6301

Instructions and Applications

Paper Tape Punch Type 6301

A paper tape punch with two inputs. The first is used for the punching of a 14 bit 8–4–2–1 BCD input in a standard punch code, using a choice of two formats. The second is used for the direct punching of an 8 bit input. Interface is contained within the punch to allow the direct connection between the inputs and other B & K instruments capable of providing a digital output.

BRÜEL & KJÆR

030-0427

PAPER TAPE PUNCH TYPE 6301

August 1972

CONTENTS

1. INTRODUCTION

Many present day instruments are capable of producing results at a far faster rate than the conventional methods used can record them. Where the instruments form a part of some feedback monitoring loop, or are operating on line with a computer, this problem is of little consequence, since their results can be assimilated just a quickly as they are produced. However, outside of a feedback loop or where the cost of using a computer on line cannot be justified, very real problems can result, since conventional recording methods are incapable of recording at the same rate. The outcome of this is that the instrument must remain idle while its results are recorded. Further, the time during which it remains idle is huge when compared with the time taken to produce the results.

Where the instrument is being used to measure a non-varying function, or alternatively one which varies at extremely low frequency, this time lapse can be tolerated. However, if this function is of a continuously variable nature, it becomes a serious handicap, since much valuable information about the function can be lost while one set of results is recorded. It becomes obvious that in such cases, a different approach to recording is required.

Conventional recording, such as the use of a level recorder, is of an analogue nature. When the instrument in use is capable of providing a digital output, an obvious alternative would be to use digital recording techniques. The most basic of these is to record on punched paper tape, as provided by the Paper Tape Punch, Type 6301. Recording on punched paper tape is a reliable, and relatively low cost method, which can offer an order of magnitude increase in the recording rate. Such recordings can then either be translated on an instrument such as a teletype, or used as a data input to a computer.

The Paper Tape Punch Type 6301 is a modified version of the GNT model 34. Interface has been added to allow the direct connection of other B & K instruments. Two inputs are provided, a DATA INPUT and a SUPPLEMENTARY SOURCE INPUT. The DATA INPUT allows the input of a 14 bit 8-4-2-1 BCD code, as provided by the digital outputs of the

Real-Time Third Octave Analyzer Type 3347, and the Digital Encoder Type 4421. The SUPPLEMENTARY SOURCE INPUT allows the input of an 8 bit code, as provided by the Manual Data Unit Type 5599, the Digital Event Recorder Type 7502, and the Computer Type 7504.

Where the DATA INPUT is used, as with the 3347 and the 4421, the input BCD signal is passed through interface circuitry which converts it into a punch code. This punch code is designed into the 6301, and may not be altered without internal circuitry changes. One of three codes, ASCII, Friden's Flexowriter, and IBM PTTC/8, may normally be chosen, but other codes may be designed in on request, although this will, of course, incur extra cost. A choice of two formats is also available. These are Typewriter Format and Computer Format, and are selected via a switch. These formats are again controlled via internal circuitry in the interface. Where the SUPPLEMENTARY SOURCE INPUT is used, as with the 5599, the 7502, and 7504, the code conversion circuitry in the interface is bypassed, and the input is punched directly. Note that where data is available for punching at both inputs, that at the SUPPLEMENTARY SOURCE INPUT will always take priority. All punching is carried out on standard one inch paper tape with 8 information channels.

The 6301 is provided with an auto transformer such that it may be run off a variety of voltage supplies between 100 and 240 V AC, 50 Hz. Where the supply is 60 Hz, however, a special drive wheel in the punch must be fitted.

2. CONTROLS

2.1. FRONT PANEL OF TAPE PUNCH TYPE 6301

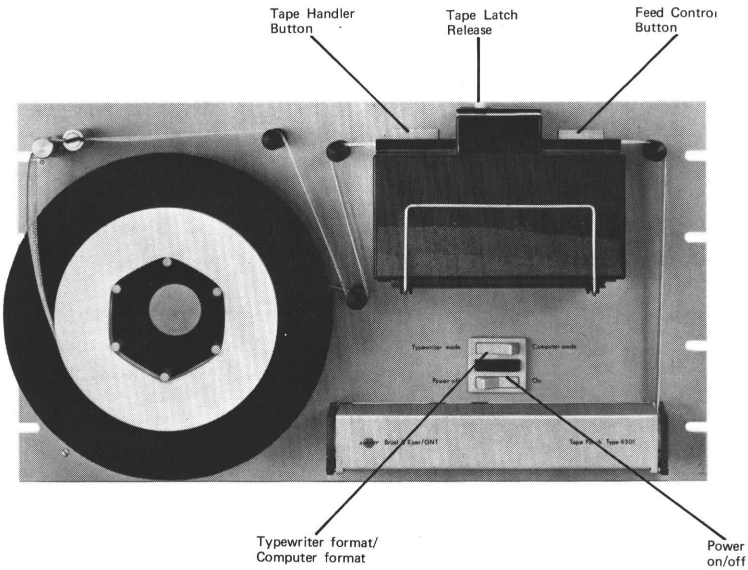

Fig.2.1. Positions of Switches and Controls, Front Panel

Below the Punch Mechanism will be found two switches.

TYPEWRITER FORMAT/
COMPUTER FORMAT

Pressing the left half or right half of the switch will select Typewriter Format of punching or the Computer Format of punching respectively.

POWER OFF/ON

Pressing the left half or right half of this switch switches the power off or on respectively. "Power On" indication is provided by a light above the switch.

On the Punch Mechanism, either side of the puncher itself, will be found two pushbuttons, marked with symbols. The left hand pushbutton is marked ⊡·□ and the right hand pushbutton is marked ⇦⇨.

TAPE HANDLER BUTTON
⊡·□

Pressing the left hand side of this pushbutton switches the tape handling system on. Pressing the right hand side of it switches the tape handling system off.

FEED CONTROL BUTTON
⇦⇨

While the left hand side of this pushbutton is held down, the Punch Mechanism will feed plain tape. When it is released, the tape feed will cease. Pressing the right hand side of it has no effect.

On top of the puncher itself will be found a white, unmarked pushbutton. This is the TAPE LATCH RELEASE.

TAPE LATCH RELEASE

While this pushbutton is held down, the tape feed and punching mechanism is released, allowing a new tape to be inserted.

2.2. REAR PANEL OF TAPE PUNCH TYPE 6301

DATA INPUT

Multipin socket for the connection of the digital output of a 14 bit 8-4-2-1 BCD source, such as the 3347 or 4421.

SUPPLEMENTARY SOURCE INPUT

Multipin socket for the connection of an 8 bit source, such as the 5599, 7502 or the 7504.

VOLTAGE SELECTOR

For selection of the appropriate mains voltage.

To turn the switch it is necessary to remove the central fuse, and then a wide bladed screwdriver or a small coin may be used.

POWER SOCKET

For connection of AC supply.

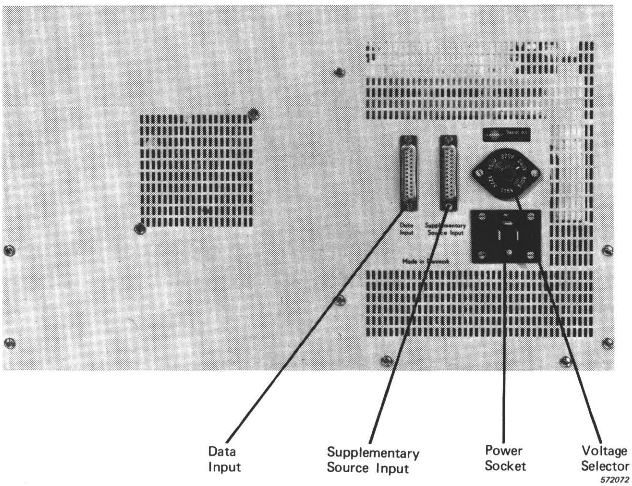

Fig.2.2. Positions of Inputs and Controls, Rear Panel

3. OPERATION

The B & K Paper Tape Punch, Type 6301, is designed to be used as a recording medium for the digital outputs of other instruments. This chapter has thus been extended to include descriptions of its operation with them.

3.1. PRELIMINARY ADJUSTMENTS

Before the instrument is connected to the power supply, the following adjustments must be made.

1. Check that the voltage selector is set to the correct line voltage. If it is not, remove the central fuse and adjust by using a small coin or a large screwdriver.

2. It is recommended that the instrument is not grounded, since this would increase the possibility of ground loops within the system in which it is being operated.

The instrument may now be switched on by means of the POWER Off/On switch on the front panel.

3.2. LOADING PAPER TAPE

Prior to the commencement of recording, it is advisable to check the amount of paper tape available for punching.

1. The quantity of tape in the punch may be checked by pulling the tape drawer forward. The front of the tape drawer will drop down to expose the tape spool and pulleys, as shown in Fig.3.1. If there is insufficient tape available, replace the spool. It should be placed on the spindle such that it rotates in a clockwise direction as the tape is pulled off.

2. Ensure that the tape comes around the pulley on the left hand side of the tape drawer as shown in Fig.3.1. Close the front of the tape drawer, ensuring that the tape goes under the pulley on the drawer's right hand side. Push the tape drawer back into place.

3. Pull the tape up and over the pulley on the right hand side of the punch mechanism. Push the TAPE LATCH RELEASE button, and hand feed about two or three inches of tape into the right hand side of the puncher itself.

4. Press the left hand side of the FEED CONTROL BUTTON. Blank tape, punched only with sprocket holes, will be fed from the left hand side of the puncher. If this does not happen, press the TAPE LATCH RELEASE button and check that the tape can feed freely through the punch mechanism. Check also that it is feeding freely through the pulleys.

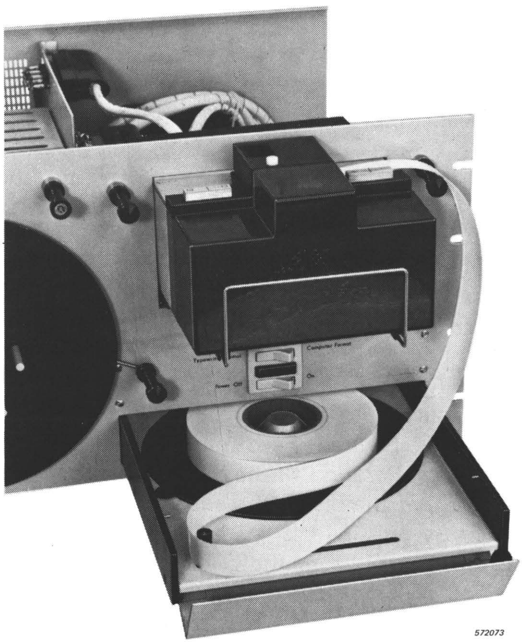

Fig.3.1. Correct Loading of Paper Tape in Tape Drawer

3.3. OPERATION AS A RECORDING MEDIUM

The following comments apply irrespective of the system in which the 6301 is operating.

1. Plug the digital output of the instrument providing the data to be recorded into the appropriate input of the 6301, using the correct cable as specified in sections 3.4 to 3.8. The 3347 and 4421 should be connected to the DATA INPUT. The 5599, 7502 and 7504 should be plugged into the SUPPLEMENTARY SOURCE INPUT. (Note that if any of these are plugged in while the Tape Punch is switched on, a spurious output might result due to noise generation. This in no way harms the Punch, and recording may proceed as normal as soon as it has ceased. However, it may be prefered that the input be connected with the Tape Punch switched off).

2. Select "Typewriter Format" or "Computer Format" as required, using the TYPEWRITER FORMAT/COMPUTER FORMAT switch. "Computer Format" will give a faster output since fewer characters are punched. "Typewriter Format" gives a more easily readable output.

3. Press the FEED CONTROL BUTTON in order to obtain a suitable length of leader tape.

4. Where the outputs to be recorded are many and short, there is an advantage in operating with the Tape Handler switched off. After each output, a section of blank tape may be fed out by pressing the FEED CONTROL BUTTON. The recording may then be detached by pulling it vertically upwards from the punch. Note that this forms an arrow in the tape which may later be used to ascertain its direction.

5. Where the output to be recorded is likely to be long, the Tape Handler should be used. Feed out enough leader tape such that it may be threaded around all the pulleys and attached to the take-up reel. Ensure that the tape is threaded as in Fig.3.2. Switch the Tape Handler on by pressing the left hand side of the TAPE HANDLER BUTTON. (Note: when the Tape Handler or Tape Punch is switched on or off, there is a possibility of mains spikes causing spurious holes on the tape. It is thus advisable to run off a blank piece of tape after switch on or before switch off such that these spurious holes are not confused with the recording itself).

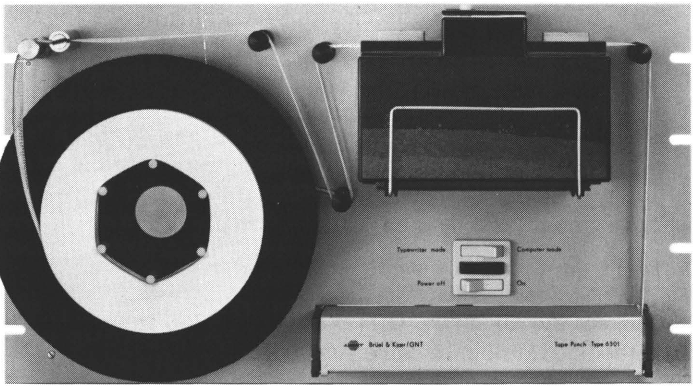

Fig.3.2. Correct Threading of Paper Tape through Tape Handler

6. The Tape Punch is now ready to record an output. For details of recording the various outputs of the instruments with which it may operate, refer to sections 3.4, 3.5, 3.6, 3.7 and 3.8.

7. When recording has been completed, the Tape Punch should be switched off by means of the POWER OFF/ON switch on the front panel.

3.4. OPERATION WITH THE B & K REAL TIME THIRD OCTAVE ANALYZER TYPE 3347

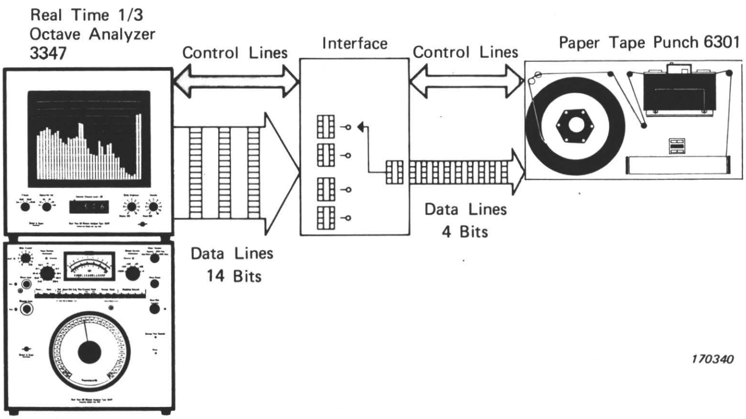

Fig.3.3. Connection of the 6301 to the Real Time Analyzer Type 3347

The 6301 may be used as a fast output recording device for the B & K Real-Time Third Octave Analyzer, Type 3347. The 3347 itself consists of two units, the Frequency Analyzer Unit, Type 2130, and the Control and Display Unit, Type 4710. The 6301 contains interface which allows the direct connection of the DIGITAL OUTPUT of the 4710 to the DATA INPUT on its rear panel. Note that the maximum permissible cable length between the two is about 2 metres (about 7 ft). If a longer cable is required, a special drive circuit must be used for each line.

Outputs from the 3347 may be recorded as follows:

1. Connect the DIGITAL OUTPUT of the 4710 to the DATA INPUT of the 6301, using the cable AO 0085.

   NOTE: CONNECTION AND DISCONNECTION OF THE DIGITAL OUTPUT OF THE 4710 MAY ONLY TAKE PLACE WITH THE 3347 SWITCHED OFF.

2. Set up the 6301 for recording as described in sections 3.1, 3.2, and 3.3. Note that if "Computer Format" is chosen, a complete spectrum from the 3347 will be punched in about 4 seconds. Where "Typewriter Format" is chosen, this will take about 7 seconds, but a more readable output will result. If the major requirement is for fast recording, or the tape punched is later to be used as a data input to a computer, then "Computer Format" recording should be chosen.

3. The setting up and operating instructions for the 3347 may be found in chapter 3 of the 3347 Instructions and Applications Manual.

4. As soon as both instruments are set up and functioning, an output may be recorded. This is done by pressing the READ OUT button on the front panel of the 2130. Punching will start automatically, and will cease when the complete spectrum has been recorded. Note that when outputs from the 3347 are being recorded by the 6301, it is advisable that the 4710 be switched to its "Via Store" mode using the READ OUT MODE switch on its rear panel. This will ensure that the spectrum recorded is always a time coincident one, irrespective of the settings of the storage mode of the 2130.

5. A further recording may be made as soon as the previous one has been completed, by again pressing the READ OUT button of the front panel of the 2130.

Recordings may be made on an automatic basis at a fixed time intervals by use of the B & K Digital Clock, Type 6201, as in the set up shown in Fig.3.4. The 6201 is connected via an interface into the SUPPLEMENTARY SOURCE INPUT of the 6301. "Data Request" pulses are then supplied at regular intervals, each one causing an output from the 3347 to be punched. Such a system could then be used for automatic datalogging of a continuous function.

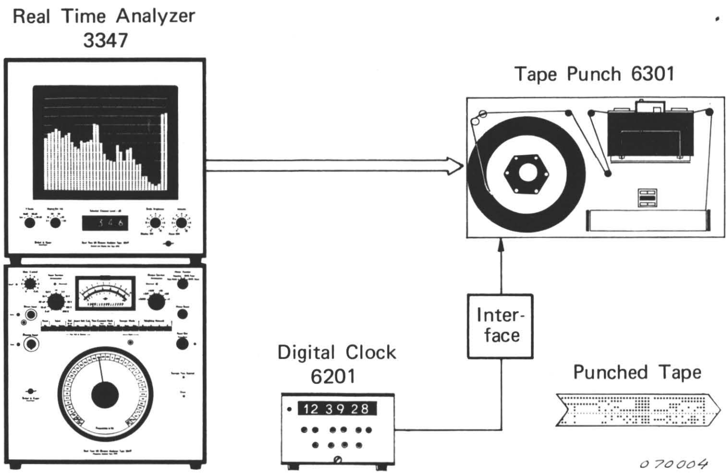

Fig.3.4. Connection of Digital Clock, Type 6201 to provide automatic data logging

3.5. OPERATION WITH B & K DIGITAL ENCODER TYPE,4421

The B & K Digital Encoder Type 4421 is an instrument which may be used with the B & K Level Recorders, Types 2305 and 2307, to convert their outputs into a digital form. The digital output of the 4421 may then be recorded on punched tape using the 6301. Its form, when punched, will depend on the function of the system in which the Encoder and Level Recorder are operating. If it is to perform frequency analysis, using a third octave filter set, as illustrated in Fig.3.5, then the output of the 4421 will be such that the 6301 will punch one reading for each of the filters. With octave filters, three such outputs will be punched. If, however, the system is to measure a continuous function then the output of the 4421 will be punched continuously at a rate limited by the 6301. Outputs from the 4421 may be recorded as follows:

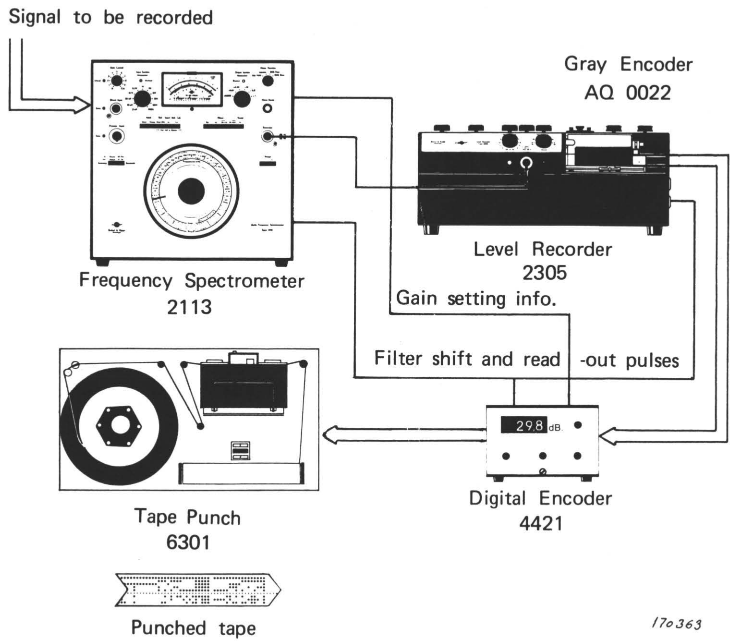

Fig.3.5. Connection of 6301 to the Digital Encoder Type 4421, with a measuring system connected

1. Connect the OUTPUT of the 4421 to the DATA INPUT of the 6301, using cable AO 0084. Note that the cable length should not be allowed to exceed about 2 metres (about 7 ft).

2. Set up the 6301 for recording as described in sections 3.1, 3,2 and 3.3. If the system is monitoring a continuous function, then in "Computer Format" about 10 samples a second will be punched, while in "Typewriter Format" about 6 samples a second will be punched. If the system is being used for frequency analysis, the speed of punching will be limited by the rate with which the Level Recorder records the spectrum. It is thus advised that "Typewriter Format" be chosen, in order to give a more readable result, unless the punched tape is later to be used as data input to a computer.

3. For the setting up and operating instructions of the 4421, and its connection to a 2305 or 2307, refer to chapter 3 of the 4421 Instruction Manual.

4. As soon as the system is set up and operating, an output from the 4421 may be punched. This is initiated from the Level Recorder by the start of a recording. Punching will cease automatically when this recording is stopped.

5. Further recordings may be made, as soon as the previous one has been completed, by again initiating them from the Level Recorder.

3.6. OPERATION WITH B & K MANUAL DATA UNIT TYPE 5599

Where the 6301 is being used to punch many outputs from different sources, it can be useful to be able to put some kind of marker on the punched tape prior to each seperate recording, especially if the data on the recordings is not to be processed until a later date. This marker can then be used as an aid to identification. This may be done by means of the B & K Manual Data Unit, Type 5599, which may be used to punch identifying numbers, in blocks of six, onto a punched tape via the 6301.

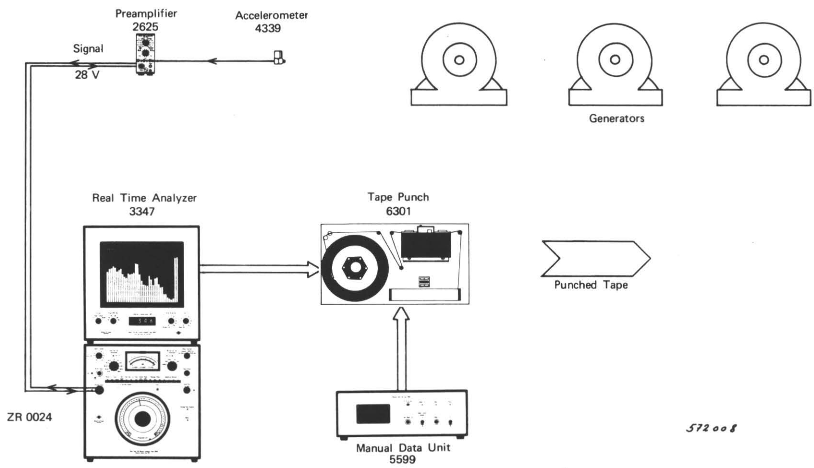

Fig.3.6. Connection of Manual Data Unit Type 5599, to system with 6301 and 3347

An application where such marking would be useful might be where a Real-Time Analyzer Type 3347 was being used to analyse the vibrations of each of a large number of generators, as illustrated in Fig.3.6, the 6301 being used to record each output. Prior to each recording, the serial number of the generator causing it could be punched onto the tape, thus enabling its identification at a later date, by means of the 5599. The 5599 must, of course, be programmed to punch in the same code as the 6301, since it is connected to the SUPPLEMENTARY SOURCE INPUT of the 6301, meaning that the code conversion part of the interface is bypassed, and its input is punched directly. Operation with the 6301 is as follows:

1. Connect the OUTPUT of the 5599 to the SUPPLEMENTARY SOURCE INPUT of the 6301, using cable AO 0084. Note that the cable length should not be allowed to exceed about 2 metres (about 7 ft).

2. Check that the mains input of the 5599 is set correctly for the supply voltage and connect it to the mains. It is advised that the instrument should not be grounded in order to minimise the risk of errors due to ground loops. Switch the power on by means of the ON/OFF switch on its front panel. That the power is on will be indicated by the POWER light emitting diode on its front panel.

3. Connect the correct output of the instrument providing the data to be recorded, to the DATA INPUT of the 6301, using the appropriate cable, and set it up as described in sections 3.4 and 3.5.

4. Set up the 6301 for recording as described in sections 3.1, 3.2 and 3.3.

5. As soon as the system is set up and operating, transfer of data from the 5599 to the 6301 may commence. Reset the 5599 by pushing the RESET button on its front panel.

6. If the number of characters to be transferred onto the punched tape is equal to or less than six, switch the INHIBIT CONTROL TRANSFER switch on the front panel of the 5599 to its "Off" position. Set up the characters to be transferred using the thumbwheels on its front panel.

7. Press the START READ OUT button. The characters indicated by the six thumbwheels will be transferred onto the punched tape. Control of the recording will then be transferred to the instrument connected to the DATA INPUT of the 6301. If it is the 3347, an output will be punched automatically as soon as the characters have

been recorded. With the 4421, however, output punching must be initiated from the Level Recorder, as described in section 3.5.

8. If more than six characters are to be transferred, switch the INHIBIT CONTROL TRANSFER switch to its "On" position. That it is on will be indicated by the INHIBIT ON light emitting diode. Set up the first block of six characters to be transferred using the thumbwheels on the front panel of the 5599, and press the START READ OUT button. The characters will be transferred onto the punched tape, but control of punching will now remain with the 5599. Further blocks of six characters may be transferred similarly. (Note that transfer should start with the most significant block of characters and end with the least significant).

9. Prior to the transfer of the last block of six characters, switch the INHIBIT CONTROL TRANSFER switch to its "Off" position. Recording may then proceed as described in point 7 of this section.

10. Should at any time an undesired condition appear on the 5599, e.g. if the BUSY light emitting diode comes on when the instrument is first switched on, it may be reset by pressing the RESET button on its front panel.

3.7. OPERATION WITH B & K DIGITAL EVENT RECORDER, TYPE 7502

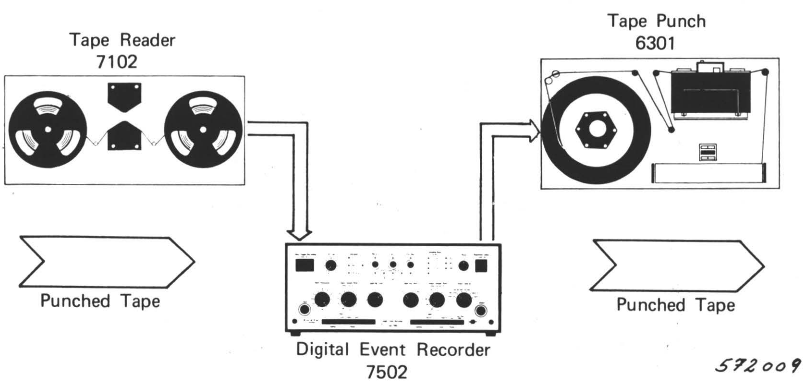

Fig.3.7. Connection of Digital Event Recorder Type 7502, to system with 6301 and 7102

The 6301 may be used as an external storage medium for the B & K Digital Event Recorder, Type 7502. The 7502 stores an event in its memory until such a time that a play back is required. One of the forms of playback which is available is to read out the event stored while it is still in its digital form. This may then be recorded on punched tape by means of the 6301, leaving the 7502 free to store another event. The tape acts as a store, since if its contents are fed back into the 7502, via the B & K Tape Reader, Type 7102, the event recorded will be reconstructed in its entirety. Such an application is illustrated in Fig.3.7. Alternatively, the tape may be used as a data input to a computer.

Digital play back from the 7502 may be recorded as follows:

1. Connect the DIGITAL OUTPUT of the 7502 to the SUPPLEMENTARY SOURCE INPUT of the 6301, using cable AO 0084. The cable length should not be allowed to exceed 2 metres (about 7 ft).

2. Set up the 6301 for recording as described in sections 3.1, 3.2 and 3.3.

3. For the setting up and operating instructions of the 7502, refer to chapter 3 of the 7502 Instructions and Applications Manual.

4. As soon as both instruments are set up and operating, and an event has been recorded on the 7502, (i.e. the 7502 has jumped from its "Record" mode to its "Standby" mode), a digital play back may be punched. Switch the OUTPUT SELECTOR of the 7502 to its "Digital" position.

5. Press the PLAYBACK button on the front panel of the 7502. The 6301 will start punching the play back automatically, and cease when it has been recorded in its entirety (about 32 seconds for the 2K memory size). The 7502 will then return to its "Standby" mode. (A further recording of the play back may be obtained by again pressing the PLAY BACK button).

6. Return the 7502 to its "Record" mode by pressing the STANDBY button followed by the RECORD button, and then releasing them. As soon as it has recorded another event, a further digital play back may be punched.

7. Recording and play back to the 6301 can be made to take place automatically by leaving the OUTPUT SELECTOR of the 7502 set

to "Digital", and pressing the AUTO MODE button on its front panel. If the system is then left set up and operating, as soon as the 7502 records an event, it will automatically jump to its "Play Back" mode, and a digital play back will be punched by the 6301. When play back is complete, the 7502 will return to "Record" until a further event has been recorded, when the play back cycle will be repeated. This will continue until such a time that the 7502 is switched out of its "Auto" mode. The events recorded can then be reconstructed by feeding the information punched back into the 7502, using a B & K Tape Reader Type 7102. This combination of the 7502 and the 6301 can thus be made to record a large number of events within a time period with little or no human supervision.

3.8. OPERATION WITH B & K COMPUTER TYPE 7504

The basic input and output medium, as well as operator's console, for the B & K Computer Type 7504, is the Teletypewriter Type 6401. Although this is an indispensable accessory in the computing system, as an input and output device, it is slow, since it will only read or punch 10 characters per second. Where this speed is insufficient on the output side, a 6301 may be added to the system to provide a considerable improvement in the output punching rate. On the input side, a Tape Reader Type 7102 can be added to complete the system and give fast input reading also. The complete system would then be as in Fig.3.8.

The interface of the 6301 allows direct connection with the 7504. Once the two are connected and functioning, all tape punching is under software control in the computer. Connection of them is as follows:

1. Connect the TAPE PUNCH output of the 7504 to the SUPPLEMENTARY SOURCE INPUT of the 6301, using cable AO 0103. The length of this cable should not be allowed to exceed 2 metres (about 7 ft).

   NOTE: IF THIS CONNECTION IS MADE WITH THE COMPUTER SWITCHED ON, ENSURE THAT IT IS IN ITS "STEP" MODE, WITH ALL ITS REGISTERS CLEARED BEFOREHAND. THIS IS TO AVOID THE POSSIBILITY OF DEPOSITING FALSE INFORMATION IN ITS MEMORY.

2. Set up the 6301 for recording as described in sections 3.1, 3.2 and 3.3.

3. The setting up and operating instructions for the 7504 may be found in chapter 2 of the 7504 Instructions and Applications Manual.

4. When both instruments are set up and operating, the 7504 may be taken out of its "Step" mode and the program in use initiallised. All punching will be under program control.

5. If at any time the 6301 starts to punch an unwanted output, (e.g., when tape copying, it begins to punch "rub outs" when the entire original tape been be copied), it may be stopped by pressing the SYSTEM RESET switch on the 7504. Note, however, that after this, the program in use should be re-initialised, or a new program called up.

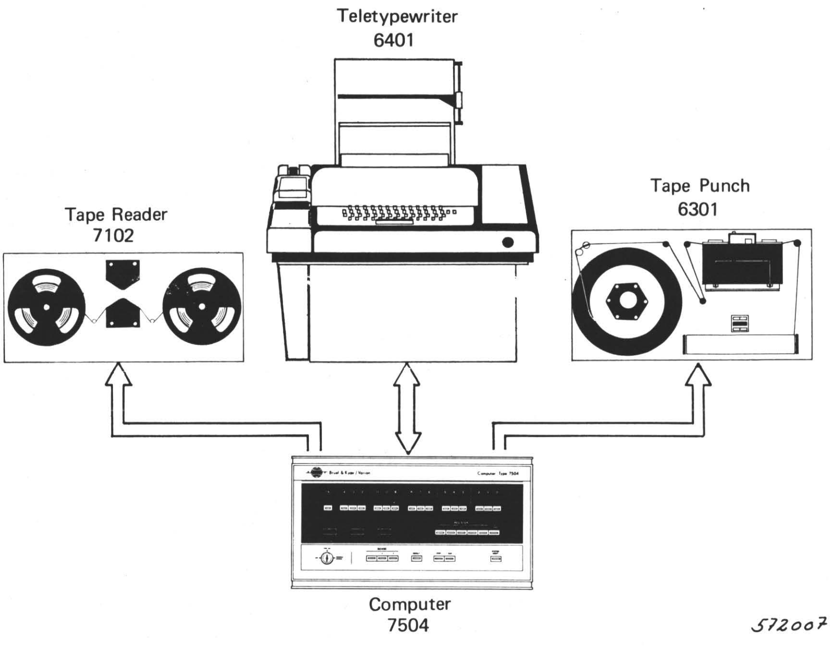

Fig.3.8. Complete Computing system including 7504, 6401, and 7102 with the 6301

4. DESCRIPTION

4.1. GENERAL

A block diagram of the 6301, with its various data lines, is shown in Fig.4.1. The circuitry within the diagram can be divided into three main parts, which are as follows:

1. The control for the punch itself.
2. The Code Converter, the Channel Counter, and the Circuitry for the interface of a 14 bit BCD source connected to the DATA INPUT.
3. The circuitry for the interface of an eight bit coded source connected to the SUPPLEMENTARY SOURCE INPUT.

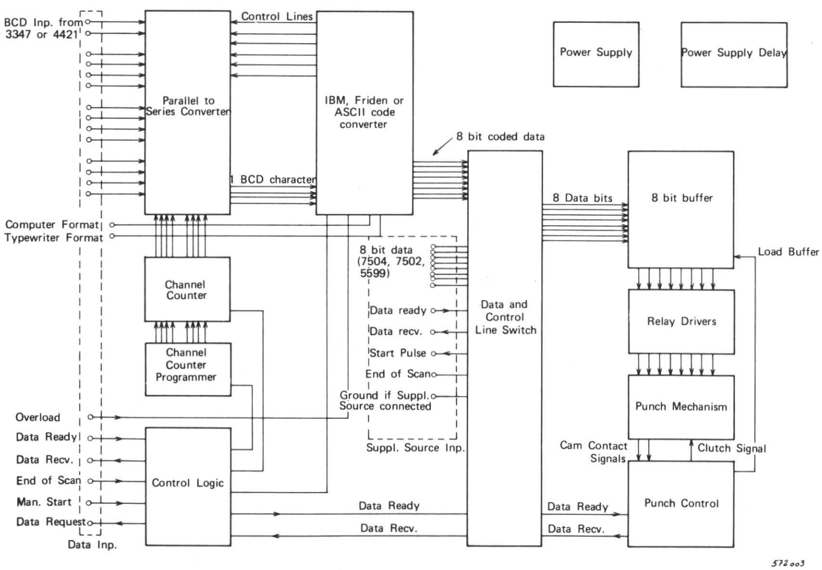

Fig.4.1. Block Diagram of Tape Punch Type 6301

The source connected to the SUPPLEMENTARY SOURCE INPUT will always have priority when a read out is made. Control will only be transferred to the DATA INPUT when the correct signal has been received on the "End of Scan" line to indicate that punching from the SUPPLEMENTARY SOURCE INPUT has been completed. Where only one input is in use, however, that input will always have priority.

A brief description of the function of each unit within the block diagram now follows. Certain of these will be expanded into more detail later in this chapter.

4.1.1. Parallel to Series Converter and Control Logic

The DATA INPUT receives data in parallel as a 14 bit BCD word representing four decimal characters. However, the punch mechanism can only punch one character at a time. Thus, the Parallel to Series Converter takes the 14 bit word, and converts it into four 4 bit BCD words, each representing one decimal character. Each character is then transmitted serially to the Code Converter.

Before a readout can take place, the correct signals must be received and generated by the Control Logic (Manual Start and Data Request). It will then begin to generate the control signals to the rest of the circuit such that the BCD data can be accepted, serial converted, code converted and then punched. When one 14 bit BCD word has completed its punch cycle, the Control Logic requests the next.

4.1.2. Channel Counter

The Channel Counter is used in "Typewriter Format" only. Its function is to generate identifying numbers for the outputs of third octave filters, or channels, when a frequency analysis is being recorded. The channel number generated is equal to 10 log f_o, where f_o is the centre frequency of the third octave filter channel. Channel number 30 thus corresponds to a centre frequency of 1 kHz. The channel number generated is then transmitted to the Parallel to Series Converter, as two 4 bit BCD words, where it is combined with information from that channel, before being transmitted to the Code Converter.

Since not all third octave filter sets will start at the same frequency the first two channel numbers may be programmed to correspond with the set in use. The Channel Counter will then count in sequence from the last programmed number. A more detailed description of the Channel Counter may be found in section 4.3.

4.1.3. Code Converter

The purpose of the Code Converter is to take the BCD output of the Parallel to Series Converter and convert it into a recognised punch code. Each 4 bit BCD word transmitted by the Parallel to Series Converter is converted into an 8 channel punch code, parity bits being added as required. Further, since the Code Converter also controls the punch format (i.e. "Typewriter Format" or "Computer Format"), the extra characters demanded by the format selected are inserted. The 8 bit coded data is then transmitted to the Data and Control Line Switch. A more detailed description of the Code Converter appears in section 4.4.

4.1.4. Data and Control Line Switch

The Data and Control Line Switch determines whether data punching is controlled from the DATA INPUT or the SUPPLEMENTARY SOURCE INPUT. If both are used, then the latter has priority, and control will not be transferred until a positive going edge is detected on the "End of Scan" line at the SUPPLEMENTARY SOURCE INPUT. This is taken as an indication that punching from this input has been completed. If, however, only one input is used, then control will be with that input permanently.

The Data and Control Line Switch transmits the 8 bit coded data from the source selected to the Punch Circuits so that it may be transferred onto punched tape.

4.1.5. Punch Circuits

The Punch Circuits consists of an 8 bit buffer, to hold the data during the punching cycle, and relay drivers to drive the electromechanical relays which energise the punching pins in the punch mechanism. In order that the relays are energised at the correct point in the punching cycle, mechanical cam contacts feed information to logic circuits on the point of advancement in the cycle of the punch mechanism.

The use of the buffer ensures that the data for punching need only be held on the input of the Data and Control Line Switch for approximately 50 μsec., instead of 10 msec. (the length of time the data must be present during the punch cycle). That new data can be buffered is indicated by the correct signal on the "Data Received" line.

4.2. REAR CONNECTORS AND CONTROL SIGNALS

Fig.4.2 shows the pin arrangement of both the DATA INPUT socket and the SUPPLEMENTARY SOURCE SOCKET. The view shown is that from the outside of the socket or from the rear of the plug. The plug used is the McMurdo DB – 25 P, B & K part number JP 2500.

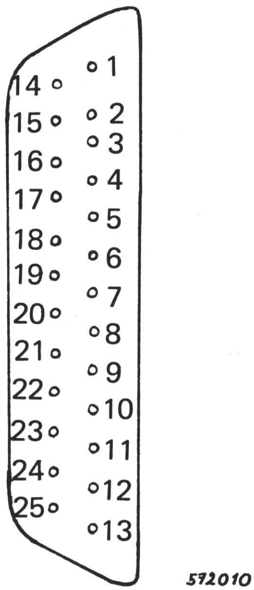

Fig.4.2. Terminal layout of McMurdo 25 pole socket, JP 2500

4.2.1. Data Input Socket

The pin identification for the DATA INPUT socket is given in Table 4.1.

As can be seen, the inputs to it fall into two groups, 14 lines for the transfer of 14 bit 8-4-2-1 BCD data, and 6 lines for the transfer of the control signals between the data source and the 6301. The sequence of the control signals, and their timing, will depend on whether the data source is the Real-Time Third Octave Analyzer, Type 3347, or the Digital Encoder, Type 4421.

Pin	Function
1	No Connection
2	No Connection
3	Overload
4	Bit 2
5	Data Request
6	Bit 11
7	Bit 4
8	Bit 5
9	Bit 13
10	Bit 6
11	Bit 0
12	Ground
13	Bit 9
14	Manual Start
15	End of Scan
16	Data Ready
17	Bit 1
18	Data Received
19	Bit 12
20	Bit 7
21	Bit 10
22	Bit 8
23	No Connection
24	No Connection
25	Bit 3

072014

Table 4.1. Pin Identification of DATA INPUT socket

Real Time Analyzer

Fig.4.3 shows the sequence of the control signals when the data source is the 3347. The times $t_1 - t_8$ referred to in the figure may be found in Table 4.2.

A data transmission between the 3347 and the 6301 is initiated by pressing the READ OUT button on the front panel of the 2130. This causes the 3347 to transmit a "Manual Start" pulse to pin 14 of the DATA INPUT of the 6301. The sequence of events is then as follows:

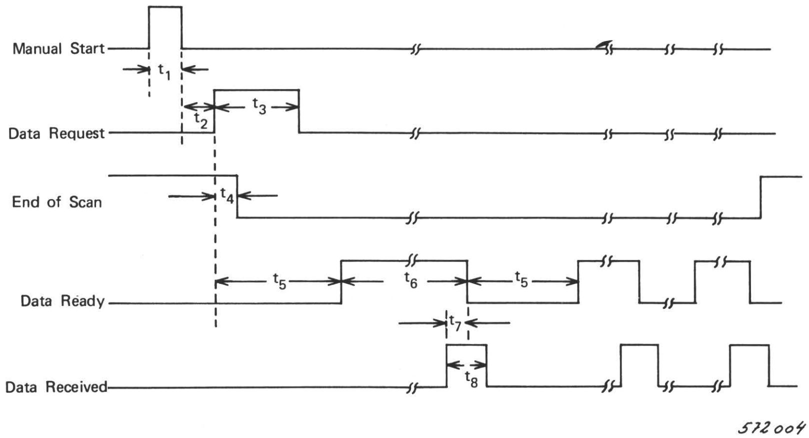

Fig.4.3. Control Signals at DATA INPUT, with 3347 connected

Delay Time	Minimum Value µsec.	Maximum Value µsec.
t_1	0.4	-
t_2	0.2	-
t_3	36	44
t_4	0.2	0.4
t_5	0.1 msec	1.2 msec
t_6	140 msec	240 msec
t_7	0.4	-
t_8	3.6	4.4

072015

Table 4.2. Delay times between control signals with 3347 connected

a) On receipt of the "Manual Start" pulse, the 6301 raises a "Data Request" pulse which is transmitted to the 3347, and resets its Channel Counter (see sections 4.1.2 and 4.3).

b) The leading edge of the "Data Request" pulse then causes the "End of Scan" signal on the 3347 to drop from a logic "1" to a logic "0". At the same time, the 3347 initialises itself for a digital read out, and starts the analogue to digital conversion of the signal level in the first channel. Conversion is to BCD.

c) When the conversion of the first channel is complete, the 3347 transmits a logic "1" on the "Data Ready" line. The leading edge of this signal causes the 6301 to begin to accept and punch the BCD data which is standing on the data lines at that time.

d) The 6301 now waits until such a time that all data transmitted on the data lines during the cycle has been punched. The length of this waiting period is dependent on whether it is punching in "Typewriter Format" or "Computer Format". When the last punch cycle is complete, the 6301 transmits a "Data Received" pulse to the 3347.

e) The leading edge of the "Data Received" pulse causes the "Data Ready" line of the 3347 to reset to a logic "0". The 3347 advances one channel and begins a new analogue to digital conversion.

f) When the next conversion is complete, the 3347 again transmits a logic "1" on the "Data Ready" line. The 6301 again begins to accept the data on the data lines, and the cycle described in (d) and (e) is repeated.

g) The cycle continues until data from the last channel of the 3347 has been punched. The leading edge of the "Data Received" pulse then transmitted by the 6301 causes the "End of Scan" signal from the 3347 to be reset to a logic "1". This in turn causes the data transmission to be terminated.

Note that the fixed duration control pulses (i.e. "Manual Start", "Data Request" and Data Received") are all logic "1" by nature and that any read out from the 3347 is inhibited while the "End of Scan" signal is at "1".

Digital Encoder

Fig.4.4 shows the sequence of control signals when the data source is the 4421. Note that the "Data Request" and "End of Scan" signals are now absent. The times $t_1 - t_5$ referred to in the figure may be found in Table 4.3.

A data transmission from the 4421 to the 6301 is now initiated by the start of a recording on the Level Recorder controlling the 4421. This causes the Level Recorder to remove the "Stop" signal from the input of the 4421, which in turn causes the 4421 to transmit a "Manual Start" pulse to pin 14 of the DATA INPUT of the 6301. The sequence of events is then as follows:

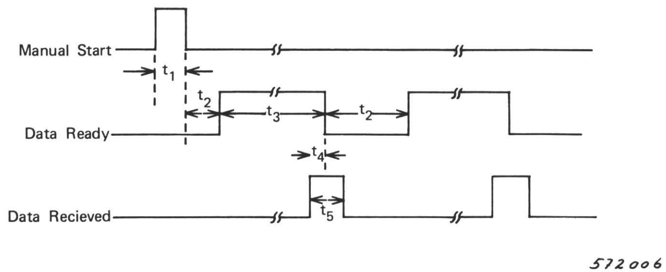

Fig.4.4. Control Signals at DATA INPUT, with 4421 connected

Delay Time	Minimum Value µsec.	Maximum Value µsec.
t_1	0.3	2
t_2	15	52
t_3	140 msec	240 msec
t_4	0.4	-
t_5	3.6	4.4

072016

Table 4.3. Delay times between control signals with 4421 connected

a) The leading edge of the "Manual Start" pulse causes the 6301 to reset its Channel Counter (see sections 4.1.2 and 4.3).

b) The trailing edge of the "Manual Start" pulse acts as a "Data Request" to the 4421 by causing it to hold Gray coded data the moment it is enabled, and complete the conversion of this data to BCD.

c) When the conversion of this data is completed, the 4421 transmits a logic "1" on the "Data Ready" line. The leading edge of this signal causes the 6301 to accept and punch the BCD data which is standing on the data lines at that time.

d) The 6301 now waits until such a time that all the data transmitted has been punched. The length of this waiting period again depends on whether it is punching in "Typewriter Format" or "Computer Format". When the last punch cycle is complete, the 6301 transmits a "Data Received" pulse to the 4421.

e) The leading edge of the "Data Received" pulse causes the 4421 to reset its "Data Ready" line to a logic "0". It then resets its hold circuit, allowing it to update.

f) The trailing edge of the "Data Received" pulse now acts in the same way as the trailing edge of the "Manual Start" pulse in (b). The cycle (c) to (f) is then repeated. This continues until such a time that the Level Recorder ceases to record. It then transmits a "Stop" signal to the 4421, which resets its hold circuit after the final read out has been completed. The transmission then ceases.

Note again that the fixed duration control pulses (i.e. "Manual Start", and "Data Received") are logic "1" by nature, and that any read out from the 4421 is inhibited when the "Stop" signal is present in its input.

4.2.2. Supplementary Source Input Socket

The pin identification for the SUPPLEMENTARY SOURCE INPUT socket is given in Table 4.4.

As can be seen, the inputs to it fall into two groups, 8 lines for the transfer of 8-bit data, and 4 lines for the transfer of control signals between the data source and the 6301. Fig.4.5 shows the sequence of the control signals between a data source and the 6301 when a data transmission is taking place. The times $t_1 - t_6$ referred to may be found in Table 4.5.

A data transmission is indicated by the "End of Scan" signal on the source dropping from logic "1" to logic "0". The sequence of events is then as follows:

a) The leading edge of the "End of Scan" signal causes the 6301 to transmit a "Start" pulse on the "Start to System" line.

b) The leading edge of the "Start" pulse causes the data source to put the first word for punching on the data lines. It then resets its "Data Ready" line to a logic "1". The leading edge of this signal causes the 6301 to reset its "Data Received" line from logic "1" to logic "0", causing the data standing on the data lines to be accepted.

c) When the data transferred has been loaded into the punch buffer, the 6301 resets its "Data Received" line back to logic "1", which in turn causes the data source to set its "Data Ready" line back to logic "0". The punch cycle then begins.

d) The data source is then free put another word for punching onto the data lines. When this is completed, it again raises its "Data Ready" line to logic "1", which is reflected by the "Data Received" line dropping back to logic "0". However, the data for punching cannot be loaded into the punch buffer until the previous punch cycle is complete. The "Data Received" line then remains at logic "0" until the previous punch cycle has been completed, and data can again be loaded into the punch buffer. When the data standing on the data lines has been loaded into the punch buffer, the "Data Received" line resets to logic "1", and the new punch cycle begins. The "Data Ready" line reflects this by reseting to logic "0". (Note that data must not be removed from the input of the punch buffer until the "Data Received" line resets to logic "1").

e) The cycle described in (d) is then repeated until the end of the transmission. When all the data to be punched has been transmitted, the "End of Scan" signal resets to logic "1", thus inhibiting any further transmission. Note that if the DATA INPUT is also connected the reseting of the "End of Scan" signal causes the transfer of punching control to it.

Note that in the timing of this sequence, the times t_5 and t_6 are to some extent interdependent, since their sum must be approximately equal to the length of the punch cycle (16 msec. when punching at the fastest rate). Thus, if t_5 is very short (as, say, in computer operations), t_6 approaches the length of the punch cycle. Note also, however, that if t_5 exceeds 5 msec., the punch will operate in a step-by-step mode giving a maximum punching rate of 50 characters per second, compared with its fastest rate of 70, and that the maximum value of t_6 will now be 22 msec.

Pin	Function
1	Connected to Pin 2
2	Connected to Pin 1
3	No Connection
4	Bit 2
5	No Connection
6	No Connection
7	Bit 8
8	Bit 7
9	No Connection
10	Bit 6
11	Bit 4
12	Ground
13	Ground from Supp. Source
14	End of Scan
15	No Connection
16	Data Ready
17	Bit 3
18	Data Received
19	No Connection
20	Bit 5
21	No Connection
22	No Connection
23	Start of System
24	No Connection
25	Bit 1

072017

Table 4.4. Pin Identification of SUPPLEMENTARY SOURCE INPUT socket

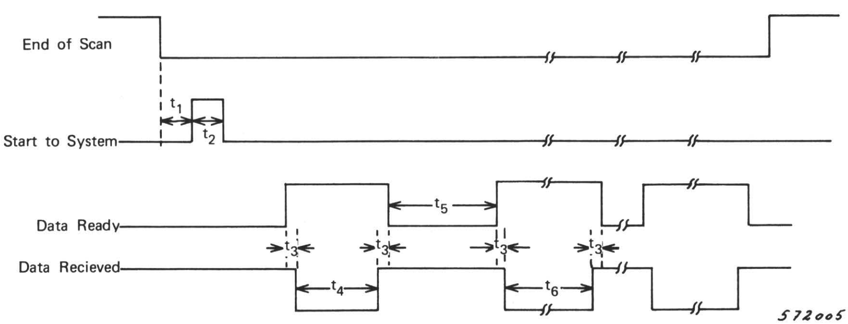

Fig.4.5. Control Signals at SUPPLEMENTARY SOURCE INPUT

Delay Time	Minimum Value μsec.	Maximum Value μsec.
t_1	4	6
t_2	3	5
t_3	1	3
t_4	40	60
t_5	-	5 msec
t_6	11 msec	16 msec

072018

Table 4.5. Delay times between control signals to SUPPLEMENTARY SOURCE INPUT

4.3. CHANNEL COUNTER

The Channel Counter is a device which generates identifying numbers for the successive outputs of third octave filters, in such a way that the channel number generated is equal (to the nearest integer) to 10 log f_o, where f_o is the centre frequency of the filter whose output is being identified. The centre frequencies of the filters corresponding to channels 1 to 10 is given in Table 4.6.

Channel No.	Centre Frequency Hz
1	1.25
2	1.6
3	2.0
4	2.5
5	3.15
6	4.0
7	5.0
8	6.3
9	8.0
10	10.0

072019

Table 4.6. Centre frequencies of 1/3 octave channels 1 — 10

As third octave filter sets will start at different centre frequencies the first two channels numbers generated by the counter may be programmed. These may thus be set to correspond to the centre frequencies of the first two filters of the third octave set being used, or in the case of a Real-Time Third Octave Analyzer, Type 3347, to 0 (the reference channel) and to correspond to the centre frequency of the first third octave filter. After the second programmed number, the Channel Counter will count sequentially until such a time that the data transmission is terminated.

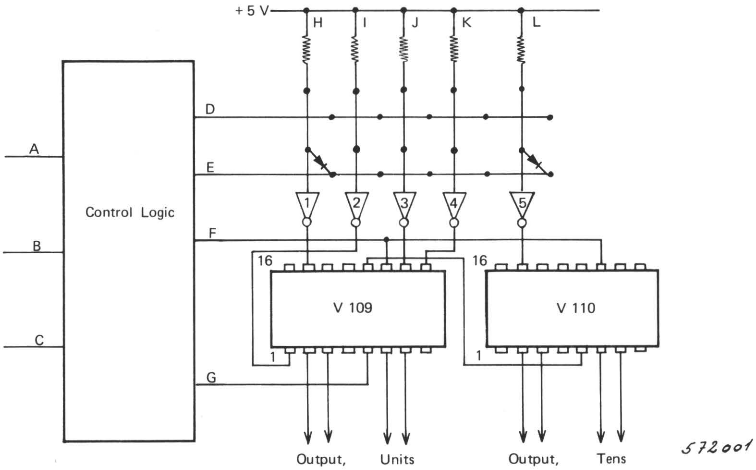

Fig.4.6. Schematic Diagram of Channel Counter

The essential parts of the Channel Counter are shown in Fig.4.6. It consists of two BCD counters, (V 109, V 110), the Control Logic required to drive it, and the circuitry required to program the first two channel numbers. Programming of the first two Channel numbers is carried out by the connection, with diodes, between lines H to L and line D in the case of the first one, and lines H to L and line E in the case of the second, using an 8-4-2-1 BCD code. The relative weights of lines H to L in the BCD code are given in Table 4.7, a diode being connected to represent a logic "1" on a particular line. Thus, in Fig.4.6, the first number is programmed to be zero, and the second to be 11, which should correspond to a 3347, where the reference channel is denoted as channel zero, the first third octave channel having centre frequency 12.5 Hz.

If a third octave filter set were being used, where the first filter had a centre frequency of 20 Hz, the first channel number would be programmed as being 13 and the second as 14, (10011 and 10100 in 8-4-2-1 BCD). This could be achieved by the connection of diodes between line D and lines H, I and L for the first number, and line E and lines J and L for the second.

Line	BCD Weight
H	1
I	2
J	4
K	8
L	10

072020

Table 4.7. BCD weights of lines H – L in Channel Counter

Operation of the channel counter is as follows: at the start of a data transmission, the "Manual Start" pulse causes a signal to appear on line A of the Control Logic. This causes:

a) Line D to drop from logic "1" to logic "0", and line E to be raised from logic "0" to logic "1". Any diodes connected between line D and lines H to L become forward biased and conduct, meaning that the inputs to the inverters on the respective lines fall to logic "0". Where a diode is not connected, the input to the inverter on that line remains at logic "1". The signals from lines H to L are then inverted by inverters 1 to 5, such that the required BCD number stands on the inputs to the counters, V 109 and V 110.

b) A "Load" pulse to appear on line F, after the BCD number has been set up. This causes the number to be loaded into the counters.

The first number is then transmitted to the Parallel to Series Converter where it is combined with the first piece of input data from the data source. V 109 transmits the units figure and V 110 the tens. The Channel Counter now does not change its state until the punch transmits its first "Data Received" pulse. This causes a signal to appear on line B on the Control Logic. This, in turn, causes:

a) The positions in lines D and E to be reversed, i.e., line E falls to logic "0" and line D is raised to logic "1". The second programmed number thus now stands in the inputs to the two counters.

b) A second "Load" pulse to be transmitted, causing the second programmed number to be loaded.

This number is then transmitted, as before, to be combined with the second of the piece of input data from the data source.

After the second programmed number has been transmitted from the counter counting takes place sequentially from that number. Each "Data Ready" pulse from the data source causes a signal to appear on line C, which in turn causes the Control Logic to transmit a "Count" pulse to V 109 in line G, which causes it to increment itself by one.

When V 109 reaches the end of a decade count, it in turn tranmits a "Count" pulse to V 110. The Counters thus continue to count and transmit numbers sequentially, each number being combined with its respective piece of data in the Parallel to Series Converter, until such a time that the data transmission is terminated, or the capacity of the counters (99) is reached. If the capacity of the counters is reached, then on receipt of the next "Count" pulse, they reset to zero and continue counting. Note that two programmed numbers will not be reloaded without the receipt of another "Manual Start" pulse.

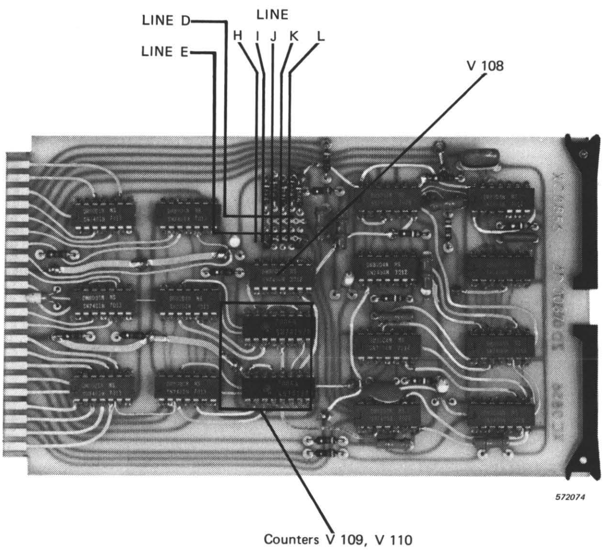

Fig.4.7. Board ZD 0037, showing positions of Channel Counter components

A photograph of board ZD 0037, on which the channel counter is mounted, is shown in Fig.4.7. The positions of lines D and E and H to L on the board are indicated, together with the positions of the counters, V 109 and V 110. The inverters are contained in V 108. In the photograph, there are no diode connections between line D and lines H to L, but line E is connected to lines H and L. The counter is thus programmed to deliver 0 and 11 as its first two numbers.

Note that although the Channel Counter operates continuously during any data transmission, its output is inhibited when "Computer Format" is selected. Its output is only punched if the equipment is operating in "Typewriter Format".

4.4. CODE CONVERTER

It is the Code Converter which takes the 4 bit BCD characters transmitted from the Parallel to Series Converter, inserts the extra characters demanded by the punch format, and transmits them as a recognised 8 channel punch code to the Data and Control Line switch. (A description of the standard punch formats and punch codes may be found in Section 4.5). A block diagram of the Code Converter may be found in Fig.4.8. This shows the control and data lines to and between the four main sections of the Code Converter.

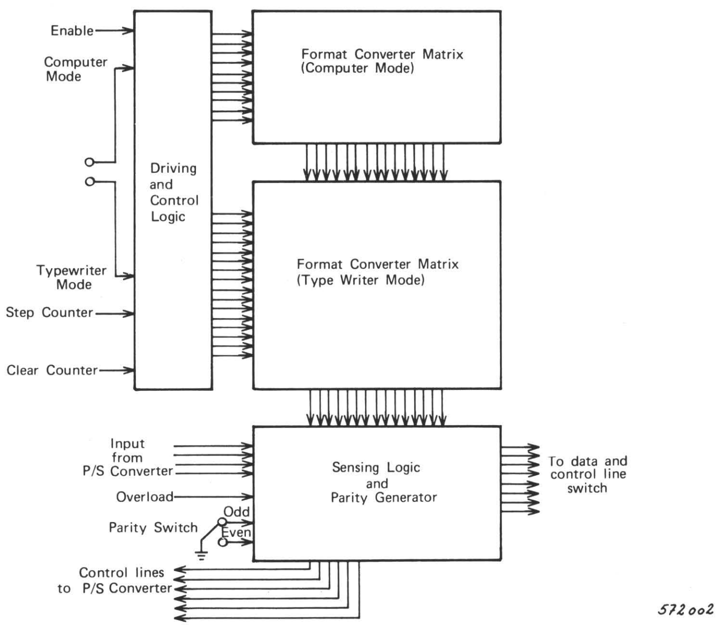

Fig.4.8. Block Diagram of Code Converter

The Driving and Control Logic consists primarily of a counter and two driving circuits, one for the "Computer Format" Format Converter Matrix, and one for the "Typewriter Format" Format Converter Matrix. They are controlled in such a way that only one of them can be energised at any one time. Selection of the driving circuit to be energised is via the TYPEWRITER FORMAT/COMPUTER FORMAT switch on the front panel of the Tape Punch. In "Typewriter Format" the driving circuit to the "Typewriter Format" Format Converter Matrix is enabled, and in "Computer Format" that to the "Computer Format" Format Converter Matrix is enabled. The Format Converter Matrices are Read Only Memories (ROMS), which actually generate the punch codes and formats. They consist of diode matrices, whose operation is similar to that used in programming the first two numbers generated by the channel counter, although on a much larger scale. They are also used to generate the control signals which regulate the flow of information from the Parallel to Series Converter to the Code Converter. The outputs from the Format Converter Matrices go directly to the Sensing Logic and Parity Generator. This consists of series of gates which combine the information from the Parallel to Series Converter with that from the format converter in use, before it is transmitted to the Data and Control Line switch, in the correct format and code. At the same time, it adds parity bits as required, and transmits the control signals back to the Parallel to Series Converter.

The operation of the Code Converter may be summarised as follows: at the start of the transmission of a piece of data, the counter in the Driving and Control Logic is in a cleared state. The receipt of the "Data Ready" pulse at the input to the punch causes a signal to appear on the "Step Counter" line. The sequence is then as follows:

a) The counter increments itself by one, and transmits a signal to the driving circuit selected, such that it will energise the first line in the diode matrix of the Format Converter.

b) The character generated by the first line of the Format Converter is transmitted to the Sensing Logic, where a parity bit is added, if required. The 8 channel punch code for the character thus generated is then transmitted to the Data and Control Line switch.

c) The counter again increments itself by one, causing the driving circuit to de-energise the first line of the diode matrix and energise the second.

d) In the standard ASCII punching format of the 6301, the second character punched is the first of the data characters from the Parallel to Series Converter. Thus, energising the second line of the diode matrix generates the control signal required for this 4-bit BCD character to be transmitted. This is transmitted from the Sensing Logic. The Parallel to Series Converter then sets the first BCD character to be punched on the Sensing Logic input.

e) This BCD character must now be converted into a punch code. In the standard punch codes offered with the 6301, (ASCII, Friden's Flexowriter and IBM PTTC/8), decimal integers are represented in a 4 bit BCD code in 4 channels. In the case of ASCII, 2 further bits are added in a further 2 channels to complete the punch code, but these added bits are always the same, whatever the integer being represented. (An exception to the above is the zero in both Friden's Flexowriter and IBM PTTC/8, which is not in BCD, see section 4.5). Thus, to convert the BCD character into a punch code, the Sensing Logic gates it such that the correct bit appears in the correct channel, adds any extra bits demanded by the punch code, (these are generated from the same line of the Format Converter Matrix as gave the control signal), and adds the parity bit as required. The now punch coded character is then transmitted by the Sensing Logic to the Data and Control Line switch.

f) The counter again increments itself, and the next operation programmed into the Format Converter Matrix is carried out. If it is to insert an extra character, as demanded by the punch format, this is generated from the diode matrix and transmitted. If it is to convert a BCD character from the Parallel to Series converter, the transfer control signal is transmitted, and the conversion takes place. The cycle is repeated until the last line of the diode matrix has been energised.

g) A signal is then raised in the "Clear Counter" line which causes the counter to clear itself. The last line is de-energised. The timing of the signal is dependent on that standing on the "End of Scan" input to the 6301. If this is at logic "0", the "Clear Counter" signal is fast enough to prevent the character generated by the last line of the diode matrix from being punched. It is only punched if the "End of Scan" signal is raised to logic "1".

h) The complete cycle is repeated when a signal appears on the "Step Counter" line to indicate that another block of data awaits conversion.

Note that in its standard form, the Code Converter is set to deliver even parity when operating in ASCII, and odd parity when operating in Friden's Flexowriter code, or IBM PTTC/8. Parity may be reversed by the addition of a short circuit to ground within the Parity Generator circuit. Fig.4.9 shows a photograph of the rear of board ZD 0036. It is on this board that the Code Converter for ASCII is mounted. (For Friden's Flexowriter and IBM PTTC/8, the board numbers are ZD 0039 and ZD 0038 respectively). The points between which the short circuit should be wired, in order to reverse parity, are indicated.

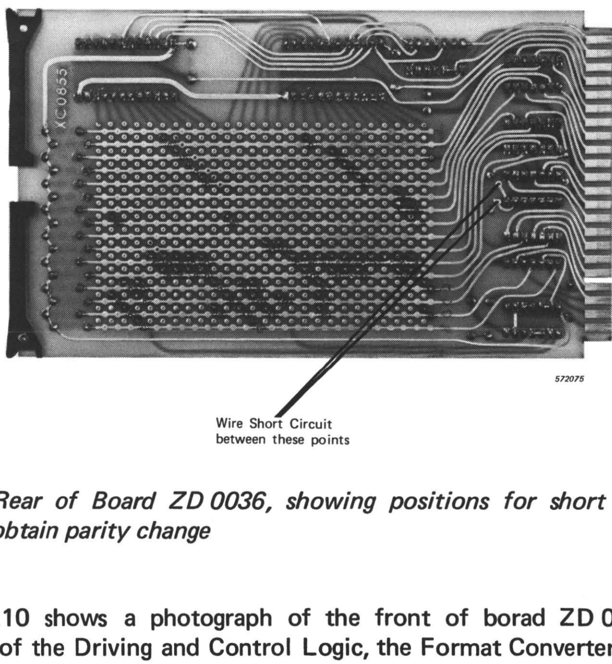

Fig.4.9. Rear of Board ZD 0036, showing positions for short circuit to obtain parity change

Fig.4.10 shows a photograph of the front of borad ZD 0036. The positions of the Driving and Control Logic, the Format Converter Matrices, and the Sensing Logic are indicated. Boards ZD 0038 and ZD 0039 show a similar layout, although, of course, the programming of the Format Converter Matrices will differ.

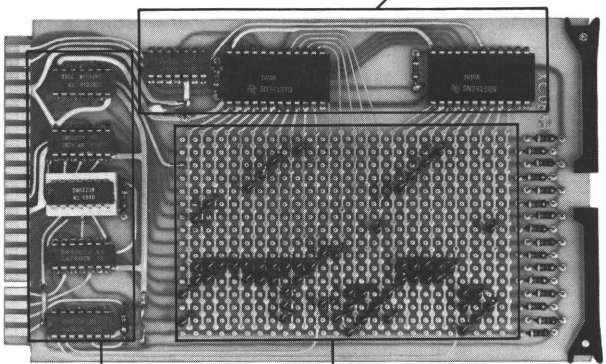

Fig.4.10. Front of Board ZD 0036, showing position of Code Converter components

4.5. PUNCH FORMATS AND CODES

In its standard form, the 6301 can punch a 14 bit BCD input to its DATA INPUT in one of two formats, "Typewriter Format" or "Computer Format" and in one of three punch codes, ASCII, Friden's Flexowriter or IBM PTTC/8. The format is selectable via the switch on the front panel, but the code punched is a design feature, which can only be changed by changing the programming of the Code Converter. In "Typewriter Format" up to 16 characters can be punched in a single line, while in "Computer Format" the limit is 10.

Fig.4.11 shows the layout of the print-out of a punched tape from the 6301 when an input is punched using "Computer Format", and when the same input is punched using "Typewriter Format".

Note that the output from the channel counter appears in "Typewriter Format" only, and that this mode also gives a more "readable" print-out. It is, however, due to the extra characters within the format which must be

Computer format	Type Writer Format
1000	00 100.0 DB
1000	11 100.0 DB
1000	12 100.0 DB
1000	13 100.0 DB
1106	14 110.4 DB
1124	15 112.2 DB
1102	16 110.0 DB
1118	17 111.6 DB
1100	18 109.8 DB
1138	19 113.8 DB
1006	20 100.2 DB
1116	21 111.4 DB
1172	22 117.0 DB
1188	23 118.6 DB
1220	24 122.0 DB
1214	25 121.2 DB
1236	26 123.6 DB
1268	27 126.8 DB
1326	28 132.6 DB
1310	29 131.0 DB
1322	30 132.2 DB
1318	31 131.6 DB
1318	32 131.6 DB
1308	33 130.8 DB
1302	34 130.2 DB
1298	35 129.8 DB
1274	36 127.4 DB
1254	37 125.4 DB
1224	38 122.2 DB
1204	39 120.4 DB
1178	40 117.8 DB
1138	41 113.8 DB
1114	42 111.2 DB
1062	43 105.8 DB
1000	44 100.0 DB
1000	45 100.0 DB
1000	46 100.0 DB
1000	47 100.0 DB
1000	48 100.0 DB

171089

Fig.4.11. Punching Formats of Type 6301

Character	"Computer Mode"	"Typewriter Mode"
1	Line Feed	Line Feed
2	First Digit from Data Source	First Digit in Channel No.
3	Second Digit from Data Source	Second Digit in Channel No.
4	Third Digit from Data Source	Space
5	Fourth Digit from Data Source	Space
6	Blank (– when overload signal on input)	First Digit from Data Source
7	Car Return	Second Digit from Data Source
8	Line Feed	Third Digit from Data Source
9	End of Transmission	Decimal point
10	–	Fourth Digit from Data Source
11	–	Blank (– when overload signal on input)
12	–	Letter D
13	–	Letter B
14	–	Car Return
15	–	Line Feed
16	–	End of Transmission

072021

Table 4.8. Punch formats, "Typewriter Format" and "Computer Format", ASCII

Character	"Computer Mode"	"Typewriter Mode"
1	New Line	New Line
2	Upper Case	Upper Case
3	First Digit from Data Source	First Digit in Channel No.
4	Second Digit from Data Source	Second Digit in Channel No.
5	Third Digit from Data Source	Blank
6	Fourth Digit from Data Source	Blank
7	Blank (– when overload signal on input)	First Digit from Data Source
8	New Line	Second Digit from Data Source
9	Code Stop	Third Digit from Data Source
10	–	Decimal Point
11	–	Fourth Digit from Data Source
12	–	Blank (– when overload signal on input)
13	–	Letter D
14	–	Letter B
15	–	New Line
16	–	Code Stop

072022

Table 4.9. Punch formats, "Typewriter Format" and "Computer Format", Friden's Flexowriter

Character	"Computer Mode"	"Typewriter Mode"
1	New Line	New Line
2	Lower Case	Lower Case
3	First Digit from Data Source	First Digit in Channel No.
4	Second Digit from Data Source	Second Digit in Channel No.
5	Third Digit from Data Source	Blank
6	Fourth Digit from Data Source	First Digit from Data Source
7	Blank (– when overload signal on input)	Second Digit from Data Source
8	Blank Space	Third Digit from Data Source
9	New Line	Decimal Point
10	End of Block	Fourth Digit from Data Source
11	–	Blank (– when overload signal on input)
12	–	Upper Case
13	–	Letter D
14	–	Letter B
15	–	New Line
16	–	End of Block

072023

Table 4.10. Punch formats, "Typewriter Format" and Computer Format", IBM PTTC/8

punched. The punching formats in "Typewriter Format" and "Computer Format" for the ASCII, Friden's Flexowriter, and IBM PTTC/8 codes are illustrated in Tables 4.8, 4.9 and 4.10 respectively. Note that the last character in the format (i.e. character 16 in "Typewriter Format" and character 9 or 10 in "Computer Format") is only punched when the "End of Scan" signal on the DATA INPUT is raised to logic "1". This character corresponds to "End of Transmission" in ASCII, "Code Stop" in Friden's Flexowriter code, and "End of Block" in IBM PTTC/8. Thus, if the data source is a Real Time Third Octave Analyzer, Type 3347, this character will only appear when the data pertaining to the last channel has been punched. Note also, however, that if the data source is a Digital Encoder, Type 4421, this character will never be punched, as the "End of Scan" signal is absent.

ASCII code:

	8	7	6	5	4	.	3	2	1
Line Feed					4	.		2	
Car Return	8				4	.	3		1
End of Transmission	8					.	3		
Blank	8		6			.			
.			6		4	.	3	2	
,	8		6		4	.	3		
!			6			.			1
(			6		4	.			
)	8		6		4	.			1
=	8		6	5	4	.	3		1
$			6			.	3		
?			6	5	4	.	3	2	1
@	8	7				.			
A		7				.			1
B		7				.		2	
C	8	7				.		2	1
D		7				.	3		
E	8	7				.	3		1
F	8	7				.	3	2	
G		7				.	3	2	1
H		7			4	.			
I	8	7			4	.			1
J	8	7			4	.		2	
K		7			4	.		2	1
L	8	7			4	.	3		
M		7			4	.	3		1
N		7			4	.	3	2	
O	8	7			4	.	3	2	1
P		7		5		.			
Q	8	7		5		.			1
R		7		5		.		2	
S		7		5		.		2	1
T	8	7		5		.	3		
U		7		5		.	3		1
V		7		5		.	3	2	
W	8	7		5		.	3	2	1
X	8	7		5	4	.			
Y		7		5	4	.			1
Z		7		5	4	.		2	
0			6	5		.			
1	8		6	5		.			1
2	8		6	5		.		2	
3			6	5		.		2	1
4	8		6	5		.	3		
5			6	5		.	3		1
6			6	5		.	3	2	
7	8		6	5		.	3	2	1
8	8		6	5	4	.			
9			6	5	4	.			1

072024

Fig.4.12. ASCII punch code

The ASCII, Friden's Flexowriter and IBM PTTC/8, punch codes may be found in Figs.4.12, 4.13 and 4.14 respectively. Note that in ASCII, the parity bit is contained in channel 8, while in Friden's Flexowriter code and IBM PTTC/8, it is contained in Channel 5.

Friden's Flexowriter Code:

	8	7	6	5	4	.	3	2	1	Upper Case/Lower Case
Lower Case		7	6	5	4	.		2		(U/L)
New Line	8					.				(U/L)
Stop Code					4	.		2	1	(U/L)
Upper Case		7	6	5	4	.	3			(U/L)
Blank				5		.				(U/L)
.		7	6		4	.		2	1	(U)
(				5		.	3		1	(L)
+				5		.	3	2		(L)
)			6			.				(L)
-		7				.				(U)
/			6	5		.			1	(U)
'			6	5	4	.		2	1	(U)
=		7				.				(L)
A		7	6			.			1	(U)
B		7	6			.		2		(U)
C		7	6	5		.		2	1	(U)
D		7	6			.	3			(U)
E		7	6	5		.	3		1	(U)
F		7	6	5		.	3	2		(U)
G		7	6			.	3	2	1	(U)
H		7	6		4	.				(U)
I		7	6	5	4	.			1	(U)
J		7		5		.			1	(U)
K		7		5		.		2		(U)
L		7				.		2	1	(U)
M		7		5		.	3			(U)
N		7				.	3		1	(U)
O		7				.	3	2		(U)
P		7		5		.	3	2	1	(U)
Q		7		5	4	.				(U)
R		7			4	.			1	(U)
S			6	5		.		2		(U)
T			6			.		2	1	(U)
U			6	5		.	3			(U)
V			6			.	3		1	(U)
W			6			.	3	2		(U)
X			6	5		.	3	2	1	(U)
Y			6	5	4	.				(U)
Z			6		4	.			1	(U)
0			6			.				(U)
1						.			1	(U)
2						.		2		(U)
3				5		.		2	1	(U)
4						.	3			(U)
5				5		.	3		1	(U)
6				5		.	3	2		(U)
7						.	3	2	1	(U)
8					4	.				(U)
9				5	4	.			1	(U)

072025

Fig.4.13. Friden's Flexowriter punch code

Note that as an alternative to the formats and the choice of codes, other formats and codes can be designed in request, although this will incur extra cost, since it requires non-standard programming of the Code Converter. However, the 6301 could be programmed to punch in any 8 channel code, and in any format, provided that the number of characters in a line is limited to 16 in "Typewriter Format" and 10 in "Computer Format".

IBM PTTC/8 Code:

	8	7	6	5	4	.	3	2	1	Upper Case/Lower Case
Lower Case		7	6		4	.	3	2		(U/L)
New Line	8	7		5	4	.	3		1	(U/L)
Backspace		7		5	4	.	3	2		(U/L)
Line Feed			6	5	4	.	3		1	(U/L)
End of Block			6	5	4	.	3	2		(U/L)
Upper Case					4	.	3	2		(U/L)
Blank				5		.				(U/L)
.		7	6		4	.		2	1	(L)
(				5	4	.			1	(U)
+		7	6	5		.				(U)
&		7	6	5		.				(L)
$		7		5	4	.		2	1	(L)
*					4	.				(U)
)				5	4	.		2		(U)
-		7				.				(L)
/			6	5		.			1	(L)
,			6	5	4	.		2	1	(L)
'				5		.	3	2		(U)
=						.			1	(U)
A		7	6			.			1	(U)
B		7	6			.		2		(U)
C		7	6	5		.		2	1	(U)
D		7	6			.	3			(U)
E		7	6	5		.	3		1	(U)
F		7	6	5		.	3	2		(U)
G		7	6			.	3	2	1	(U)
H		7	6		4	.				(U)
I		7	6	5	4	.			1	(U)
J		7		5		.			1	(U)
K		7		5		.		2		(U)
L		7				.		2	1	(U)
M		7		5		.	3			(U)
N		7				.	3		1	(U)
O		7				.	3	2		(U)
P		7		5		.	3	2	1	(U)
Q		7		5	4	.				(U)
R		7			4	.			1	(U)
S			6	5		.		2		(U)
T			6			.		2	1	(U)
U			6	5		.	3			(U)
V			6			.	3		1	(U)
W			6			.	3	2		(U)
X			6	5		.	3	2	1	(U)
Y			6	5	4	.				(U)
Z			6		4	.			1	(U)
0				5	4	.		2		(L)
1						.			1	(L)
2						.		2		(L)
3				5		.		2	1	(L)
4						.	3			(L)
5				5		.	3		1	(L)
6				5		.	3	2		(L)
7						.	3	2	1	(L)
8					4	.				(L)
9				5	4	.			1	(L)

072026

Fig.4.14. IBM PTTC/8 punch code

5. SPECIFICATIONS

5.1. DATA INPUT

Data Input:	14 bit 8-4-2-1 BCD code, at levels compatible with standard DTL and TTL levels.
Control Signals to 6301:	Manual Start of System Data Ready for Transfer Overload End of Scan
Control Signals from 6301:	Data Request Data Received

5.2. SUPPLEMENTARY SOURCE INPUT

Data Input:	8 bit, in any code, at levels compatible with standard DTL and TTL levels.
Control Signals to 6301:	Start to System Data Ready for Transfer End of Scan
Control Signals from 6301:	Data Received

5.3. PUNCH OUTPUT (DATA INPUT)

Punch Speed:	0 to 70 characters per second.
Punch Format:	"Typewriter Format" or "Computer Format". Selectable via switch on front panel. Actual formats programmed into the Code Converter.

Punch Code:	Any 8 channel punch code, as programmed into Code Converter. A choice of either ASCII, Friden's Flexowriter, or IBM PTTC/8 may be programmed into the ROM of the Code Converter in the Standard 6301. UNLESS OTHERWISE SPECIFIED AT THE TIME OF ORDERING, THE ASCII CODE CONVERTER IS SUPPLIED.

5.4. PUNCH OUTPUT (SUPPLEMENTARY SOURCE INPUT)

Punch Speed:	0 to 70 characters per second.
Punch Format:	Exactly as format of data input to SUPPLEMENTARY SOURCE INPUT.
Punch Code:	Exactly as code of data input to SUPPLEMENTARY SOURCE INPUT.

5.5. CHANNEL COUNTER

Programming:	First two numbers generated programmable between 0 and 19.
Counting:	Sequential from the second programmed number up to upper limit of 99, and then from 0 to 99. Programmed numbers only generated when "Manual Start" signal received.
Output:	Output from the Channel Counter only punched when the 6301 is operating in "Typewriter Format" from the DATA INPUT. (Standard model).

5.6. CODE CONVERTER

Programming:	Programmable to deliver any 8 channel punch code in any format where the limit

is 16 characters per line in "Typewriter Format" and 10 characters per line in "Computer Format". Standard punch codes and formats as in section 4.5. Others may be designed request at extra cost. Changing from one punch code to another requires that the Code Converter be changed.

Parity: Odd or even as required.

5.7. POWER REQUIREMENTS

Power Supply: 100 – 115 – 127 – 150 – 220 – 240 V AC at 50 Hz. If Power Supply is 60 Hz, this should be specified at the time of ordering.

Power Consumption: 100 VA

5.8. MECHANICAL DETAILS

Dimensions: 19 in rack mounting
Height: 266 mm (10.5 in)
Width: 485 mm (18.5 in)
Depth: 350 mm (13.75 in)

Weight: Model A (metal case) 24.3 kg
Model C (19 in rack mounting) 22.7 kg

5.9. ACCESSORIES INCLUDED

1 x QP 6000 spool of paper tape

1 x AO 0084 cable for connection between the 6301 and the 4421, 5599 or 7502

1 x AO 0085 cable for connection between the 6301 and the 3347, (4710).

1 x QP 6000	spool of paper tape
1 x AO 0084	cable for connection between the 6301 and the 4421, 5599 or 7502.
1 x AO 0085	cable for connection between the 6301 and the 3347, (4710).

5.10 ACCESSORIES AVAILABLE

Cable AO 0103 for connection between the 6301 and the 7504.

Extra Code Converters such that the 6301 may be used to punch in more than one code. The standard code converter board numbers are:

ASCII	ZD 0036
Friden's Flexowriter	ZD 0039
IBM PTTC/8	ZD 0038

BRÜEL & KJÆR instruments cover the whole field of sound and vibration measurements. The main groups are:

ACOUSTICAL MEASUREMENTS
Condenser Microphones
Piezoelectric Microphones
Microphone Preamplifiers
Sound Level Meters
Precision Sound Level Meters
Impulse Sound Level Meters
Standing Wave Apparatus
Noise Limit Indicators
Microphone Calibrators

ACOUSTICAL RESPONSE TESTING
Beat Frequency Oscillators
Random Noise Generators
Sine-Random Generators
Artificial Voices
Artificial Ears
Artificial Mastoids
Hearing Aid Test Boxes
Audiometer Calibrators
Telephone Measuring Equipment
Audio Reproduction Test Equipment
Tapping Machines
Turntables

VIBRATION MEASUREMENTS
Accelerometers
Force Transducers
Impedance Heads
Accelerometer Preamplifiers
Vibration Meters
Accelerometer Calibrators
Magnetic Transducers
Capacitive Transducers
Complex Modulus Apparatus

VIBRATION TESTING
Exciter Controls — Sine
Exciter Controls — Sine — Random
Exciter Equalizers, Random or Shock
Exciters
Power Amplifiers
Programmer Units
Stroboscopes

STRAIN MEASUREMENTS
Strain Gauge Apparatus
Multi-point Panels
Automatic Selectors

MEASUREMENT AND ANALYSIS
Voltmeters and Ohmmeters
Deviation Bridges
Measuring Amplifiers
Band-Pass Filter Sets
Frequency Analyzers
Real Time Analyzers
Heterodyne Filters and Analyzers
Psophometer Filters
Statistical Distribution Analyzers

RECORDING
Level Recorders
Frequency Response Tracers
Tape Recorders

DIGITAL EQUIPMENT
Digital Encoder
Digital Clock
Computers
Tape Punchers
Tape Readers

BRÜEL & KJÆR

DK-2850 Nærum, Denmark. Teleph.: (01) 80 05 00. Cable: BRUKJA, Copenhagen. Telex: 15316

Orboe Print · Copenhagen · Denmark