ESBUS: A PRACTICAL APPLICATION

As long ago as 1980 the European Broadcasting Union were working on the idea of a standardised remote control system for all the different types and makes of VTRs, ATRs, telecines, projectors and peripheral equipment, primarily with the broadcast environment in mind. Dave Foister looks at ESbus and a practical unit

Clearly a common standard, bringing an end to dedicated remotes and interfaces, is as good an idea in this context as in any other. In 1981 the SMPTE became involved in discussions with the EBU, and in 1984, after a considerable amount of change and evolution, the first document (TECH 3245-E or SMPTE 207M depending on which side of the pond you were) was published setting out the basic details of the ESbus system.

This was to be a network arrangement using distributed intelligence, with intelligent interfaces (known, in conjunction with their attached machines, as Tributaries) communicating with each other and with a master Bus Controller via a standard RS422 interface running at 38.4 kbaud. The Bus Controller, which could reside in any Tributary, would supervise the network and communication between the other tributaries. The initial document laid down little more than the software protocols and the electrical characteristics of the hardware for the bus itself, together with the connector type, which was to be a 9-pin D-type.

In 1986 the first supplement was published, laying the groundwork for the control language to be used and discussing the concept of the 'Virtual Machine'—a device that ESbus could treat as a standard machine and which in turn would interpret ESbus commands and translate them into machine-specific commands to be sent to an actual ATR, VTR or whatever. It still did not discuss those actual machines and their individual problems and applications; this was left to later supplements, which published work largely developed between manufacturers using the 'Confer' computer conferencing network. These manufacturers included AEG, Ampex, Audio Kinetics, the BBC, Kudelski, Otari, Philips, Sony, SSL and Studer, which gives an idea of how seriously the whole thing is being taken.

It had become apparent early on that a single control language capable of addressing all possible types of machine was both illogical (because of their different capabilities and variable parameters) and impossible, and that different dialects would be required to address different broad groups of equipment. Thus in 1986 the next supplement appeared, defining the dialect for use with VTRs, which can cope not only with transport commands but also alignment control, which would clearly be meaningless to anything other than a VTR. This dialect is already in use, notably in Munich by Bavarian Broadcasting and by the BBC on modified Ampex machines. By now the ATR dialect should be published, with manufacturers already committed to using it, and other group-specific dialects are in preparation covering telecine, routers, communications, switchers and even cameras; mixing consoles and audio peripherals have as yet no committees to formulate their dialects.

Where two types of machines are required to perform similar functions but in different ways (such as the different ways VTRs and ATRs find and lock to sync) the relevant commands can be mapped to the same logical place in the language, facilitating control and avoiding conflicts. Obviously not all machines using a given dialect will be capable of implementing all the commands in that dialect, and this is not a problem provided the relevant tributary reports to the Bus Controller any commands it can't respond to.

So what we have is a system similar in some ways to a computer Local Area Network, featuring any number of tributaries all communicating via, and being controlled by, a Bus Controller. This Controller should not be confused with a machine controller, which could well be on a tributary of its own; there could even be more than one machine controller on the bus, but there can never be more than one Bus Controller, whose sole purpose is to supervise the network and distribute commands and communication as required. In practice, the Bus Controller might well be contained in the same box as a master machine control panel, for the sake of simplicity and operating speed, but they remain two separate devices.

The Bus Controller addresses each tributary in turn, sending any messages it may have for it and asking if the tributary (which never speaks unless it is spoken to) has anything to say. Hence the possibility of several machine controllers on the bus; each can in turn send its commands on to the bus to be sent by the Bus Controller to the required machine. Details of which controller is dealing with which machine(s) are held in memory in the Bus Controller in Linkage Directories, which may be reconfigured at any time. In addition, logical Groups of machines may be created that all respond identically and simultaneously to a common controller.

The flexibility and operational speed gained by a medium or large installation using ESbus could clearly be considerable, making new ways of working possible and radically simplifying old ones. This is the kind of standardisation we need and which so rarely happens; let us hope that the atmosphere of co-operation and good intent continues, and that ESbus survives the inevitable early hurdles to become established.

Audio Kinetics and the AK ESbus

Audio Kinetics joined the ESbus consultative process about two years ago. They had started to recognise that some customers were not buying their *Q.Lock* synchronisation system because of the limitations it imposed (in common with other systems) in terms of the number of machines it could handle. Having decided that what was needed was a system with a more open architecture and hence more flexibility for future expansion, they became aware of what was going on in the ESbus discussions via the Confer network, including the important contributions being made by the BBC, and decided to espouse ESbus as something they could use as a means to realise their ideas. Before long they began to feel that ESbus was the way forward in more general terms, and that by championing the system they could introduce their own ideas and expand ESbus into something more than just a remote control interface.

ESbus, being basically a remote control bus for broadcast applications, incorporates little in the way of synchronisation facilities, apart from a concept of a so-called Time-Line, but it was

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relatively easy to include extra synchronisation-related buses while retaining compatibility with the original specifications. To this end Audio Kinetics started adding extra lines to the system, ending up with four extra buses to meet the needs of the post-production and music recording industries.

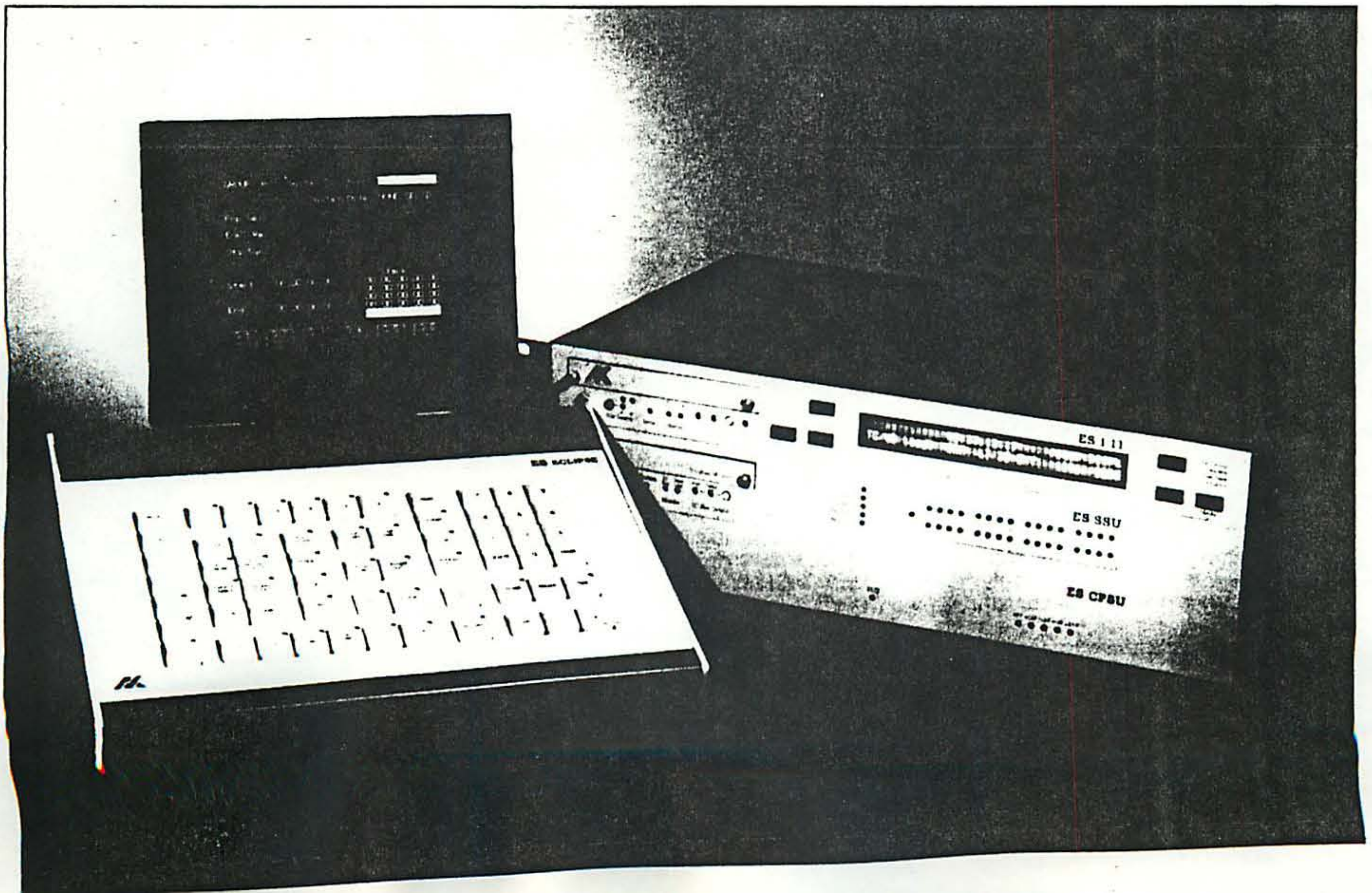
The most important addition is the hardware necessary for the realisation of the ESbus Time-Line concept. This distributes a synchronisation signal from a central clock, and introduces AK's concept of the one-machine synchroniser—a device that synchronises any machine to that master source, which would ideally be a video sync, removing the need for a real master machine. This provides perfect syncing of all machines on the bus to the central source, eliminating the locking delays inherent in a conventional master-slave set-up, which is limited by the start-up time of the master machine. To retain system versatility, the central source can itself be referenced to any synchronisation source on the system, for instance to allow for a deliberately varispeeded multitrack master or a machine incapable of being slaved, but otherwise the sync source behaves as a perfect machine, with zero start-up time and absolute predictability.

For installations requiring the use of conventional timecode in varying configurations, the second bus, the Time Code bus, was added. This distributes SMPTE or other timecode around the system but the choice of master and slave machines is under software control from the central control point, eliminating the need for conventional re-patching of timecode signals when a different configuration is required. The third bus, the Frame bus, distributes video syncs or frame rate pulses in a similar way, and either of these buses can be used as a reference source for the Time Line bus.

The fourth and final bus is aimed directly at the music recording industry, and AK hope it will overcome the only problem ESbus may pose in that area. While it is recognised that in some applications drop-in and drop-out points can conveniently be pre-programmed, there will always be circumstances, particularly in music recording, where manual drops will be required. Although ESbus will handle most transport functions faster than the machines being addressed can react, or as near as makes no difference, the potential and unpredictable delay on a busy system of a few milliseconds could wreck a tight drop-in. For this reason AK have incorporated what they call the Crash Record bus, which puts any connected machines in Ready mode and Record Enabled instantly into Record, bypassing the conventional ESbus command. This itself may also be pre-programmed, and can incorporate delays or advances in monitor switching and so on in order to make drop-in rehearsals sound exactly like the final result.

Audio Kinetics' expansion of ESbus requires a larger connector—15 pins instead of nine—although converters will be available and all non-expanded ESbus commands will function as usual. In addition, AK's hardware provides two completely independent ESbuses (A and B), which can be locally or remotely selected. Thus a central machine room could have varying combinations of machines accessed from two independent control rooms—with this in mind wind limits can be programmed for the machines—or a pair or group of machines in one room could be split off from the rest to perform one task while work proceeded on the other bus.

AK's expanded system, with its extra sync



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facilities, is available as a standard for other synchroniser manufacturers to use but they are the first to put hardware on the market incorporating even ESbus, never mind AK ESbus, as their system is called. The hardware comprises an updated version of the *Eclipse* controller (existing *Eclipses* can have ESbus software added), which incorporates a basic ESbus controller, and a universal ESbus synchroniser called the *ES 1.11*. This extends the ESbus idea of the virtual machine by having two microprocessors; one feeds ESbus commands into a shared RAM from where the second translates them into machine-specific actions. The old idea of a machine-specific interface is eliminated by having the second processor refer to a look-up table, stored in ROM, to convert ESbus commands into the required commands for its connected machine. This ROM can store look-up tables for a few hundred specific machines, and can be updated when necessary without opening up the box since it is mounted on a slide-in tray accessed from the front panel. The *ES 1.11* knows which machine it is supposed to be talking to because of links in the interconnecting cable, which means that this cable is the only machine-specific part of the installation.

Audio Kinetics will be looking to dealers to replace the ROMs with updates covering new machines when required, and possibly to a Modem link to a central database so that dealers can download updates into their local computers and blow their own replacement ROMs. There are also plans for front-panel access to the interface programming so that the inevitable occasional unknown machine can be accommodated on site by someone with the necessary programming expertise.

Closely related to the *ES 1.11* is the *ES SSU* (System Services Unit), which provides ESbus-driven relay switching, a MIDI interface, and service functions like mimic LEDs and beeps.

Since several machine manufacturers have already committed themselves to incorporating on-board ESbus interfaces on future products, devices like the *ES 1.11* should eventually become necessary only on older machines. AK therefore hope to target future work on ESbus controllers since they feel that is where their background and experience lie, and in fact they already have further controllers in the pipeline. However, they have not ruled out the possibility of supplying ready-built interfaces to machine manufacturers to be fitted to their products.

It has been easy recently to get the impression in many areas, not just audio, that interfacing is a growth industry in itself, relying on a multiplicity of standards and demands to provide a market for hardware and expertise to overcome the problems they pose for the end user. Thus we have not only several so-called standards applied to one task but also so much diversity within each standard (look at the various ASC I protocols and MIDI) that configuring apparently compatible devices to talk properly to each other can be difficult and time-consuming. This does not help promote the image of new technology. How refreshing then to see a major portion of our industry conferring on and agreeing to a single unambiguous standard to meet most foreseeable needs of its users. If, in addition, Audio Kinetics can gain acceptance for their work in expanding ESbus to cover virtually all the interfacing and control needs of the audio industry, then perhaps ESbus will have scored a first in providing a worry-free genuinely standard system to allow us all to get on with our real work. It is to be hoped that manufacturers will see that such a system benefits everybody.□