

Trade of Sheet Metalwork

Module 7:	Introduction to CNC Sheet Metal Manufacturing
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Unit 5:	Data Input/ Storage/ Programme Proving
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	Phase 2
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Document Release History

Date	Version	Comments
20/01/07	First draft	
09/04/14	2.0	SOLAS transfer

Module 7 – Introduction to CNC Sheet Metal Manufacturing

Unit 5 – Data Input/ Storage/ Programme Proving

Duration – 14 Hours

Learning Outcome:

By the end of this unit each apprentice will be able to:

- State the methods which may be used to enter data into a CNC system
- State the methods which are commonly used for programmer proving
- Input a programme using 1) Manual data input; 2) Computer DNC/Palm top/disk reader
- Edit a programme using machine console
- Prove a programme using dry run and graphic simulation

Key Learning Points:

Rk	Manual data input – conversational data input. Master computer (direct numerical control).
SK	Dry run, test run, plotter tool path graphics.
P H	Safety during unguarded programme proving, collision free tool path.

Training Resources:

- Examples of data input devices, e.g. scanner, digital camera
- Prepared part programmes
- CNC machine

Key Learning Points Code:

M = Maths **D** = Drawing **RK** = Related Knowledge **Sc** = Science
P = Personal Skills **Sk** = Skill **H** = Hazards

Data Input/Storage Methods

The main methods which can be used to input data into a CNC control unit are:

- Punched tape and tape reader
- Magnetic tape
- Magnetic disc
- Host computer/DNC link or RS232 interface
- Manual data input

Punched Tape: This is a low cost method of data input. The tape is available in rolls or can be fan folded.

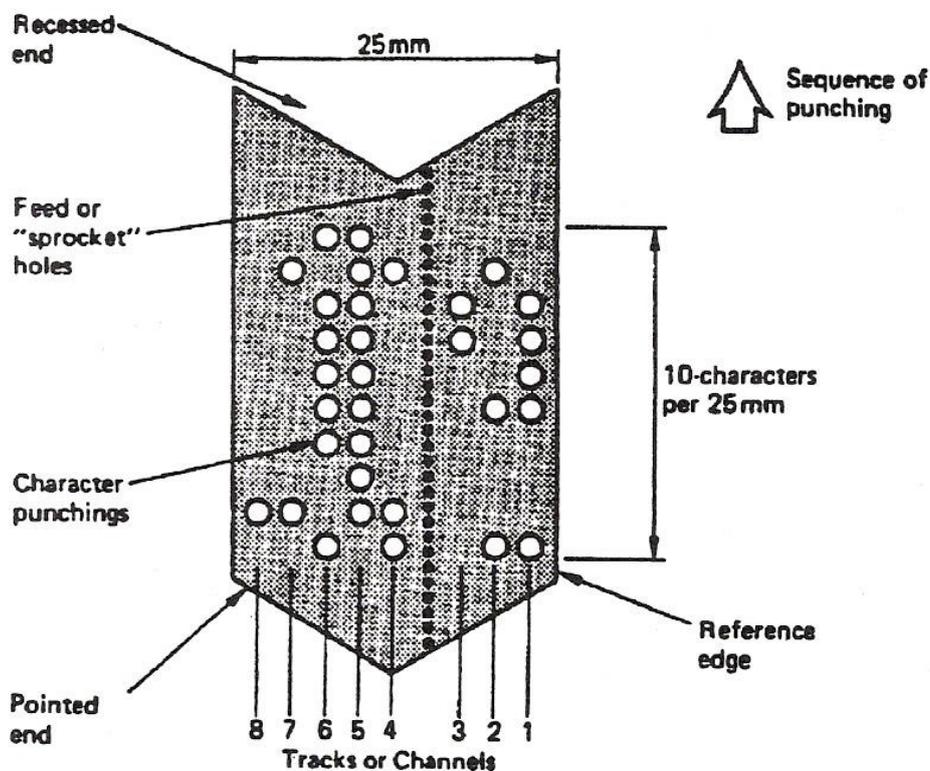


Figure 1 - Section of Punched Tape

Punched tape is available made from paper, polyester, paper/polyester laminates, or polyester/aluminium foil laminates.

Punched tape has certain advantages such as shop floor suited i.e. insensitive to magnetic fields or oil contamination. It can also be read visually by an experienced person. Tape damage is also immediately noticeable.

The disadvantages of punched tape are the sprocket holes tend to wear or tear with use. The storage density is low and the tape is not erasable and re-usable.

Tape readers: The function of the tape reader is to detect the presence and position of holes in the tape. There are three different types of tape reader:

- Pneumatic
- Mechanical
- Photo-electric

Magnetic Tapes and Discs

Magnetic tape is a cheap and convenient method of storing large volumes of data in a small space. Tape cassettes are easy to handle and store. It can also be erased and rewritten as required. The tape recorder fulfils the task of both the tape punch and tape reader since it can record and playback.

However it is impossible for an operator to know if a tape contains any information or not by visual inspection. Magnetic tapes can also be erased accidentally in the presence of a magnetic field.

Magnetic Discs

The data transfer rate is faster for a disc than magnetic tape. The access time to stored data is faster because the disc is a random access device. That is any single piece of data recorded on the disc can be accessed as easily and as quickly as any other.

Host Computer

The process of transferring part programs from a host computer into the memory of a CNC machine tool is called Direct Numerical Control (DNC). A number of machine tools of different types can be involved.

Manual Data Input (MDI)

This is a term used to describe the method of entering data into the machine control unit using the console keypad. The entering of complete programs other than relatively short ones is not practical as the machine is idle while data is being entered on most machines. The most common use of MDI is for editing programs and for machine setup. This has the advantage that once edited the new program can be saved or re-punched automatically by outputting to the tape punch.

Advantages of DNC Link

While the MCU might be doing any job at a particular moment, someone else, logged in at the mainframe, might be preparing drawings, programs etc. There is no need for interrupting the production since a job's preparation can be done off line.

The mainframe can serve as a mass storage system for all MCUs connected to it.

DNC linking is a method of communicating between a general purpose computer and a CNC machine tool. In the true sense a DNC system contains a number of numerically controlled machines. All the machines are linked to a mainframe computer which sends the information to the individual machines as required.

One widely used system of electrical connections is the Electronic Industries Association (EIA) communication standard RS232C interface. This is a serial interface for data transmission. There can be up to eight or more wires in the linking cable, but the minimum connections required are:

- (a) A wire for transmitting data from the computer to the machine.
- (b) A wire for sending data from the machine to the computer.
- (c) A wire to act as a common return.

To send direct to the machine it is necessary for the control units of the machine tool to have an RS232 interface fitted as part of the electrical circuitry. The speed of transmission of the data has to be set for both transmitting from the computer and receiving by the control unit. The speed transfer is measured in bauds, and the transfer rate can be set to values ranging from 110 to 9600 bauds. It is also necessary to ensure that the format of the byte being sent i.e. the number of data bits, odd even or null parity and number of stop bits is what the computer in the machine control unit is set up to receive.

Program Proving

Before a program is used it should be 'proved' to check that the desired operation will take place. The consequences of not proving a part program range from damage to the components and tooling, catastrophic damage to the machine tool or serious injury to the operator or other observers. The following methods can be used to prove a program.

Dry Run

This involves running the program in automatic mode without the component installed in the chuck or on the machine table. The purpose is to verify the tool path.

Plotter

A relatively simple way of checking the programmed component profile is to substitute a pen tip for the cutting tool. For a milling operation a two dimensional trace of the cutter path may be produced on paper by placing a board on top of the machine table.

Single Step or Stepping

This involves the operation "stepping" through the program line by line and actually cutting a component one step at a time. After each step the next movement is carefully checked before execution.

Computer Graphics

The program is fed into a computer using the keyboard, floppy disc or tape. The computer graphics are then used to simulate a test run. The correct sized blank appears on the screen and using animated tool movements it is machined to final shape and size according to the program data.

Self Assessment

Questions on Background Notes – Module 7.Unit 5

1. List three methods used to input data into a CNC Control Unit.

2. What is a DNC Link?

3. What are the advantages of a DNC Link?

Answers to Questions 1-3. Module 7. Unit 5

1.

- Punch Tape
- Tape Reader
- Magnetic Tape
- Magnetic Disc
- Host Computer/ DNC Link
- Manual Data Input

2.

DNC Linking is a method of communicating between a general purpose computer and a CNC machine.

3.

While the MCU might be doing any job at a particular time, someone else logged in at the mainframe might be preparing drawings programs etc. The main framer can serve as a mass storage system for all MCU's connected to it.

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