TURRET PUNCH PRESS MACHINES

RS-232C COMMUNICATIONS

(CBD-06)

SOFTWARE SPECIFICATIONS

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CONTENTS

1. APPLICATIONS

These specifications apply to the protocol of communications between an NC device for a turret punch press made by NISSHINBO and an external device via RS-232C.

2. SYSTEM OUTLINE

Between the NC device and the external device this system has the ability to receive and send NC programmes.

3. TRANSMISSION SPECIFICATIONS

1. Interface	In accordance with RS-232C
2. Transmission system	Start-stop synchronous system, Half duplex system
3. Transmission speed	Variable (selected from 600, 1200, 2400, 4800, 9600, 19200 bps)
4. Data format	Data bit : Variable (selected from 7, 8) Stop bit : Variable (selected from 1, 2) Parity : Variable (selected from NONE, ODD, EVEN)
5. Flow control	Flow controlled by RTS, CTS (The control will exit from waiting by either time-out or manual termination.)
6. Transmission code	ASCII code
7. Protocol name	CBD-06 (NISSHINBO)

(NOTE) _____ is default, but is changeable at the control.

4. COMMUNICATIONS PORT

4-1. COMMUNICATION PORT CONNECTOR

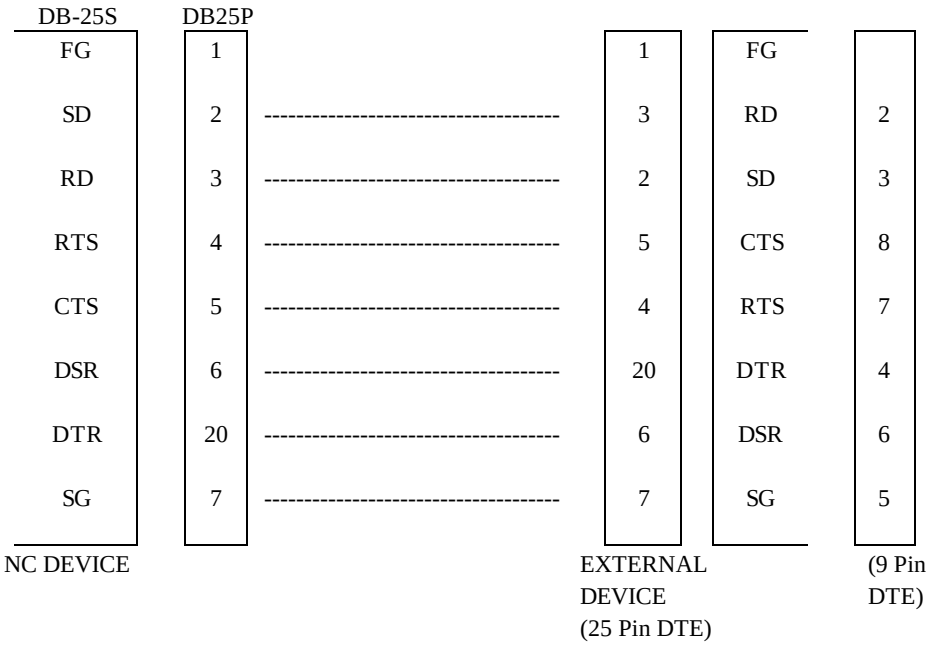
The NC device employs a 25 pin D-SUB connector (female type) as a connector for communication port.

4-2. COMMUNICATION PORT CONNECTOR PIN ARRANGEMENT

1	FG	(FRAME GROUND)
2	SD (TXD)	(TRANSMITTED DATA)
3	RD (RXD)	(RECEIVED DATA)
4	RS (RTS)	(REQUEST TO SEND)
5	CS (CTS)	(CLEAR TO SEND)
6	DR (DSR)	(DATA SET READY)
20	ER (DTR)	(DATA TERMINAL READY)
7	SG	(SIGNAL GROUND)

4-3. THE SIGNAL CONNECTION FOR COMMUNICATION PORT

The following signals are employed between the NC device and the external device. In cases where the length of the communication cable is greater than or equal to 15 metres, an optical communication modem may have be used.



5. TRANSMISSION CODE

The ASCII code is used for the transmission protocol.

5-1. CONTROL CODES

The following codes are employed in order to control the communication functions.

DC1 [11H] : to request start sending text data (NC programme)
DC2 [12H] : to indicate start receiving text data (NC programme)
DC3 [13H] : to request stop sending text data (NC programme)
DC4 [14H] : to indicate end receiving text data (NC programme)
ACK[06H] : to confirm that the text data has been received (NC programme)

5-2. TEXT DATA (NC PROGRAMME)

The text data is written in ASCII codes. For reference, a list of ASCII codes is shown in [APPENDIX 1].

6. COMMUNICATION FUNCTION

6-1. SINGLE RECEIVING FUNCTION

For sending a single program to the control, the NC device sends a signal to the external device, and then receives one NC programme. The procedure is as follows.

(1) The NC device sends a DC1 code.

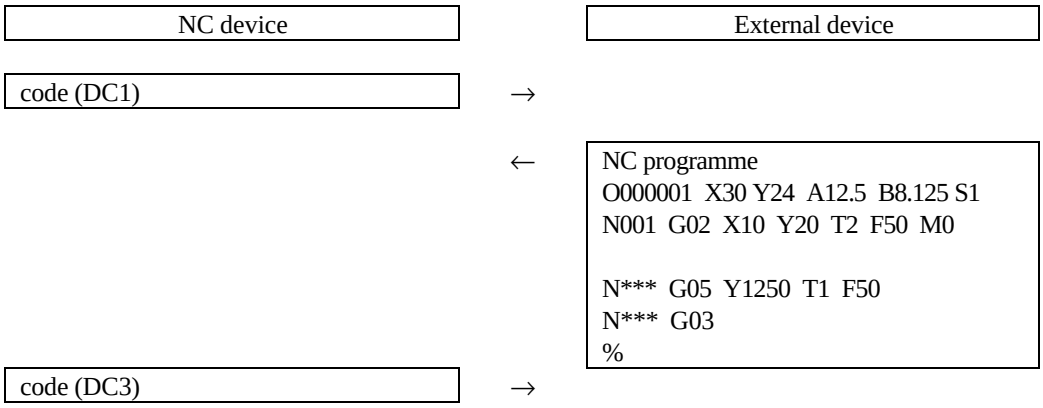
(2) The external device starts sending text data (NC programme) to the NC device after receiving the DC1 code. The text data should end with a set of three characters, "% <CR> <LF>" as a data end mark at the end of text data.

(3) The NC device recognises the completion of receiving data from the external device by receiving the data end mark.

(4) The NC device sends the DC3 code after the completion of data received, and then its receive procedures finish.

(5) After the external device sends the data end mark, it finishes the sending procedures by receiving the DC3 code from the NC device.

An outline of the single receiving procedure is shown in "FIGURE 1". Note that although it is not required, it is acceptable to have the program begin with "<DC2> <CR> <LF>" and to end with "<DC4>" for compatibility with Schedule Receiving, described later in this document.



[FIGURE 1] A SUMMARY OF THE SINGLE RECEIVE PROCEDURE

6-2. SINGLE SENDING FUNCTION

The single sending function is defined as that the NC device sends a signal to the external device, and then sends one NC programme to the external device. Its procedure is as follows.

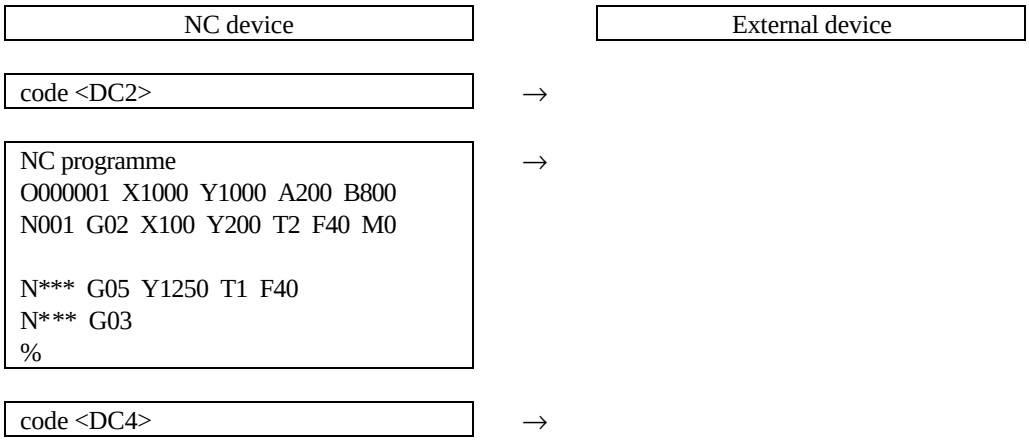
(1) The NC device sends the <DC2> code.

(2) When the external device receives the <DC2> code, it will enter a waiting condition to receive the text data (NC programme).

(3) The NC device sends the text data (NC programme) after the <DC2> code. At the end of the text data, a data end mark will be sent, (a set of the three characters "% <CR> <LF>"), followed by a <DC4> code.

(4) The external device recognises that it has completed receiving data from the NC device after receiving the data end mark and the <DC4> code, and then finishes its receiving procedure.

Refer to an outline of the single sending procedure shown below [FIGURE-2].



[FIGURE-2] A SUMMARY OF THE SINGLE SENDING FUNCTION

6-3. SCHEDULED RECEIVING FUNCTION

The scheduled receiving function is defined as that the external device sends a signal, and then sends one or more NC programmes to the NC device. Its procedure is as follows.

(1) The external device sends the <DC2> code.

(2) When the NC device receives the <DC2> code, and it will enter a waiting condition to receive the text data (the NC programme).

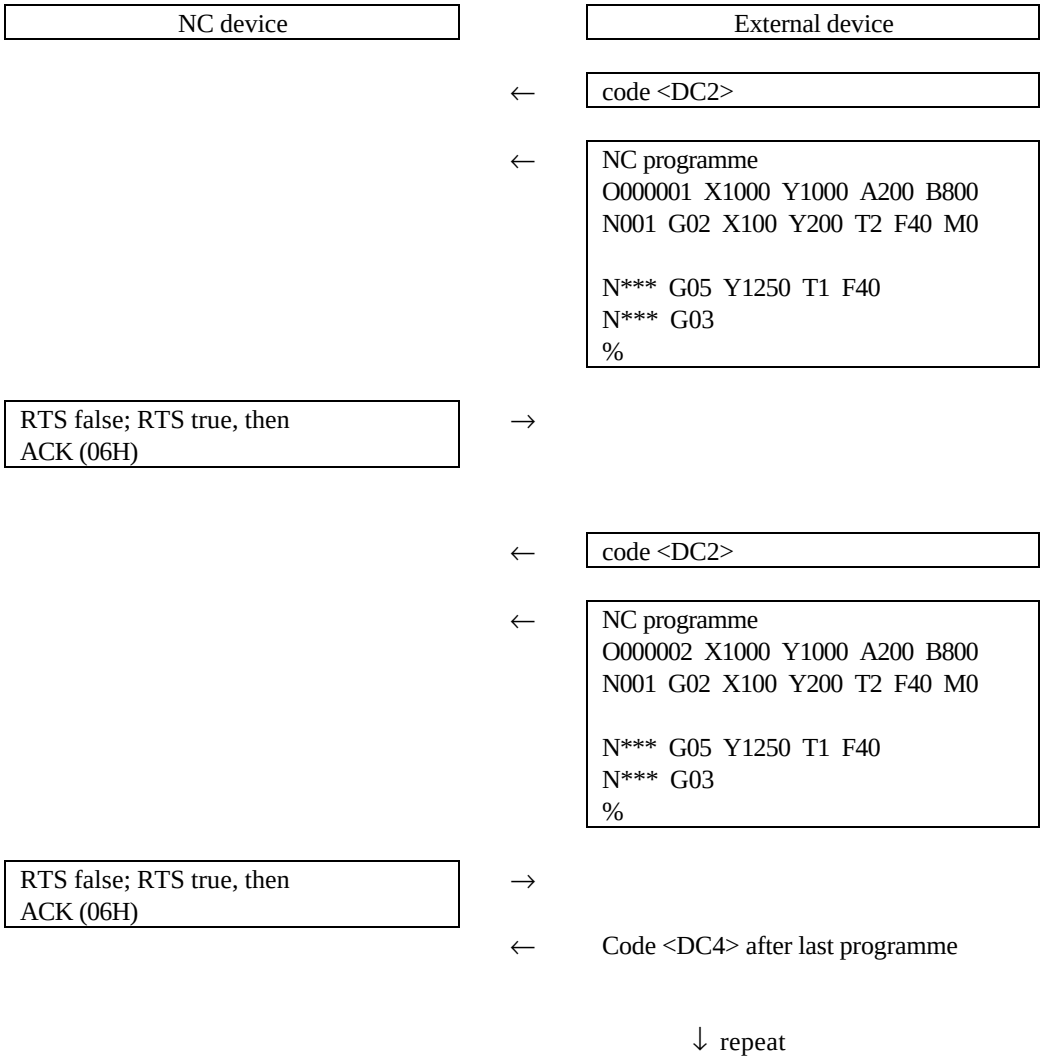
(3) The external device sends the text data (the NC programme) after sending the <DC2> code. A data end mark, (a set of the three characters "% <CR> <LF>"), must be sent at the end of the text file.

(4) The NC device recognises that it has received one entire program by seeing the data end from the external device, and then finishes its receiving procedure.

(5) The NC device stores the received NC programme in the buffer memory, and then converts it into the control's internal storage format. This process may take several seconds. When it becomes possible to receive the next programme, it will send the ACK code. The control will also cause the RTS signal to be false when it is no longer capable of receiving data, and re-assert RTS when it is ready to receive additional information.

(6) A number of NC programmes, (9 maximum, depending on machine model), can be sent from the external device to the NC device, by repeating (1) - (5). The NC device stores the received programme in the buffer memory sequentially. A <DC2> code should be sent after the last NC programme is sent.

Refer to an outline of the schedule receiving procedure shown below [FIGURE-3].
Refer to an outline of a storage method for the received NC programme in the buffer memory shown below [FIGURE-4].



[FIGURE-3] AN OUTLINE OF THE SCHEDULED RECEIVING FUNCTION

When the NC programme received by scheduled receiving is stored in the buffer memory of the NC device, it will be stored in the slot immediately following the previously received program. After the last slot has been filled by incoming programs, the next program which is received will be stored at the beginning of the buffer.
The following shows an example.

[EXAMPLE]

- The maximum number of NC programmes which can be stored in the buffer: 9
- The storage place where the previous received NC programme goes: the 7th buffer memory
- The number of programmes received: 4

BUFFER MEMORY IN THE NC DEVICE

1		← NC programme which is received the 3rd
2		← NC programme which is received the 4th
8		← NC programme which is received the first
9		← NC programme which is received the 2nd

(NOTE) The name of the buffer memory, the maximum number of NC programmes which can be stored, the "slot" number at the beginning of the buffer memory, and so forth will differ depending on the type of machine.

[FIGURE-4] AN OUTLINE OF STORAGE METHOD TO THE BUFFER MEMORY OF THE RECEIVED NC PROGRAMME BY SCHEDULED RECEIVE

7. TEXT DATA FORMAT (NC PROGRAMME)

7-1. AN OUTLINE OF THE TEXT DATA (NC PROGRAMME)

The text data (NC programme) consis ts of the following three parts.

(1) Programme Information
The information for programme name, work piece dimensions and so forth.

(2) Programme
The G code information.

(3) Tooling Information
The information for the type and dimensions of the tooling for the part program.

7-2. BASIC FORMAT OF THE TEXT DATA (NC PROGRAMME)

The text data (NC programme) is basically a collection of a parameter names (addresses) and numerical values written in ASCII codes. The address and the data altogether are called a word. A number of words collected and having meaning are called a block. The following shows an example of a word and a block.

EXAMPLE:

```
  N001   G02 X15 Y40 T2 F40 M0 <CR> <LF>
  ↑      ↑
word     word
                    block
```

One block consists of a block head, block data, and an end code as follows.

EXAMPLE:

step number ← block head
N001 G02 X100 Y200 T2 F40 M0<CR> <LF>
G code a set of parameters end code

block data

The text data (NC programme) consists of a series of blocks.
A comment can be added to a block. Anything following ":", (colon), is understood as a comment, and is ignored by the NC. The comment is terminated at the end of the block, (<CR> <LF>).
The "+" sign may be omitted for positive values. For negative values, a minus "-" must be used after the address.
The control is case-sensitive. Use only capital letters..

7-3. FORMAT OF THE DATA FOR PROGRAMME INFORMATION

The programme information block defines the overall part. It consists of a programme name and/ program number, material dimensions, clamp positions and so forth.
The programme information block is usually placed at the beginning of the program. Blocks which begin with an "O" are recognised as programme information blocks.
A list of the word address of the programme information block are shown below.

Address	Meaning	Effective value (MM)	Effective value (INCH)	Remarks
O	NC programme number	0 - 999999	←	6 integral numbers
(see NOTE 3)	NC programme	16 characters max	←	(see NOTE 4)
P	Program comment	32 characters max	←	
M	work piece materials	16 characters max	←	
X	sheet size X	0 - 9999.99	0 - 999.999	
Y	sheet size Y	0 - 9999.99	0 - 999.999	
T	material thickness t	0 - 99.99	0 - 9.999	
A	clamp position 1	0 - 9999	0 - 999.9	(see NOTE 5)
B	clamp position 2	0 - 9999	0 - 999.9	
C	clamp position 3	0 - 9999	0 - 999.9	
D	clamp position 4	0 - 9999	0 - 999.9	
H	Total number of workclamps	0 - 255	←	
K	Tensile strength of material	0 – 255	←	(see NOTE 10)
S	unit	0 – 9	←	(see NOTE 8)
;	Comment	Alphanumeric	←	(see NOTE 9)

EXAMPLE:

```
O"TEST" P"Part 1" M"STAINLES" X20Y20T0.060A10B30C60S1K75 <CR> <LF>
N001 G02 X100 Y100 T1 F40 M0 <CR> <LF>
```

(NOTE 3)
In cases where an address is O, depending on the following data, its meaning is recognised differently.
In cases where the data shows numeric values only, its meaning will be “programme number”.
In cases where the data is enclosed by double quotes, its meaning will be “programme name”.
Therefore, “programme number” and “programme name” should not be specified on the same block. .

(NOTE 4)
The data for “programme name”, “comment” and “work piece material” must be enclosed by double quote characters.. (`M"MILD ST" or M"STAINLES" or M"AL-HARD" or M"AL-SOFT"`

(NOTE 5)
If a machine has only two workclamps, it is not necessary to send C and D values.

(NOTE 8)
S1 should be used for inch programs. For metric programs, no S address should be included at all.

(NOTE 9)
Any characters following a semicolon will be ignored by the control.

(NOTE 10)
The data defaults are 50 for MILD ST, 75 for STAINLES, 50 for AL-HARD and 20 for AL-SOFT

7-4. DATA FORMAT FOR PROGRAMME

A main body of the programme consists of the NC programme written with G codes.
The NC device recognises programme blocks as those lines which begin with “N”.
The words of the programme part are shown below.

Address	Meaning	Effective value(MM)	Effective value(INCH)	Remarks
N	step number	0 - 9999	←	
G	G function	0 - 999	←	
M	M parameter	0 - 9	←	
T	tool number	0 - 999	←	
F	table moving speed	0 - 99	←	
X	X parameter	±99999.999	±9999.9999	
Y	Y parameter	±99999.999	±9999.9999	
A	A parameter	±999.999	←	
B	B parameter	±999.999	←	
C	C parameter	±999.999	←	
D	D parameter	0 - 9999	←	
I	E parameter	±99999.999	±9999.9999	
J	J parameter	±99999.999	±9999.9999	
R	R parameter	±99999.999	±9999.9999	
P	P parameter	±99999.999	±9999.9999	
H	H parameter	0 - 9999	←	
K	K parameter	0 - 9999	←	
L	L parameter	±99999.999	±9999.9999	
V	V parameter	0 - 9999	←	
W	W parameter	0 - 9999	←	
S	S parameter	0 - 9999	←	
U	circular tool number	0 - 99	←	

(NOTE 1)
The actual maximum and minimum values are machine-dependent.

(NOTE 2)
One block of a programme will be consist of a step number, a G code, a set of parameters, and the end-of-block code (<CR> <LF>).

[EXAMPLE]:

block number	G code	parameters	end of block
N001	G02	X10. Y20. T002 F50 M0	<CR> <LF>

A program consists of a number blocks.

[EXAMPLE]:

N001 G02 X100 Y100 T12 F40 M0 <CR> <LF>
N002 G71 X200 Y100 I10 A45 H10 T2 F40 M0 <CR> <LF>
:
:

:
N254 G05 Y1250 T1 F40 <CR> <LF>
N255 G03 <CR> <LF>

(NOTE 3)
All values are modal, except for G codes. (When a parameter has the same value as the previous block, it can be omitted. However, the G code can not be omitted.)

[EXAMPLE]:

N001 G02 X100 Y100 T12 F40 M0 <CR> <LF>
N002 G01 ____ Y200 T2 F40 __ <CR> <LF>
N003 G02 X200 ____ T1 F40 __ <CR> <LF>
N004 G01 X100 Y100 T11 F40 __ <CR> <LF>

The above five underlines show that the values may be omitted.

(NOTE 4)
Depending on the G code, the parameters will differ. Refer to the programming manual for parameter requirements for each G code.

7-5. DATA FORMAT FOR TOOLING INFORMATION

The tooling information part consists of data such as a the tool's shape and dimensions.
The tooling information is usually added on to the end of text data (the NC programme).
The tooling information data should include only the tooling which will be used. If the tooling information is omitted, all of tooling specifications for the tooling information data will become undefined.
The NC device recognises the programme information when the head of the block is “T”.
The word definitions of the tooling information is shown below.

Address	Meaning	Effective value (MM)	Effective value (INCH)	Remarks
T	holder number	0 - 999	←	
U	circular number	0 - 99	←	(NOTE 3)
S	type of holder	0 - 9	←	(NOTE 4)
K	key information	0 - 9	←	(NOTE 5)
F	tool shape	0 - 255	←	(NOTE 6)
A	dimension A	0 - 999.99	0 - 99.999	
B	dimension B	0 - 999.99	0 - 99.999	
C	dimension C	0 - 999.99	0 - 99.999	(NOTE 7)
D	dimension D	0 - 999.99	0 - 99.999	
G	angle	0 - 999.99	←	
H	clearance	0 - 999.99	0 - 99.999	

[EXAMPLE]:

O0123456 X2000 Y1000 A300 B900 C1500 <CR> <LF>
N001 G02 X100 Y100 T1 F40 M0 <CR> <LF>
T002 S0 K1 F1 A5 <CR> <LF>
T003 S0 K1 F3 A5 <CR> <LF>

(NOTE 1)
None of the tooling parameters is modal. (If the parameter data has the same value as the previously defined tool, it cannot be omitted.) The data for the word omitted will be recognised as zero.

(NOTE 2)
The effective value is on communications. The actual maximum and minimum values are machine dependent.

(NOTE 3)
This will be effective in cases where a multitool is used in the correspond station. If a multitool is not being used, this word may be omitted.

(NOTE 4)
The relationship between holder type and the data is as follows. In cases where the specification of a machine does not match, this will be ignored. Normally, this word can be omitted.

A type: 0, B type: 1, C type: 2, ~, Y type: 24, Z type: 25

(NOTE 5)
The relationship between key information and the data is as follows. In cases where the specification of a machine does not match, this will be ignored. Normally, this word can be omitted.
no key: 0, with key: 1, with auto index: 2, tap holder: 3

(NOTE 6)
The relationship between tooling specifications and the data is as follows.

1: round	2: obround	3: square	4: rectangle
5: extrusion	6: corner Radius tool	7: triangle	8: centre punch
9: square R	10: rectangle R	11: single D	12: double D
13: louver	14: counter sink	15: cluster	16: key hole
17: emboss	18: shaped emboss	19: special	20: tap
21: shear	22: edgeless	23: rolling shear	24: rolling form
0: undefined			

(NOTE 7)
In cases where the shape of the tool is a triangle, the effective range of data is “0 - 999.99 degrees”, regardless of whether the program is inch or metric, because the dimension C becomes a unit of angle, not a unit of length.

(NOTE 8)
Depending on the shape of the tool, the data will differ. Dimension data for the specification of tooling and each dimension for the tooling specification is described in [APPENDIX 3].

[APPENDIX 1] ASCII CODE

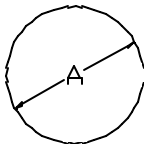
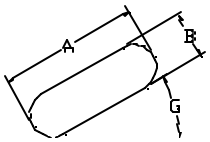
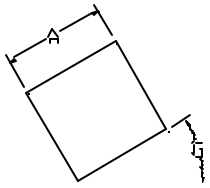
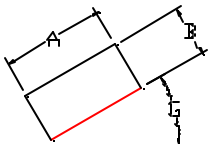
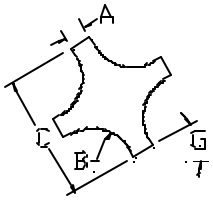
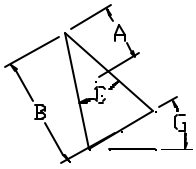
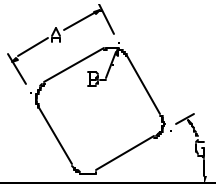
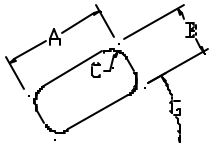
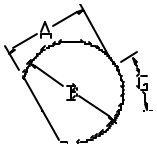
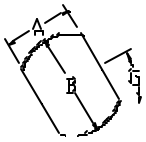
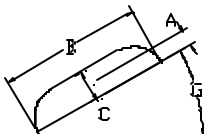
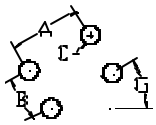
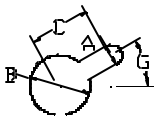
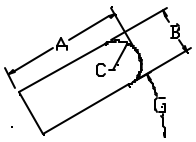
ROW COLUMN	0	1	2	3	4	5	6	7
0	NUL	DEL	(SP)	0	@	P		p
1	SOH	DC1	1	1	A	Q	a	q
2	STX	DC2	-	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	.	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	:	K	[	k	{
C	FF	FS	,	<	L	\	i	|
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	DEL

ACK: Acknowledge
BEL : Bell
BS : Back Space
CAN: Cancel
CR : Carriage Return
DC : Device Control
DEL : Delete
DLE : Data Link
EM : End of Medium
ENQ: Enquiry
ESC : Escape
ETX : End of Text
ETB : End of Transmission Block
EOT : End of Transmission
FF : Form Feed
FS : File Separator
NUL: Null
RS : Record Separator
SI : Shift In
SO : Shift Out
SOH: Start of Heading
SP : Space
STX : Start of Text
SUB : Substitute Character
SYN : Synchronous Idle
US : Unit Separator
VT : Vertical Tabulation

[APPENDIX 2] TOOLING SPECIFICATIONS AND DIMENSIONS

DATA	TOOLING SPECIFICATIONS	DIMENSIONS		
1	ROUND	A,		Clearance
2	OBLONG	A, B	Angle	Clearance
3	SQUARE	A,	Angle	Clearance
4	RECTANGLE	A, B	Angle	Clearance
5	EXTRUSION	A,		Clearance
6	CORNER R	A, B, C	Angle	Clearance
7	TRIANGLE	A, B, C	Angle	Clearance
8	CENTER PUNCH			Clearance
9	SQUARE R	A, B	Angle	Clearance
10	RECTANGLE R	A, B, C	Angle	Clearance
11	SINGLE D	A, B	Angle	Clearance
12	DOUBLE D	A, B	Angle	Clearance
13	LOUVER	A, B, C	Angle	Clearance
14	COUNTER SINK	A		Clearance
15	CLUSTER	A, B, C	Angle	Clearance
16	KEY HOLE	A, B, C	Angle	Clearance
17	EMBOSS	A		Clearance
18	SHAPED EMBOSS	A, B	Angle	Clearance
19	SPECIAL	A, B	Angle	Clearance
20	TAP	A, B		
21	SHEAR	A, B		Clearance
22	EDGELESS	A, B, C		Clearance
23	WHEEL SHEAR TOOL	A, B	Angle	Clearance
24	ROLLING RIB TOOL	A, B	Angle	Clearance
0	UNDEFINED			

[APPENDIX 3] TOOLING SPECIFICATIONS AND DIMENSIONS

1,5,8,14,17,20 	2 	3 	4,18,19 	6 
7 	9 	10 	11 	12 
13 	15 	16 	22 	23 A = Limits of Ram Position, (.393≥A≥-.059) B = Wheel Diameter, (Station Size≥B)