SECTION VIII

OPTIONAL EQUIPMENT

8.1 TAPE READER

The following programming instructions are associated with control of input data through the tape reader. A logical description of the use of Repetitive Programming has been made in Section VI in which it is assumed that the input program is less than 80 feet of tape, the tape reader is merely the device that inputs that data to storage quickly. 80 feet of tape can be run in approximately 50 seconds. (The system controls the reading rate at 150-200 cps when storage is empty.)

8.1.1 Tape Reader Real Time Control

For more than 80 feet of tape in a program, special rules are set up to make this condition function properly:

a. Subroutines such as TLO's if used and Macro definitions must be at the beginning of the tape.

Thus:

```
T1/ ---
Tn/ ---
#1
---text---
$
#2
---text---
$
#n
---text---
$
```

b. The main program text must be segmented and should commence with a % (rewind stop code):

```
%#0
---text---
$
#0
```

```
---text---
$
#0
---text---
$
                                etc and must end
#0 ----- text --- m02 (cr)$(cr)$(cr)
```

Operation is as follows: When a #0 code is used, a subsequent $ code will temporarily cease loading data from the reader into storage, setting a temporary end of file flag. When this first program text has been executed and the control reads the temporary end of file flag, the tape reader will reload the next segment of data starting at the character after the $ and write it into storage on top of the previous segment. A detected subsequent $ code will again temporarily cease loading tape into storage, etc. This operation requires further rules:

c. The #0 (main program segment start code) and the $ terminator in each main program segment must be programmed on a separate line.

When an M02 (rewind) occurs during a main program segment, the tape reader will rewind the tape to the % code then read forward storing the first segment of data, i.e. to the first $ terminator after the % code.

d. The maximum area in storage allotted for each segment of the main program is equal to the total storage less that used for subroutines.

e. Since program execution is interrupted temporarily while the tape reader is reading a new segment, the programmer must make a judicious choice of tool position before the $ terminator.

f. Do not terminate a segment with a subroutine call.

g. The M02 code must be followed by (cr)(cr)(cr).

h. Do not use slash delete (/) in the Real Time mode of control of the tape reader.

NOTE: When editing changes are required within a segment of the program, it is recommended they be made off line (External Peripheral Device).

8.2 ROTARY TABLE WITH BOSS 4 AND BOSS 5 SYSTEMS(See 8.3 (BOSS 6))

8.2.1 General

The 12 inch diameter Rotary Table is driven by a worm gear arrangement with a 180:1 ratio. Power is supplied by a stepmotor compatible with the drive systems of all Bridgeport Series 1 CNC machines (Table assy. code 2521000). The counter incorporated into the drive system is capable of being read to 0.01°, the resolution of the total system. The rotary table can be driven from the control output to one of the linear axes. Suitable special provision has been made to utilize the Y-axis output to drive the rotary table instead of its normal output to the saddle drive motor. A special Y-axis motor lock (3770773) and disconnect (3770789) is then made available and installed at the factory. For field installation use 2770773 and 2770789 respectively.

Depending on the requirements, the table can be mounted vertically on the left side of the machine table, or with its working face horizontal. Note that when the table face is mounted vertically (axis of rotation horizontal), mounting holes are provided to suit the T-slot spacing.

Bridgeport Tailstock 2520003 may be used when this rotary table is mounted vertically.

CAUTION: Do not apply excessive end load with the tailstock and ensure that the table face is not distorted when clamping the workpiece.

8.2.2 Rotary Table Programming Using the Y-Axis

Absolute Programming (G90) - Y axis data with input of 0.001" to 99.999" can be programmed provided that the maximum difference between two adjacent absolute positions is no more than 32.000" (812mm).

Incremental Programming (G91) - Y axis data can be input from 0.001" to 32.000" (812mm), corresponding to 0.01 degrees to 320.0 degrees.

Direction of Rotation - The Y axis drive motors are disposed differently on the Series II and Series I CNC machines. Since the rotary table is common to both, it may be useful to consider the same output direction of rotation of the table to be the same on both. To do this, program a modal G32 with the Series I CNC. Rotary motion will then be as follows: When facing the rotary table surface, programmed plus will move the table in the clockwise direction. Minus input for CCW.

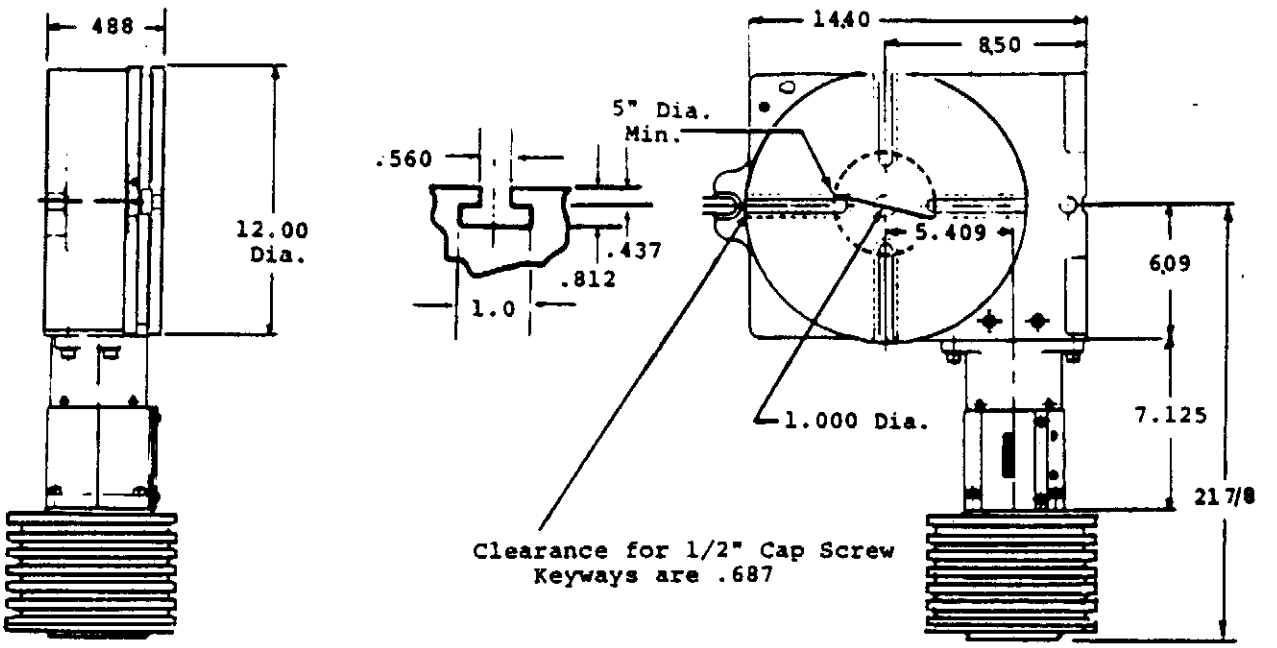

Figure 8-1. General Arrangement Rotary Table

8.2.3 Inch Programming (Modal G70)

Inches Input	Degrees
.001	.01
.002	.02
.005	.05
.020	.2
.050	.5
.200	2.0
2.000	20.0
18.000	180.0
20.000	200.0

To calculate the programmed distance value when the angle is known, divide the angle by 10.
ie.

$$\frac{\text{Angle}}{10} = \text{Programmed Distance Value}$$

eg.

$$\frac{25 \text{ Deg}}{10} = 2.5 \text{ Inches input}$$

Rapid Motion = 3.333 RPM

NOTE: Feed increments are an integer (2-320), each integer having a value of 1 deg./min. Thus a feed number Coded F120 would result in a feed of 120 deg./min.

Cutting Feedrate is a function of the part diameter. To calculate the input feed number for rotary motion, divide the desired feedrate by the Cutter Path Radius times 0.175.

ie. $\frac{\text{Desired Feed}}{\text{Part Rad. (.175)}}$ = Input Feedrate Number

eg. $\frac{12}{\text{4.0 Rad. (.175)}} = \frac{12}{.7} = F171$

8.2.4 Metric Programming (Modal G71)

Metric Input	Degrees	Metric Input	Degrees
.02	.01	2.00	.7874
.20	.07874	3.20	1.25984
.40	.15748	6.40	2.51986
.80	.31496	20.00	7.874
1.27	.5	457.2	180.00
1.60	.62992	812.8	320.00

To calculate the programmed distance value when the angle is known, multiply the angle by 1.27.
ie. Angle (2.54)=Programmed Distance Value

eg. 25 Deg (2.54) = 63.5mm

Rapid Motion = 3.333 RPM

NOTE: Feed increments are an integer (1-812), each integer having a value of 0.3937 deg./min. Thus a feed coded F120 would result in a feed of 47.244 deg./min.

Cutting Feedrate is a function of the part diameter. To calculate the input feed number for rotary motion, divide the desired feedrate in mm/min. by the Cutter Path Radius in mm times 0.175.

ie. $\frac{\text{Desired Feedrate in mm/min.}}{\text{Part Radius mm (.175)}}$ = Input Feedrate Number

eg. $\frac{210\text{mm/min.}}{100\text{mm (.175)}} = F120$

8.3 ROTARY TABLE PROGRAMMING WITH BOSS 6 SYSTEMS

Absolute Programming (G90) - Y axis data with input of .0005" to 99.999" can be programmed provided that the maximum difference between two adjacent positions is no more than 32.000" (812mm).

Incremental Programming (G91) - Y axis data can be input from .0005" to 32.000" (corresponding to 0.01 degrees to 640.0 degrees).

Direction of Rotation - The Y axis drive motors are disposed differently on the Series II and Series I CNC machines. Since the rotary table is common to both, it may be useful to consider the same output direction of rotation of the table to be the same on both. To do this, program a modal G32 with the Series I CNC. Rotary motion will then be as follows: When facing the rotary table surface, programmed plus will move the table in the clockwise direction. Minus input for CCW.

8.3.1 Inch Programming (Modal G70)

Inches Input	Degrees
.0005	.01
.001	.02
.0025	.05
.010	.20
.025	.50
.100	2.00
1.000	20.00
9.000	180.00
10.000	200.00

Rapid Motion - 5.555 RPM

To calculate the programmed distance value when the angle is known, divide the angle by 20.

ie.

$$\frac{\text{Angle}}{20} = \text{Programmed Distance Value}$$

eg.

$$\frac{25 \text{ Deg}}{20} = 1.25 \text{ Inches input}$$

Note: Feed increments are an integer (2-510), each integer having a value of 2 deg./min. Thus a feed number Coded F120 would result in a feed of 240 deg./min.

Cutting Feedrate is a function of the part diameter. To calculate the input feed number for rotary motion, divide the desired feedrate by the Cutter Path Radius times 0.035.

ie.

$$\frac{\text{Desired Feed}}{\text{Part Rad. } (.035)} = \text{Input Feedrate Number}$$

eg.

$$\frac{12}{4.0 \text{ Rad. } (.035)} = \frac{12}{.14} = \text{F86}$$

8.3.2 Metric Programming (Modal G71)

Metric Input	Degrees	Metric Input	Degrees
.01	.007874	1.00	.7874
.10	.07874	1.60	1.25984
.20	.15748	3.20	2.51986
.40	.31496	10.00	7.874
.635	.5	226.771	180.00
.80	.62992	453.542	360.00

To calculate the programmed distance value when the angle is known, multiply the angle by 1.27.

ie. Angle (1.27) = Programmed Distance Value

eg. 25 Deg (1.27) = 31.75mm

Rapid Motion = 5.555 RPM

Note: Feed increments are an integer (5-1295), each integer having a value of 0.7874 deg./min. Thus a feed coded F120 would result in a feed of 94.488 deg./min.

Cutting Feedrate is a function of the part diameter. To calculate the input feed number for rotary motion, divide the desired feedrate in mm/min by the Cutter Path Radius in mm times 0.0138.

ie.

$$\frac{\text{Desired Feedrate in mm/min.}}{\text{Part Radius mm } (.0138)} = \text{Input Feedrate Number}$$

eg.

$$\frac{210\text{mm/min.}}{100\text{mm } (.0138)} = 152$$