial SSTV equipment, has done just that with the recent introduction of their Model 400 digital scan converter. One of the early model 400s was obtained to

perform an evaluation of the unit's potential, and what follows is the result of that evaluation.

The Model 400, in conjunction with a closed circuit TV monitor or, in some cases, a modified TV set, and a standard CCTV camera, will perform virtually all of the operations required for working two-way slow scan TV. On the display side, it will take an SSTV signal from *any* source — the receiver, tape recorder, SSTV camera, flying spot scanner, or keyboard — and display the picture on a TV monitor. With the flick of a switch you can have each new picture replace the previous one, bit by bit as it comes in, or you can freeze the picture in memory and view it as long as power is applied to the scan converter. Recordings of incoming SSTV pictures can be made directly from the source or from the digital information stored in the memory. A very handy feature of the 400 is its ability to provide "instant replay" of pictures received

over the air. If a received picture is held in memory, you can transmit from the memory and thus show the station at the other end what a representative frame looked like at your end. This is particularly useful in critiquing pictures as it is possible to show the other operator that contrast, lighting, composition, or some other factor requires improvement.

The 400 also functions in generating SSTV pictures from a fast scan CCTV camera or other video source. A single frame of fast scan video can be "snatched" and stored in the 400's memory and read out in the SSTV format for transmission and/or recording. Frame snatch can be initiated manually at any time desired or it can occur automatically at the beginning of each SSTV frame. Since a single fast scan frame, occurring over a time interval of 1/60 of a second, is all that is required, motion no longer distorts the image and the subject need not remain motionless during the SSTV frame interval. The 400 permits real time viewing of the fast scan video in its digitized form so that there is no doubt as to how the picture will look when snatched. Levels are set up in the 400 so that the picture as viewed on the monitor is exactly how it will appear at the other end. All frames obtained using the snatch function have a four step gray scale inserted in the last couple of lines in the frame. This is an extremely useful feature as it provides you with a constant contrast reference when setting up the picture as well as providing the operator at the other end with an unambiguous reference against which to judge tuning, his contrast and brightness adjustments, and your video "swing."

The 400 also incorporates a precision 4 step digital gray scale to assist in setting the brightness and contrast on received pictures and pro-

viding a comparison scale for setting up the same values in pictures to be transmitted. In short, it would seem that the 400 can do just about anything. Let's look briefly at the physical and electrical characteristics of the unit and then see how this performance potential is actually realized in practice.

Physical Description

The 400 arrives beautifully packed and is unlikely to suffer damage in shipment. It weighs 12 pounds and is packaged in a rugged two-piece aluminum cabinet measuring 12.5 inches wide, 6 inches high, and 11.75 inches deep. The unit is finished in the two-tone gray that is characteristic of the Robot equipment line. A front panel view of the 400 is shown in Fig. 1. All of the active circuitry (including the 16 4K RAM chips for the main memory, 77 other ICs, 19 transistors, and an array of discrete components) is contained on a single magnificent circuit board (Fig. 2). The rest of the cabinet simply serves to hold the power supply, front panel controls, the I/O jacks on the rear apron, and a few components associated with the controls. The main circuit board is a work of art and all of the components and wiring are of the highest quality.

The front panel control layout is well engineered with a largely functional grouping of controls. Power is controlled by a single central toggle switch with an LED indicator. The unit can be ordered to operate on 115 or 230 V ac at 50 or 60 Hz. Line voltage and frequency must be specified when ordering since there is some change in clocking and associated circuits when operated at 60 Hz as opposed to 50 Hz. Input to the main memory for display is selected by a front panel rotary switch (MEMORY INPUT). Options include GRAY SCALE, CAMERA (fast scan CCTV), RECEIVER, TAPE, and OTHER

(SSTV sources such as cameras, flying spot scanners, keyboards, or alternate receivers or recorders). A MEMORY INPUT toggle switch permits continuous display of new pictures or freezing the existing picture in memory. BRIGHTNESS and CONTRAST controls are provided to adjust these values for SSTV display. Another control (WIDTH) adjusts the internal oscillator to accommodate pictures from 60 Hz and 50 Hz sources.

The remaining controls function on the transmit side of the SSTV operations. A TRANSMIT SELECT rotary switch controls the signals routed to the transmitter and tape recorder. These options include VOICE (station microphone audio in transmit and unprocessed audio from the receiver when recording), MEMORY (the contents of the main memory), REVERSE (a black to white reversal of the image in the memory which is handy for special effects), TAPE (pictures previously recorded on tape), and OTHER (other SSTV sources which can be transmitted or recorded without going through the 400's digital memory). A DISPLAY toggle switch permits real time viewing of the digitized output of the fast scan camera or viewing of the memory contents. A SNATCH push-button permits manual updating of the fast scan camera image in memory. The fast scan snatch function has its own front panel CONTRAST and BRIGHTNESS controls so that good video swing can be obtained from cameras whose fast scan output may be of marginal quality.

The rear panel has the ac cord and circuit breaker plus the multitude of jacks required for interconnecting the 400 with the other equipment. Two of the jacks are BNCs (input from the CCTV camera and output to the video monitor) and Robot supplies a 5 foot length of

coax with BNCs on each end for connection between the 400 and the monitor. Two jacks are 3 conductor phone jacks, one of which is for the station microphone and the other for a cable between the 400 and the audio input to the transmitter. Robot supplies a cable for the latter and you simply have to equip your microphone with a 3 conductor 1/4" plug. Normal microphone PTT functions are looped through the 400. The microphone provides the audio to the transmitter in the VOICE position of the TRANSMIT SELECT switch while other positions select video sources as described previously. A front panel LED indicator comes on when video has been selected and a gain control on the rear apron lets you set the video output from the 400 to a level compatible with your transmitter audio input, eliminating the need to alter the transmitter audio gain. This gain control only functions when the 400 is generating the SSTV signal from its memory. Outside sources such as tape or other SSTV cameras must have their levels adjusted at the source. All of the other jacks on the rear apron are standard phono jacks for the receiver output, input from other sources, and input and output from the tape recorders). Robot supplies a cable for connection to the receiver and all other interconnections can be made with suitable shielded hi-fi cables.

Circuit Description

There is no way that a few well-chosen words or paragraphs are going to do justice to a complex circuit such as the 400 or any other scan converter for that matter. All I will attempt here is to hit some of the high points in describing the operation of the unit. The heart of the 400 is its digital memory. The memory is composed of 16 UPD411D random access memory (RAM) chips, each with a capacity of 4092 bits

THAT NEW **ROBOT 400** SSTV CONVERTER SURE PRODUCES A GREAT PICTURE BILL, BUT IS THERE MUCH SSTV ACTIVITY ON THE 'HAM BANDS YET?



SSTV IS REALLY GROWING PAUL. AT LAST COUNT THERE WERE OVER 3,000 SSTV STATIONS IN OPERATION IN OVER 100 RADIO COUNTRIES AND IT KEEPS GROWING EVERY DAY.

DOES IT TAKE LONG TO MAKE CONTACT?

NO SIR! JUST TUNE IN TO 14.230 MHz AND YOU'LL GET ALL KINDS OF SSTV ACTIVITY.



MOST SSTV'ERS ARE REALLY HAPPY TO RAG CHEW AND EXCHANGE PICTURES. THERE'S EVEN AN SSTV NET THAT OPERATES ON SATURDAY AFTERNOONS.

IS 14.230 THE ONLY FREQUENCY FOR SSTV?



OH, THERE'S PLENTY OF BANDS DESIGNATED FOR SSTV, PAUL. THE FCC HAS AUTHORIZED SSTV OPERATION ON ALL PHONE BANDS EXCEPT 160 AND THE GENERAL CLASS PORTIONS OF THE PHONE BANDS ON 80, 40, 20 AND 15 METERS. EXCEPT FOR THESE YOU CAN OPERATE SSTV ON THE SAME FREQUENCIES YOU OPERATE PHONE.

BILL, DX'ING IS ONE OF THE MAJOR HAM ACTIVITIES. IS THERE ANY DX'ING WITH SSTV?

SURE THING. THERE'S TREMENDOUS DX ACTIVITY WITH SSTV. PLENTY OF STATIONS ALREADY HAVE WAC, AND SEVERAL HAVE MADE DXCC ON SSTV.



AND ALL YOU HAVE TO BUY IS THE **ROBOT 400** CONVERTER, CONNECT IT TO YOUR HOME TV SET* AND YOU'VE GOT AN SSTV STATION?



RIGHT! AND THE **ROBOT 400** CONVERTER IS JUST \$695.

WRITE TODAY FOR YOUR SSTV FACT PACK FROM **ROBOT**. IT'S FREE AND TELLS YOU ALL ABOUT SSTV.

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* The Robot 400 Converter can be connected to the antenna terminal of a home TV set by means of the Robot RF Adapter Kit option for \$25.

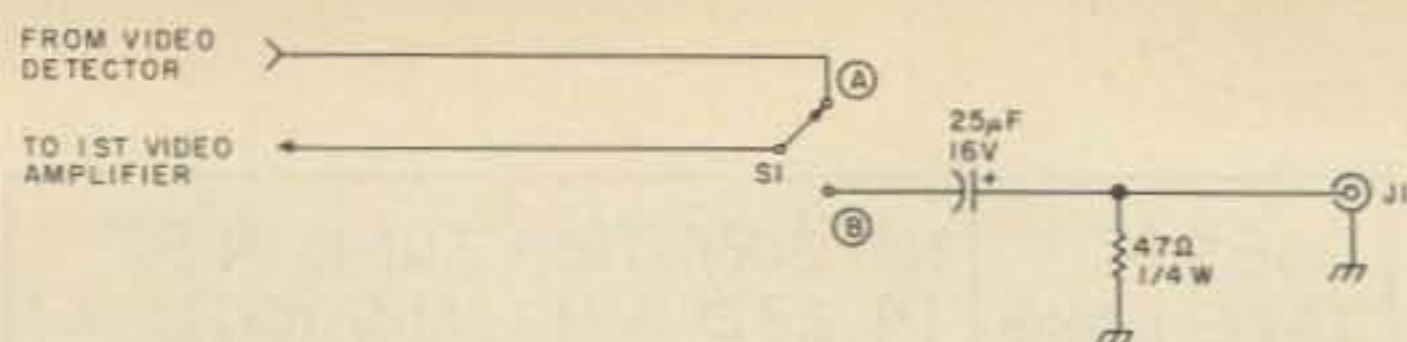


Fig. 3. Modification of a small solid state TV set for use as a video monitor. The set must be transformer operated with a grounded chassis to avoid a shock hazard and possible damage to the 400. J1 is a BNC jack and S1 is an SPDT toggle switch. Position A is for normal TV viewing, while in B the set functions as a video monitor. Similar conversions can be implemented in a variety of sets. The one I use is a Sony TV-770. In the 770, the line from the detector to the first video amp is a small piece of gray coax with a brown stripe. The coax is disconnected from the video board and soldered to the switch contacts (A). A small piece of subminiature coax is routed from the common switch lug back to the disconnect point on the video board. In converting the 770 or any other set, you should obtain a schematic or, better yet, a Sams Photo-facts booklet for the set prior to surgery. All of the SSTV pictures for this article were taken using the TV-770 and it does an excellent job.

(4K). These are dynamic memories and hence require a refresh cycle to retain their stored data. The 400 circuitry is set up so that the refresh cycling is provided in conjunction with the fast scan read operation which is going on continuously as long as power is applied to the 400.

Processing of SSTV signals is fairly conventional with op amps employed as limiters and active filters to provide the video waveform and sync signals to appropriate Schmitt triggers interfacing the SSTV sync signals to system logic levels. Incoming SSTV clocking is derived from a free running oscillator whose frequency is set by the WIDTH control on the front panel. The oscillator is triggered by the horizontal sync pulses derived from the incoming SSTV signal, thus locking the clock to the incoming video format. The A/D converter is composed of a series of 711 voltage comparators. The use of 1% resistors in the A/D circuits assures a precise A/D conversion. Initial A/D conversion is to gray code with onboard conversion from gray code to binary.

Fast scan clocking and sync and all internal slow scan clocking from memory is referenced to an onboard crystal oscillator assuring rock

stable clocking at all points in the system. The RAM memory is multiplexed in the 400 to achieve the speed required for fast scan display. The D/A conversion is accomplished with a 7486 and a series of 1% weighting resistors with several discrete transistors providing the interface to the external video monitor.

When snatching video from a fast scan source, the fast scan sync pulses from the source lock up an oscillator which serves as the reference for clocking the fast scan frame into memory. Readout from memory in the slow scan format is achieved with a custom VCO chip factory set for the 1200 Hz sync and 1500 and 2300 Hz black and white levels. Active devices are used throughout the 400 for digital and analog switching functions, thus vastly simplifying the interconnections between the board and the 400 controls and I/O ports.

The 400 manual provides a complete schematic and quite a detailed circuit description, and your ability to understand the inner workings of the beast should largely be limited only by your effort in studying the manual. Should you want to do a little digital design work yourself, the 400

is a marvelous store of interesting design approaches.

Performance

Hooking up the 400 to perform all of its tricks will require a video monitor and a standard CCTV camera. Suitable video monitors can be purchased from Robot or CCTV outlets and you can expect to pay between \$250 and \$300 for a suitable monitor going this route. Excellent monitors can often be obtained at very good prices from computer stores and at the larger hamfests. It is also possible to modify a standard TV set for use as a monitor but you must not use a set with a hot chassis. Such a set can be dangerous to your health and, what is worse, will almost certainly damage the 400. The set shown in Fig. 1 is a Sony TV-770 converted to video monitor service as shown in Fig. 3. A small screen monitor is a must and you should not consider a screen size larger than 9" unless you plan to use it strictly for large group demonstrations. Screen sizes between 5 and 8" are ideal for normal viewing distances and the TV-770 is just about ideal and costs about \$140 maximum. If you absolutely must use a set with a hot chassis, then you should go the rf route, converting the 400 video output to an rf signal for viewing on an unused VHF channel. Robot markets a board (\$25) for this purpose. The rf route is the only safe approach to using a hot chassis set since the manufacturers have taken great pains to isolate the antenna terminals from the dc circuitry. Personally, I would only resort to rf display for occasional use in large demonstrations where it is feasible to use any large screen set that might be available.

CCTV cameras can also be purchased from Robot, CCTV outlets, or at the larger hamfests. As noted later, almost any camera with standard video (not rf) output

can be used. Bargains in used cameras can usually be obtained from CCTV outlets, security operations, or community TV companies.

An experienced slow scanner can have the 400 displaying pictures within ten minutes after the package arrives at the door, but I would suggest that you spend some time with the instruction manual as it has an excellent description of the function of the various controls and should answer all of your questions about interconnection with your own equipment. In terms of all of its functions, the unit I received worked right out of the box, but I did notice an apparent problem with a lack of sensitivity at the SSTV inputs (receiver, tape, and SSTV sources). This was particularly noticeable when the level from external SSTV sources was reduced for proper transmitter operation, for at the proper output levels, the 400 would not lock up reliably. The specifications indicated that the SSTV inputs should limit with a signal level of 20 mV, but a quick check showed that this was not the case. A call to Robot revealed that this had been a problem with some of their first production units and that current production models had some resistor changes that eliminated the problem. Substitution of the new values immediately brought my unit up to specs and it is unlikely to be a problem with any 400s other than the first sets that left the factory.

The 400 was very easy to set up for proper video display and has performed flawlessly. Noise immunity is the equal of the best home brew circuits I have used, and the unit does an excellent job even under current band conditions. The major feature I felt was lacking was a tuning indicator to assure proper carrier insertion when tuning the HF sideband gear. If the pictures you are receiving have normal contrast, tuning



Fig. 4. A collection of miscellaneous SSTV pictures logged on 20 meters and displayed on the Robot 400. Only a simple dipole was used for the antenna system and, despite the current state of the band, the 400 delivered excellent pictures. Picture quality in terms of sharpness and contrast is limited only by the care with which pictures are set up at the transmitting end. If you are willing to alter the receive BRIGHTNESS and CONTRAST controls from their proper settings, even pictures of poor quality can be improved considerably. I tend not to alter these controls once they are properly set, as I want to be constantly in a position to realistically evaluate picture quality, and the replay (from the 400 memory) of a station's pictures can do wonders in getting the operator at the other end to set the pictures up more carefully!

is quite easy — you simply tune for maximum contrast and you will be right on the money. Unfortunately, there are still too many operators who are grinding out pictures that are low in contrast, and these can result in errors in tuning as you attempt to optimize video display. An LED tuning indicator can easily be added to the 400 (see the *73 SSTV Handbook* for circuit possibilities) if you desire. The lack of a tuning indicator does not really detract from the 400's performance — I just like the convenience they provide. A number of representative pictures are included to show you what can be expected under normal band conditions.

Tape display is extremely

reliable even with cassette recorders. Despite Robot's caution to use recorders with good wow and flutter specifications, a number of 10 year old tapes — recorded on a battery operated reel-to-reel recorder — actually displayed quite nicely. Given the over-the-air performance, one might expect that display of local SSTV sources would present no problems, and this is definitely the case. A variety of SSTV cameras, flying spot scanners, and an SSTV keyboard were tried with excellent results being obtained in all cases.

Experienced slow scanners may be curious to know how the 400 shapes up in the contouring department since it does not employ line averaging or psuedo-random

noise techniques. The key here is the use of a small screen monitor. With the proper monitor display, contouring has little or no subjective impact when the pictures have a normal contrast range. Contouring will always be visible with 16 gray scale shades if you take the trouble to look for it, but none of the people who have seen pictures on my 400 have even mentioned the effect. Contouring is more easily noticed if there are extensive areas of the picture with little or no detail, such as the background of an ID sign that is not evenly lighted, or in pictures with too little contrast. In the latter case, you are attempting to display a picture using too few gray scale steps and the effect is

that of using a system with fewer gray shades.

One operational convenience of the 400 that I did not anticipate was the case in making demonstration tapes. I usually record pictures off the air using a cassette tape deck. Such tapes typically have many frames marred by QRM and intervals of conversation. When such a tape is reviewed, you can freeze a particularly good frame in the memory, remove the tape from the machine, and substitute your demo cassette. You can then record two or three frames from the 400 memory, replace the tape again, and begin looking for other good frames. A single small cassette can thus contain the best pictures from a large number of tapes, result-

ing in an excellent record of your contacts as well as a good tape to play at radio clubs or hamfests to generate a little interest in SSTV. Many tape decks do not incorporate automatic level control, and these are often tedious to use since you have to ride the gain control to keep a reasonably constant signal level when recording pictures off the air. This problem can be eliminated if the transmit select switch is placed in the memory position during recording. You are thus recording from the 400 memory and the signal will have a constant amplitude regardless of the input variations in the incoming SSTV signal. The only disadvantage of this technique is that you do not preserve the audio commentary. If the voice signal is desirable, you can simply switch the transmit select to voice when pictures are not coming in, but you will have to ride the gain!

The 400 does an equally good job in terms of all of its transmit functions as well. In common with past Robot equipment, the 400 handles the interconnection of the tape recorder and other SSTV signal sources to the transmitter with the ability to select either voice or a video source. Where it really shines, however, is in frame grabbing from fast scan sources such as a CCTV camera. With the display switch in the camera position, you view the fast scan picture in real time, but

in its digitized form. The brightness and contrast controls for the snatch function let you compensate quite nicely for poorer than average subjects or flat camera output. The signal you see is precisely what will be stored in memory, so setup is no problem. With the memory input toggle switch in the continuous position, a new fast scan frame is snatched at the start of each SSTV frame. In the hold position, frame snatch is manually controlled with a front panel push-button. This is particularly nice if the camera is in an inconvenient position as you can face the camera, leer, and press the button, and then return to scratching or whatever else you do when the camera is not "live." A variety of cameras were used with the 400, ranging from some excellent new cameras with built-in viewfinders to an old Dage and several ancient home brew cameras. If you take the trouble to bring the broadcast video out of a TV set, you can also frame grab from that source. Broadcast video is excellent for test setups and demonstrations since it invariably has excellent resolution and contrast, but it is questionable whether you should transmit it on the air. I have seen quite a bit of snatched broadcast material on the air in the last few weeks, but it is worth noting that technically the practice is illegal since it involves the relay of material from the broadcast service via

the amateur service. In any case, the material from soaps or afternoon game shows hardly raises the quality of 20 meter operations! The 400 will also frame grab nicely from a video tape recorder if you are lucky enough to have one of those goodies to play with. The frame grab capability of the 400 is simply so convenient that I will gradually be phasing much of my slide pickup and special effects cameras from SSTV to fast scan format, probably with a common sync source so that all can be tied in effectively with my fast scan operations on 440 MHz. The 400 has some interesting possibilities here since fast scan video from 440 can be frame grabbed and relayed via SSTV on 2 meters to stations that are outside of the normal ATV range in our area.

Summary

The components, workmanship, and performance of the 400 are simply first rate, and it is my own personal opinion that it represents the finest piece of commercial SSTV equipment on the market today. You can build a somewhat more versatile scan converter than the 400 and you would probably be able to do it for somewhat less than the \$695 price tag of the Robot gear. Such an effort, however, would be a major project — probably one of the most complex projects that amateurs can undertake these days — and a careful evaluation would be required

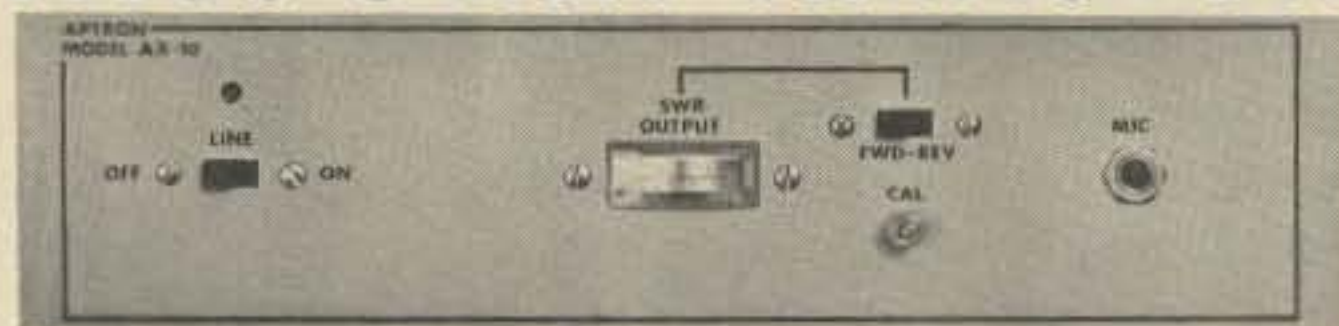
to determine if the small margin in performance that you might obtain would be worth the effort. The 400 is an excellent package at a good price for the value received. Its performance is such that I have no plans to put together a conventional scan converter for SSTV. I am in the process of adding additional memory and video circuits to accommodate real time color display, but any attempt to duplicate the features of the 400 itself is simply not worth the effort unless you enjoy building for its own sake.

Once you have used a digital scan converter, you will simply not be satisfied with a conventional monitor. Digital scan conversion is going to be responsible for another burst of growth in SSTV and a great deal of that potential growth will be chalked up courtesy of Robot and their 400. The unit is well-engineered and can be expected to perform well in the hands of a neophyte or an experienced operator. By all means seek one out for a demonstration — it will be worth the effort. ■

References

¹ Steber, George R., 1975, "SSTV to Fast Scan Converter." *QST*: Part I in March issue, Part II in May issue. This article is must reading for anyone interested in digital scan conversion. It not only describes an excellent scan converter (using 1024 bit shift registers), but it also has excellent sections on the theory of scan conversion and some approaches to image processing.

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