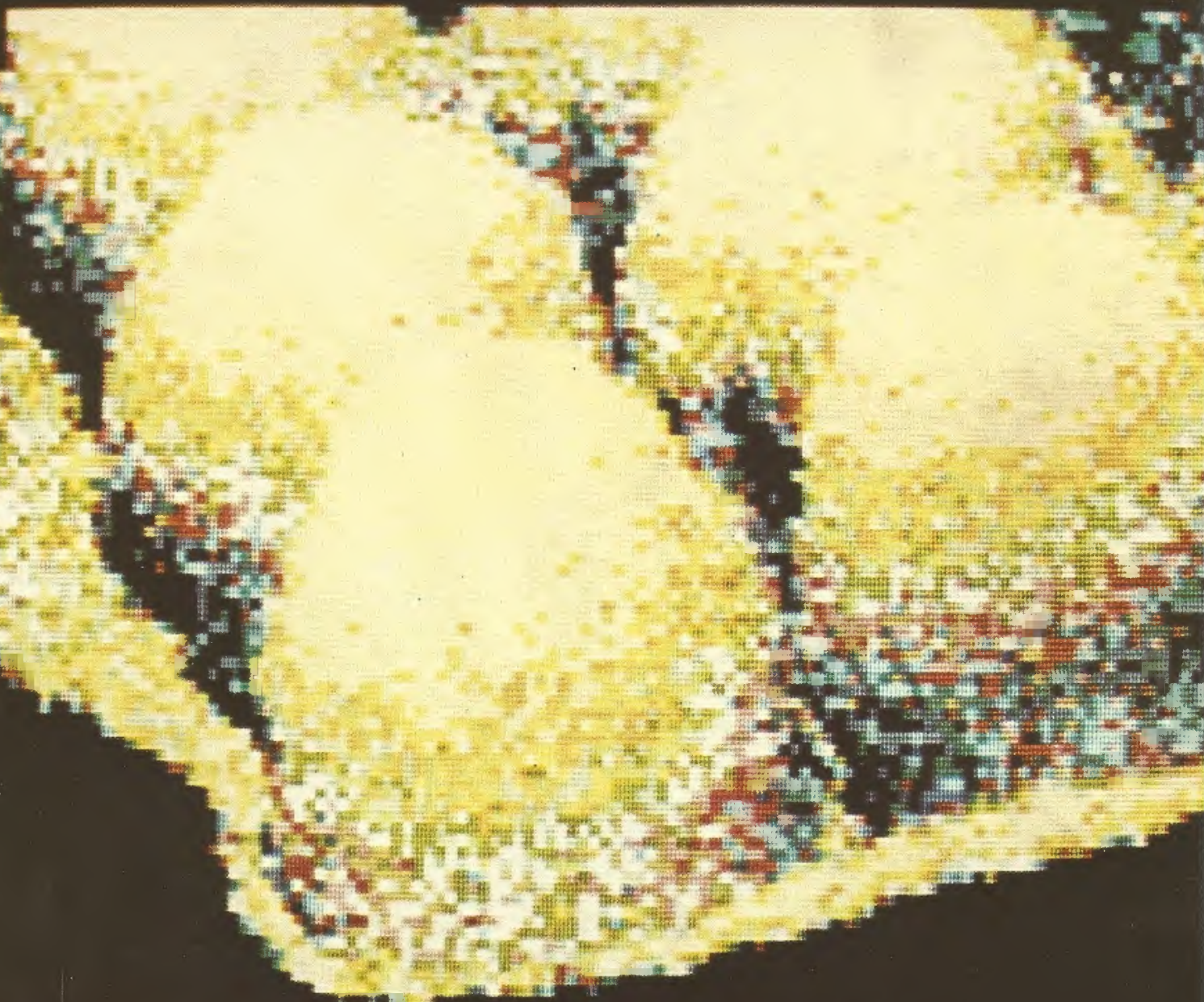


# wireless world

FEBRUARY 1982 70p

## Video camera interface

Australia A\$ 2.40  
Canada C\$3.25  
Denmark DKr 28.25  
Germany DM 6.50  
Greece Dra 160.00  
Holland Dfl 8.00  
Italy L 3100  
Norway NKr 24.00  
Singapore M\$ 5.50  
Spain Pts 240.00  
USA \$ 3.75



**Cassette data recording**  
**Active deflector television**

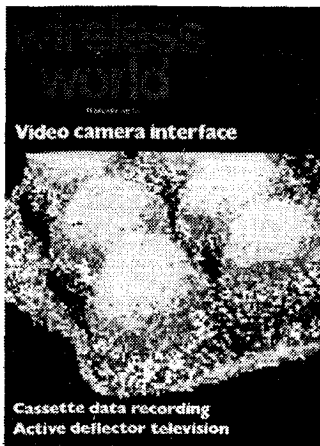




# wireless world

ELECTRONICS  
TELEVISION  
RADIO  
AUDIO

FEBRUARY 1982 Vol 88 No 1553



Front cover picture is a representation of eggs in a box, obtained by P. Howard with the micro interface to tv camera described in this issue.

## IN OUR NEXT ISSUE

**BBC microcomputer.** The first technical appraisal of the micro to be used in the BBC computer awareness programmes, which started in January. Software and hardware are both examined.

**Disc storage systems.** A series on the techniques used in disc storage, beginning with an article on the role of the disc drive in computing.

**Nickel-cadmium cells.** Charging, discharging and storage characteristics are described, and a number of charging circuits are given.

Current issue price 70p, back issues (if available) £1, at Retail and Trade Counter, Units 1 & 2, Bankside Industrial Centre, Hopton Street, London SE1. Available on microfilm; please contact editor.

By post, current issue £1.6p, back issues (if available) £1.50, order and payments to EEP General Sales Dept., Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

**Editorial & Advertising offices:** Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

**Telephones:** Editorial 01-661 3500. Advertising 01-661 3130.

**Telegrams/Telex:** 892084 BISPRS G.

**Subscription rates:** 1 year £12 UK and £15 outside UK.

**Student rates:** 1 year £8 UK and £10 outside UK.

**Distribution:** Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Telephone 01-661 3500.

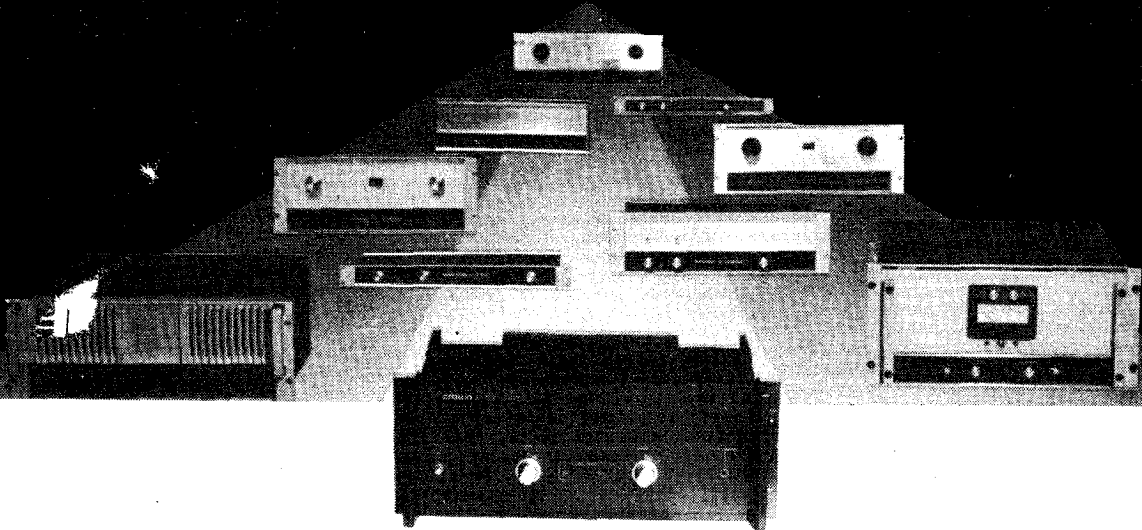
**Subscriptions:** Oakfield House, Perry-mount Road, Haywards Heath, Sussex RH16 3DH. Telephone 0444 59188. Please notify a change of address.

**USA mailing agents:** Expeditors of the Printed Word Ltd, 527 Madison Avenue, Suite 1217, New York, NY 10022. 2nd-class postage paid at New York.

© IPC Business Press Ltd, 1982 ISSN 0043 6062

- 
- 29 HUMAN ENGINEERING**
- 
- 30 CAMERA INTERFACE FOR A MICROCOMPUTER**  
by P. Howard
- 
- 37 RADAR EXPLORES THE IONOSPHERE**  
by I. Berkovitch
- 
- 38 PHASE-SHIFTING OSCILLATOR**  
by R. Roosens
- 
- 41 BOOKSHELF LOUDSPEAKER IMPROVEMENTS**
- 
- 42 CIRCUIT IDEAS** 10-bit a-to-d converter  
Capacitance meter Conductance meter
- 
- 45 WORLD OF AMATEUR RADIO**
- 
- 46 LETTERS** Distress signals  
Recharging dry cells Cordless telephones
- 
- 50 DATA RECORDING ON CASSETTE**  
by P. Smith and P. I. Zorkoczy
- 
- 53 SYMMETRICAL-OUTPUT DIVIDERS**  
by G. Girolami and P. Bamberger
- 
- 57 Z80 DEVELOPMENT SYSTEM**  
by G. Winstanley and S. R. W. Grainger
- 
- 60 DESIGNING WITH MICROPROCESSORS**  
by D. Zissos and G. Stone
- 
- 63 DIGITAL, MULTI-TRACK TAPE RECORDER**  
by A. J. Ewins
- 
- 67 OPTO-ELECTRONIC CONTACT BREAKER**
- 
- 68 NEWS OF THE MONTH**
- 
- 71 SELF-HELP TELEVISION**  
by V. Lewis
- 
- 73 INTERFACING MICROPROCESSORS**  
by J. D. Ferguson, J. Stewart and P. Williams
- 
- 78 CEPSTRUM ANALYSIS**  
by R. B. Randall and Jens Hee
- 
- 81 CLANDESTINE RADIO**  
by Pat Hawker
- 
- 84 NEW PRODUCTS**
- 
- 86 WAVES**

# The Professional Choice



**AMCRON** 

Since the introduction of the DC300 in 1967, AMCRON amplifiers have been used worldwide – wherever there has been a need for a rugged and reliable amplifier. Their reputation amongst professional users, throughout industry, has made the name of AMCRON synonymous with power amplification. For power you can depend on - choose AMCRON, the professional choice.

For further details contact the UK Industrial distributor:

**G.A.S.**

**G.A.S. ELECTRONICS**

16, ST. ALFEGE PASSAGE, LONDON SE10

TELEPHONE: 01-853 5295

TELEX: 923393 LASER G



# wireless world

**Acting Editor:**  
PHILIP DARRINGTON  
01-661 3039

**Technical Editor:**  
GEOFF SHORTER, B.Sc.  
01-661 3500 X3590

**Projects Editor:**  
MIKE SAGIN  
01-661 3500 X3588

**Communications Editor:**  
MARTIN ECCLES  
01-661 3500 X3589

**News Editor:**  
DAVID SCOBIE  
01-661 3500 X3587

**Design Editor:**  
RICHARD NEWPORT

**Drawing Office Manager:**  
ROGER GOODMAN

**Technical Illustrator:**  
BETTY PALMER

**Advertisement Manager:**  
BOB NIBBS, A.C.I.I.  
01-661 3130

DAVID DISLEY  
01-661 3500 X3593

BARBARA MILLER  
01-661 3500 X3592

**Northern Sales**  
HARRY AIKEN  
061-872 8861

**Midland Sales**  
BASIL MCGOWAN  
021-356 4838

**Classified Manager:**  
BRIAN DURRANT  
01-661 3106

OPHELIA SMITH  
01-661 3033

**Production:**  
BRIAN BANNISTER  
(Make-up and copy)  
01-661 3500 X3561

## Human engineering

While some experience of industry is a distinct benefit when one is called upon to dispense wisdom to industrialists and engineers, the lack of such experience can, evidently, also have its advantages. Prince Charles' recent speech to the Institution of Mechanical Engineers demonstrated well that the objectivity of non-involvement, when combined with perception, can be very valuable.

It has become fashionable to speak of the "British Disease" — a tired and meaningless phrase that has been used to describe almost any shortcoming in any walk of life, from the growth of bingo to an insistence on tea breaks, but the particular manifestation with which the speech was concerned was the constant theme of industrial disaster and its attraction for the news media. An obsession with failure breeds failure.

It also tends to obscure the successes of industry which, as the Prince pointed out, are considerable, and not all from the larger companies. Indeed, it sometimes seems that the larger a company, the less the motivation that can be expected from its staff. There is no lack of will to work and to obtain a better way of life for oneself and one's family — the 7.5% proportion of the 'black economy' testifies to that — but the buffering effect of working in an amorphous organization such as BL or GEC removes much of the incentive to put in more than a contractual amount of effort. The work of one man has only an imperceptible influence on the company's performance: or, at least, that is the inevitable, subjective impression.

There is no lack of successful Japanese companies to prove that the Japanese workforce equates its own fortunes with those of the company to a much greater extent than seems to be the case here, but it is at least possible that differences in national character call for different approaches.

Job satisfaction is a well-worn phrase, but a good deal more than lip-service to the idea is needed if its benefits are to be gathered. Even to hint at a reduction in the

number of people performing tedious, unskilled, mind-atrophying tasks by 'closing the loop' in automatic production machinery would be ill-timed, to say the least: a re-deployment of the same number of people in an imaginative way might, however, be practicable and acceptable.

In small companies, many of which are enterprising, enthusiastic and successful, there are few conveyor belts and endlessly repeated, apparently meaningless operations. Single workers or groups are able to produce and see more complete — in some plants entire — pieces of equipment: the finished product is theirs and they are responsible for it. It is hard for an employee on a production line to feel at one with the company that employs him, but considerably easier, and perhaps even more to be desired, to feel pride of achievement in the product itself.

Admittedly, this is only raising the level of repetition, but the contribution to an immediately recognizable product must be more gratifying than the insertion of a few components or even the final testing. People are thinking animals and should not be expected to function as maintenance-free machinery. Over thirty percent of one's waking life from 16 to 65 is spent at work — there must be more to it than a Pavlovian response to the stimulus of a workpiece moving past one's nose.

### Tom Ivall

Keen-eyed readers will have noticed that Tom Ivall's name is no longer on our 'masthead'. He has decided to leave *Wireless World* after many years — eight of them in the Editor's chair — to pursue a freelance writing career. We in the editorial team will miss his friendly guidance and persuasive leadership, but hope still to see his work in our pages from time to time. We wish him well in his new career.

High-resolution graphics display from a television camera

# Camera interface for a microcomputer

by P. Howard B.A. (Oxon)

Many microcomputers have the facility for displaying high resolution graphics. High resolution in this context means about  $300 \times 200$  points. One problem is that the software required for even a fairly simple diagram is quite extensive and may represent a considerable fraction of the entire program. The interface to be described was designed to enable a picture to be acquired, stored and displayed by the computer in high-resolution graphics, and was required to be relatively inexpensive and reasonably versatile. It presents the computer with picture information from a number of tv frames, taking about five seconds to build up the complete picture. The camera and subject must therefore be stationary for this time.

A television frame of the CCIR standard consists of two fields each of 312.5 lines, although the first and last few lines of each field do not contain any picture information. A line is 64 microseconds long and picture information is transmitted for about 40 microseconds of this time. The signal from the video camera used was +1 volt peak combined with synchronizing pulses of -1 volt.

The video camera interface (v.c.i.) divides each line into 256 sections, which may be numbered 0 to 255. When it is initialized, it digitizes the voltage of point 0 for each line of the field following the initialization signal. During the next field, point 1 of each line is digitized and the process continues until every point has been converted to a digital number. The interface does not distinguish between the two fields of a tv frame, as this is not necessary for the resolution required,

though it could be accomplished if required.

Each point or section is converted to an eight-bit number, the value of which is proportional to the brightness of that section. The time between successive conversions is therefore 64 microseconds. This allows enough time for the computer to accept each number and store it in memory. The time to digitize the complete picture is therefore 256 field periods or 5.12 seconds.

## Storage and display

Simple arithmetic shows that to store all the information presented by the interface for a picture of, say, 256 lines, each of 256 points would require 65536 bytes. This is more than the entire memory of many small computers. It may be necessary for the computer to store only part of the information with which it is presented. There are various ways in which the information to be stored may be chosen and a combination of methods may be used. The selection is carried out by the computer and is determined by appropriate software.

For example, the computer may store only part of the picture, ignoring all but some of the lines and all but some of the sections. Another method would be to store the information from alternate lines and sections. This latter method would allow the whole picture to be stored but at a lower effective resolution. Further re-

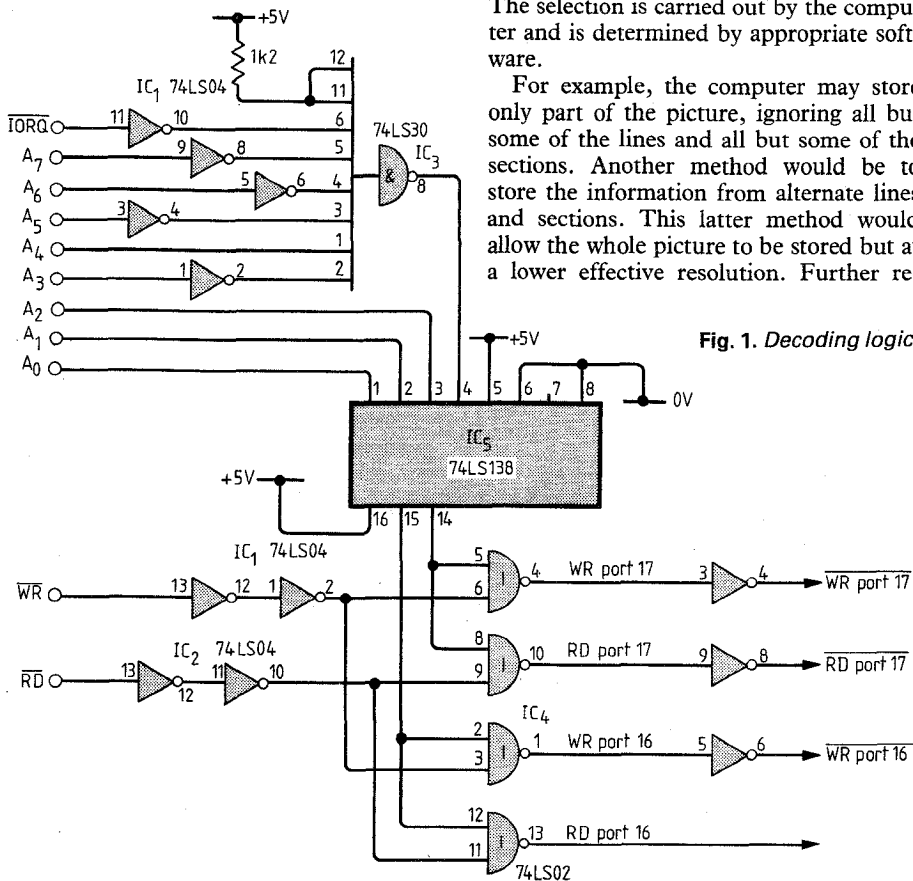


Fig. 1. Decoding logic.

duction in memory requirements could be achieved by storing only part of the digital number. If the four most significant bits are selected, there will be only 16 different possible contrast levels instead of the 256 that storing eight bits would allow.

A constraint on the complexity of the selection software is that the computer must decide whether a number presented to it by the v.c.i. is to be stored, select the appropriate number of bits to store, decide where it is to be stored and then finally store it, all before the next number is presented. The software must therefore allow the computer to accomplish this within 64 microseconds. A careful check must be made on the execution times of the machine-code instructions. The example programs were written for a Z-80A microprocessor running at 4MHz, arranged to insert an extra WAIT state into every memory read operation.

Once the picture has been stored in memory, it may be displayed or it may be processed in a variety of ways. We shall not discuss picture processing in detail as we have little experience in this field. (Another reason for building the v.c.i. was to learn about the subject.) The software for displaying the picture will depend on the facilities available, but should be fairly

straightforward to write. The prototype was interfaced to a Research Machines 380Z and some examples of display software for the high resolution graphics board of this computer are included.

### Circuit description

The v.c.i. circuitry can be divided into sections:

- The decoding logic, which is completely straightforward and is the section most likely to require modification to suit different systems. The prototype was decoded to Z-80 input and output ports, as these are easier to decode than memory addresses.
- The converter section comprises a sample-and-hold circuit and the analogue-to-digital converter itself. It also contains synchronization pulse separators which indicate the start of tv lines and fields.
- The timing circuitry sends a signal to the a-to-d converter to start the conversion of a particular section of a line. The v.c.i. runs continuously, but a signal from the computer can restart the timing circuitry at the beginning of the picture.

Fig. 2. Analogue-to-digital converter and sync. separators.

### Decoding logic

It was decided to connect the v.c.i. to the computer via input and output ports as this simplifies decoding. For those unfamiliar with the Z-80, it should be mentioned that these transfer data via the data bus when the IORQ signal is active. The port address appears on the lower eight address lines and the RD and WR signals determine whether data are to be read into, or sent from the c.p.u. If the v.c.i. is decoded to memory locations, all 16 address lines are significant<sup>1</sup>.

When the lower eight address lines assume any of the values from 00010000 to 00010111 and IORQ is low, the output of IC<sub>3</sub> goes low and enables the 3 to 8 line decoder IC<sub>5</sub>. Depending on the state of the least significant three address lines, one of the outputs of IC<sub>5</sub> will go low. These signals are gated with either RD or WR, depending on whether an input port or an output port is required. Any inputs which are connected to more than one place on the v.c.i. are buffered so that the interface puts a maximum of one l.s.t.t.l. load on any computer line. The circuitry actually decodes eight ports, though not all of these are used and are therefore available for use with other peripheral circuits if required.

