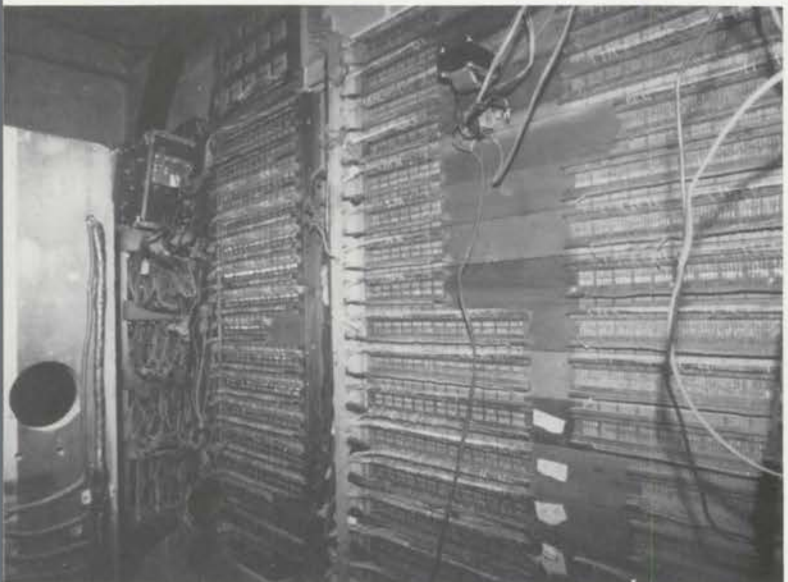
something new for something old

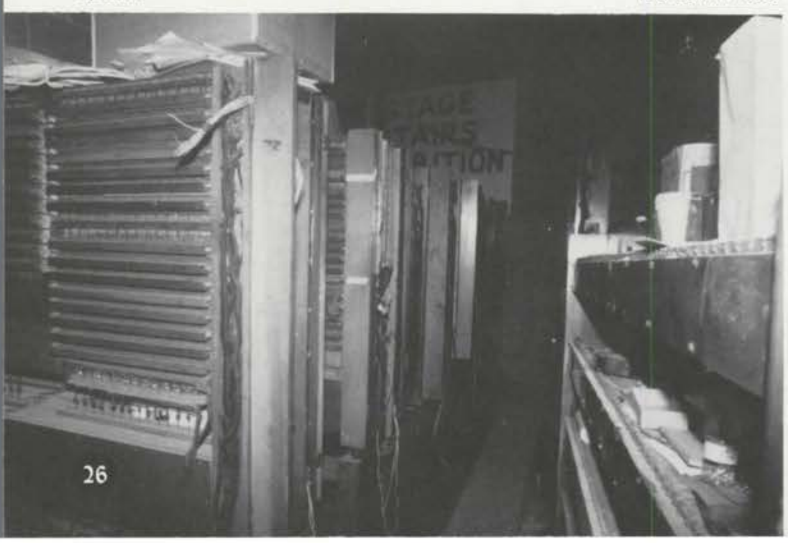
by Ray DeVault

The original unified pipe organ relays were cumbersome, exceptionally heavy caseworks filled with chattering magnetic relays (some had pneumatic action) and were connected by miles of wire that became wrist-size cables running to organ chambers and consoles. These have been shrinking in the past two decades, and today there are a number of electronic systems that have outmoded the originals. Solid-state electronic relay systems, for example, are a vast improvement in that weight is no longer a problem; there are no moving parts; less wiring is needed, and space requirements dictate their minimum measurements. Electronic relays have provided greater flexibility which has led to the ability to produce recordings and playback without the necessity of hauling in expensive recording equipment.

However, for all their new features, solid-state systems are still saddled with some limitations. And now another new idea has appeared in the organ world. Conceived in the mind of an electronics expert, the latest relay system for an organ, either electronic or pipe, provides even greater flexibility and simplicity through a computer and software written especially to perform all organ functions, including record, playback and repetitious overdubbing, if desired.

Because it is far more complex than the straight, or classic organ relays which usually have one stop-key for each rank of pipes, only

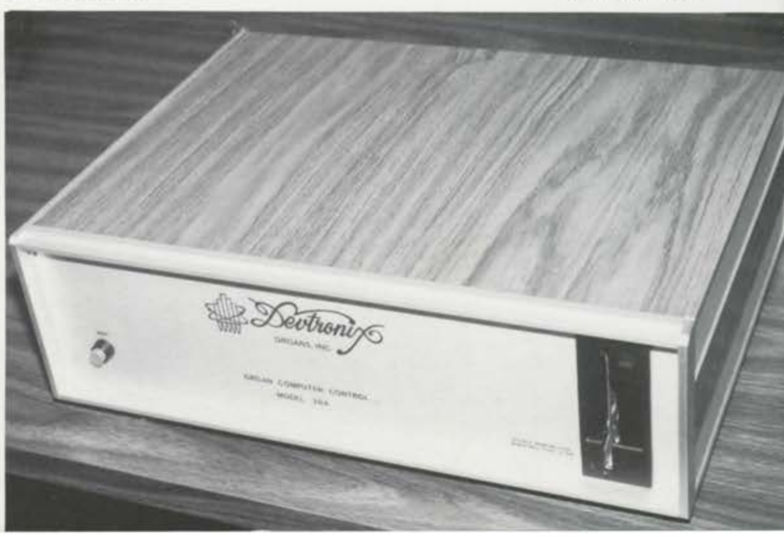




These two photos show parts of the giant Wurlitzer relay in Wichita's Civic Auditorium 4/37 Wurlitzer that have been replaced by computer and flat ribbon cable of the Devtronix system. *(Devtronix Photo)*

Mike Coup, head of Wichita Theatre Organ, Inc. holds original Wurlitzer cable in right hand and Devtronix flat ribbon cable in left. The small cable replaced the wrist-thick cable when the Devtronix computer relay was installed in the big 37-rank instrument. *(Devtronix Photo)*

This is the computer unit that replaces cumbersome, heavy relays in the Devtronix computer relay system. *(Devtronix Photo)*



the unified organ relay is the concern of this article. The unified organ relay has the capability of allowing any of the ranks of pipes in an instrument to be played on any of the divisions at the pitches required by specification; this is accomplished by a complex switch matrix. As noted, relay rooms of large theatre organs are a myriad of hundreds of multi-contact pneumatically or magnetically operated relays with thousands of soldered connections and miles of wire evolving into various sizes of cables. Combination actions and special effects create an even more complex system.

There was no change in organ relays until long after the transistor was invented. Germanium transisitors and diodes, which were really not adequate for intended functions, were very expensive and could not be adapted. It was not until silicon solid state devices became available that better characteristics appeared for use in solid state relays. It was then that the simple silicon two-diode and resistor switch came into use which eliminated all moving contacts and increased reliability. However, it did little to reduce the number of wires in cables and the number of solder joints. Many diode switch relays are currently in use and are still being manufactured because they are simple, and the average organ man who understood the old switch relays can understand them. However, the units are expensive to produce, and the cost is still very high for their minimum capability.

With the advent of the integrated circuit (IC), it became feasible to introduce scanning key and stop contacts at super speed by a method known as multiplexing. Not limited exclusively to organ relays, multiplexing was developed years ago for circuits in the electronics industry — its organ use was adapted primarily to reduce the number of wires normally necessary. Many organ men are still anti-electronics because of the stories that were perpetuated by early designs when the needed variety of ICs was not available. Too, there were times when organ magnets' high current switching transients got into signal circuits and caused no end of trouble by switching incorrectly. One installation would be trouble-free while another might have all sorts of malfunctions.

While it is the relay we are discussing, many things that have been said also apply to solid state combination action which interfaces, or joins, the relay wiring at the stop switch. Their designs must be compatible if a single stop contact is used for both circuits. Both solid-state, multiplexed relays and solid-state combination actions are very complex circuits and require large quantities of ICs, transistors and diodes on may printed circuit boards to make up the total circuits. In such systems, it is common to order add-on circuits for special functions.

In 1979, Dick Wilcox, who was living in Newport Beach, California, was a computer designer and organ buff who reasoned that the many different electronic circuits used in the latest solid-state relays and combination actions could be replaced with a computer and special software written specifically to perform all organ functions, including record and playback. He ordered a four-manual, Wurlitzer-style French console from Devtronix Organs. This console had 325 stops with 20 sets of tone generators because Dick felt that he should make the first model of an organ computer control and test it on a large instrument. The computer for this organ was a new model just introduced by his company and one of the first to use the new Motorola 68000 microprocessor.

Interface boards were designed so the computer could work with the console and the tone generators. Dick wrote the software while Devtronix built up the console and installed the electronics. The organ was completed and tested only a few hours before a December 21, 1981, Christmas party at Devtronix hosted by Sierra Chapter ATOS. The first demonstration of this organ was given at this time (An article and cover photo of the organ may be found in the January, 1982, *Console.)*. The organ remained at Devtronix for a year where it was used as a test bed for the computer system and other electronics.

Concurrently, the Old Town Music Hall's 4/23 Wurlitzer in El Segundo, California, had a relay and a console that were falling apart. The keydesk needed rebuilding and the relay needed replacing, but there was a problem because of the need for the organ to be played at nearly every performance. Wilcox agreed to lend the Music Hall his four-manual console, already wired with interface boards for computer use, and to supply the magnet driver interface boards to connect all chest magnets. The Wurlitzer chest magnets were then wired to the new interface boards and both console and computer were shipped from Devtronix to Old Town Music Hall. All that was needed to make the console play the organ was to plug the small, flat ribbon-cable from pipe chambers into the computer and reprogram the disk memory so the console would know which ranks of pipes were available on the stop rails. The organ was soon playing from the new console and was used for a year until restoration of the Wurlitzer console was completed.

In the meantime, Dr. Dee Williams of Aurora, Colorado, was installing a 10-rank Wurlitzer in his home. He had no space for his Wurlitzer relay and had heard about the computer organ control, so he visited Devtronix to learn more about it. He was impressed with what he saw, and ordered one for his installation. It was fabricated using the same commercial computer used in the Wilcox console. Williams pre-wired console input boards and chest magnet output boards, and a quick trip was made to his residence with the computer to install and program it to match the pipe ranks to the stops on the three-manual Wurlitzer console. In two days the organ was playing from the console. Minor chamber adjustments and some rough tuning needed to be done; however, the sound was tremen-

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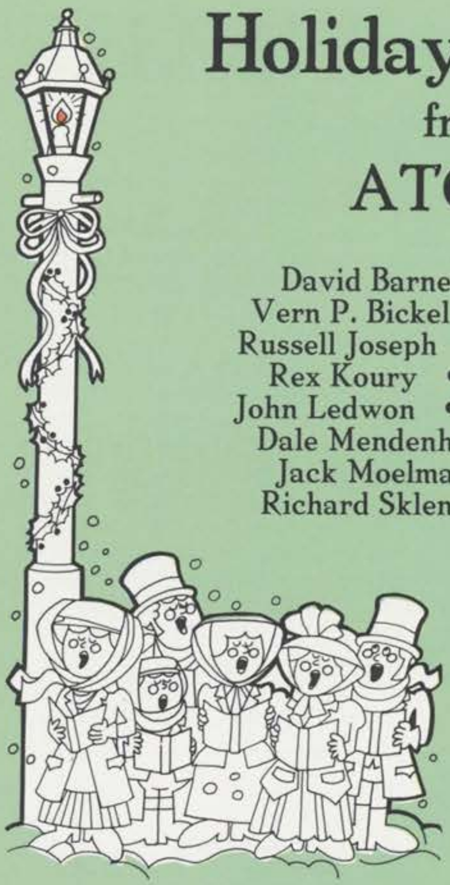

and Best Wishes for 1987

dous, and Dr. Williams was pleased with the results. His Wurlitzer has been playing perfectly since the spring of 1984.

After reviewing the excellent results of both installations, the company realized that there could be a good market for such a versatile and simple system, but that the use of such an expensive commercial business computer was not practical for many reasons. Rights for the use of the basic computer design were negotiated. This was desirable because it had proven to be a reliable, trouble-free system based on thousands of production units. A new computer was then designed for organ control, and interface boards for this computer, built by Devtronix, are now in their third production run.

To describe this new system and its capabilities, there are only three sections to it — the computer, the INPUT and the OUTPUT boards. The 10 x 12 inch computer board is mounted in a neat 17 x 13 x 5 inch enclosure which also contains the regulated power supply and a 3½ inch drive and disk which permanently contains the special operating system and program. It connects the console to the pipes by software.

Every switch contact in the console is an INPUT signal to the computer. A 5 x 9¼ inch printed circuit, designated an INPUT board with 18 eight-pin connectors, can handle up to 128 contacts. For example, two 61-note keyboards can be connected to one board. As many INPUT boards are required as there are total contacts (pistons, stop switches, playing keys, expression, etc.) divided by 128.

The third part of the system is also a 5 x 9¼ inch printed circuit, designated an OUTPUT board, which has 12 eight-pin connectors and can drive up to 96 magnets (either chest magnets, dual magnet stop assemblies or lights). For example, one OUTPUT board can control a full Tibia rank or up and down coils of 48 stop assemblies.

Stop action OUTPUT boards are used in the console with INPUT boards. All the console boards are daisy-chained together with a small, flat ribbon-cable which plugs into the computer. A second identical ribbon-cable runs from the computer into pipe chambers and daisy-chains with all pipe chest magnet driver OUTPUT boards. This is all the wiring necessary for computer control. Expansion of the organ, both in console contacts and pipe ranks, is as simple as adding the necessary INPUT and OUTPUT boards.

The relay is a software multiplex sampling system and is capable of every known relay action through software control. The system also supports an elaborate capture-type combination action with an almost unlimited number of separate sets of memories, each of which may be recalled instantly. Each of an almost unlimited number of pistons may be considered to be generals and may be assigned to any of the stop switches to function as division pistons. Any stop in the console may be programmed to be a neutral on any piston.

The system is also capable of recording and playing back for up to two or four hours on a 3½ inch floppy memory disk. Total recording time is a function of the number of keystrokes made, not how long the recording takes. Recordings may be made up of any number of selections, and each may be played back instantly from the name or number given the recording. Each recording may be overdubbed up to 17 times, but such a complex recording would be reduced in playing time. The computer, in this case, plays back the previous recording at the same time it is recording the new part being played — try that on your home recorder some time!

Computer control systems are usually ordered in two steps. All INPUT and OUTPUT boards are ordered first and are delivered with an instruction manual with pre-printed wiring sheets so the customer can easily keep track of where each organ connection is on the interface boards. After the wiring is complete, the connection sheets are returned to Devtronix where the organ specification is programmed into the memory disk. The computer is then ordered with the memory disk — the customer plugs the small, flat console and pipe chamber ribbon-cables into the back of the computer — and the pipes will play from the console. An instruction manual is included which explains how to make tests of wiring, how to change mis-wired connections without touching a soldering iron, how to set up combination action, record, playback and overdub, plus a host of standard features not described here.

Reliability is the key feature of the system since all complex circuits are in software which can easily be changed to perform new functions. The standard INPUT and OUTPUT interface PC boards are extremely simple circuits as their only purpose is to reduce the number of console and chamber wires to two small, flat ribbon-cables.

There are ten of these systems now in operation, and ten others being wired for installations. New Mexico Military Institute in Roswell, New Mexico, was the first to install one, and Lyn Larsen played the dedication of that Wurlitzer in October 1985. Lyn is now installing the same system on a 3/25 church instrument in Phoenix. He recently completed three compact disk recordings on the 4/37 Wurlitzer, which has been equipped with the computer system, in the Wichita Civic Auditorium. Nor-Cal Chapter will have one on the 4/30 Wurlitzer being installed in Berkley Community Theatre, and Bob Maes has ordered one for the 3/20 Barton being erected in the Granada Theatre in Kansas City, Kansas. □

ORGAN-IZING
POPULAR MUSIC

by

AL HERMANNS

There are three ways to play popular music on the organ: by note, by ear, and by a combination of both methods. Classical and church organ compositions should be played as written by the composer. This usually requires from six to twelve years of music study with primary emphasis on note reading.

On the other hand, popular music was not intended to be played on the organ! The composers usually had in mind performances by dance bands, pianists, or vocals with piano or orchestra accompaniment. Therefore, the organist who performs popular music on the organ must be able to play by ear and/or study keyboard harmony and arranging techniques in order to play popular songs in a musical manner. The best way for most people is to read the melody notes, use the chord symbols for harmony, and develop your accompaniment by rules or by ear. The disadvantage of playing a published arrangement as written is that you will always sound the same. If you learn to make your own arrangements, your arrangements will improve as you learn more about harmony and what to do with it.

During the performance of an ordinary popular song on the organ there are six musical elements all working together to make the total sound that the listener hears:

1. Melody — the obvious "tune" that everyone hears
2. Harmony — simple or advanced
3. Bass — alternating, sustained, walking
4. Rhythm — many varieties
5. Tone Color — choice of stops or other tone controls
6. Style — solo or chord melody, phrasing, expression, etc.

If any of these details are not carefully considered, the result is poor, unmusical arrangement.

In subsequent articles, I shall present the necessary arranging techniques to enable you to make a good sounding arrangement of anything you want to play. This is not difficult and can be learned by anyone who loves music enough to make the effort. □