



PNC -Programmable Numerical Control

Executing RS274D Tool Path Programs January 2022

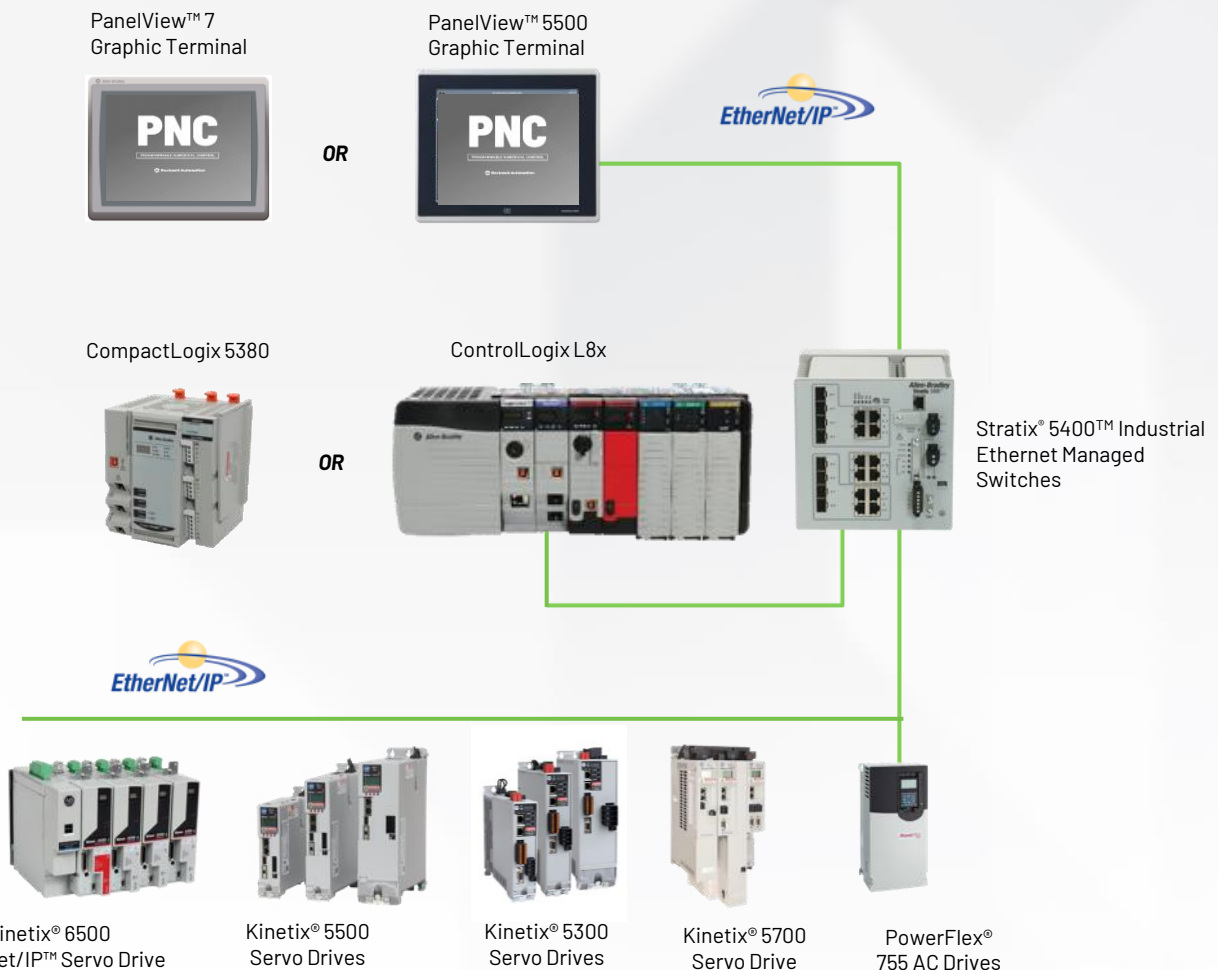
expanding **human possibility**®



PUBLIC

Overview: PNC

- **PNC is a paired Logix and PanelView™ program (“PNC Solution”)**
- **Executes RS274D based Part Files**
 - Core set of M&G codes supported.
 - Codes may be modified or added by machine builder
- **Executes on Compact or ControlLogix® controllers, PanelView™+ or PV5xx0 HMI, any CIP Motion standard drives or servo drives**
- **Support for up to 6 axis of coordinated motion**
- **Supports a wide variety of machine types**
 - X Y Z table, gantry, mill, lathe, grinder, custom machines
- **Provided as sample code at no-charge to customers**
 - Fully customizable by machine builder
- **PNC Solution – provides a good value for medium axis count coordinated motion applications, which use RS274D**



Introduction to PNC

- Programmable Numerical Control (search for it in Seismic)
- Interprets and executes RS274D tool path programs (G-Code) in a PLC using Integrated Motion on EtherNet/IP™ drives.
- Open-source application sample code. Fully customizable.
- Brief history
 - 9/Series discontinued... ASCII instruction in Logix controller... John developed first iteration... 2020 Modularized by Erik..
- Works with
 - ControlLogix (L8) or CompactLogix (5380)
 - PVP7, PV5000 or Panel PC with ME Station
 - CIP Motion standard or servo drives
- Wide range of machine types
 - Mill, Gantry, Lathe, Grinder, 3D Printing, Screen Printing, Custom Machines
- Customer Examples:
 - See “Programmable Numeric Control – Customer References File” on Seismic for the latest information

Overview: Tool path programs

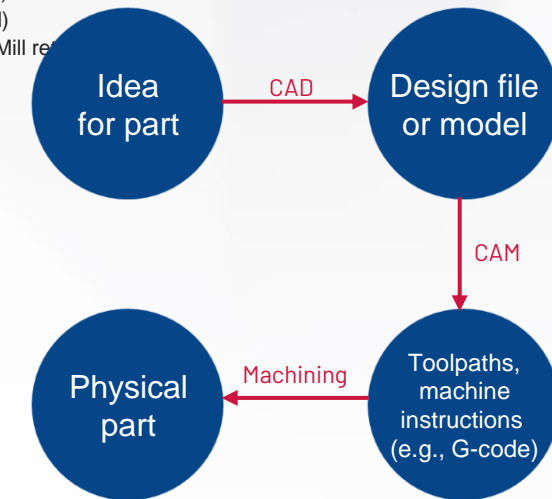
Tool Path Programs – RS274D (also known as ISO 6983)

- Series of instructions for making part or completing a task.
- Textual format – data standard that achieves compatibility between software design tools and machine controllers
- ASCII text files that consists of M & G codes, and axis coordinates
- Typically CNC controllers execute these Tool Path Programs sequentially line by line to generate a part profile

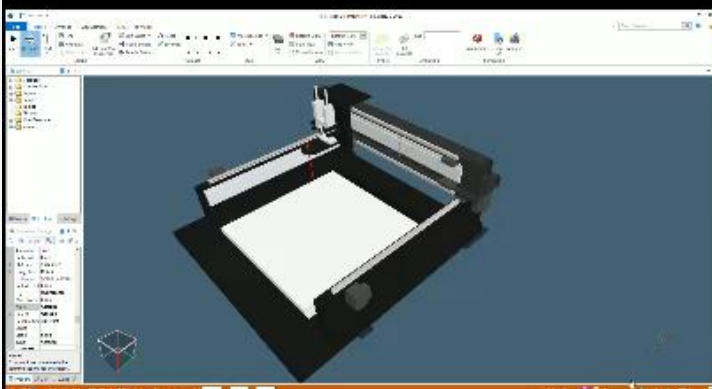
CAD/CAM tools have the capability to create Tool Path Programs




- Referred to as CNC part programs, M&G code files, or part files
 - Part Files are easily transportable/transferrable/modified
 - Slight variations exist between CAD/CAM packages and associated third-party tools

```
%
o0001
G20 G40 G80 G90 G94G54(Inch, Cutter Comp. Cancel, Deactivate all canned cycles...)
G43 H01 (Tool length comp. in positive direction, length compensation for tool)
M03 S1200 (Spindle turns CW at 1200RPM)
G00 X0. Y0. (Rapid Traverse to X=0. Y=0.)
G00 Z.5 (Rapid Traverse to z=.5)
G00 X1. Y-.75 (Rapid traverse to X1. Y-.75)
G01 Z-.1 F10 (Plunge into part at Z-.25 at 10in per min.)
G03 X.875 Y-.5 I.1875 J-.75 (Connected Components Workbench™ arc cut to X.875 Y-.5 with RADIUS
origin at I.625 J-.75)
G03 X.5 Y-.75 I0.0 J0.0 (Connected Components Workbench arc cut to X.5 Y-.75 with RADIUS
origin at I0.0 J0.0)
G03 X.75 Y-.9375 I0.0 J0.0(Connected Components Workbench arc cut to X.75 Y-.9375 with RADIUS
origin at I0.0 J0.0)
G02 X1. Y-1.25 I.75 J-1.25 (CW arc cut to X1. Y-1.25 with RADIUS origin at I.75 J-1.25)
G02 X.75 Y-1.5625 I0.0 J0.0 (CW arc cut to X.75 Y-1.5625 with same RADIUS origin as previous arc)
G02 X.5 Y-1.25 I0.0 J0.0 (CW arc cut to X.5 Y-1.25 with same RADIUS origin as previous arc)
G00 Z.5 (Rapid traverse to z.5)
M05 (spindle stops)
M30 (Program End)
%G00 X0.0 Y0.0 (Mill re
```




Emulate3D™ Demo



 Log on

Programmable Numerical Control

Station Status





10:58:22 AM
4/5/2022


Mode: Auto


Demo


A
AUTO


CONTINUOUS

SINGLE STEP

CYCLE START

CYCLE STOP

TEST MODE

JOG RETRACT

[0] AB_LOGO PROGRAM E3D1

SelectLibraryEdit

1 (AB LOGO PROGRAM)

2 ;ZOOM 1000

3 G8 G01 G90 G94 G21(G54 X-70 Y-75) F100

4

5 M21 (RAISE PEN)

6 X68.125 Y12.5 (DRAW BOTTOM PART OF OCTOGON)

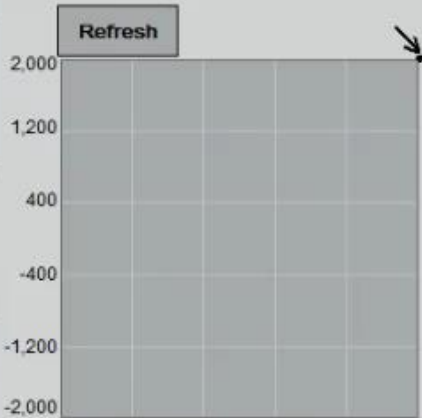
7 X68.125 Y12.5 (DRAW BOTTOM PART OF OCTOGON)

8 M01 ;RESET GRAPH

9

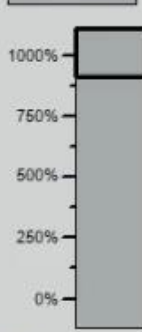
<<<Tool Path Display XY G17>>>

Refresh



% Zoom

1000.00



MM

<<<Feedrate>>>

% Rapid

100%
75%
50%
25%
5%

Program Feedrate

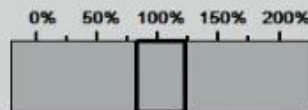
100.0000 MMPS

Override Feedrate

99.3939 MMPS

OVERVERRIDE
ENABLED

0% 50% 100% 150% 200%





% Feedrate


99.39


M
MANUAL


M01
OPTIONAL
STOP

BLOCK
DELETE

EMERGENCY
RETURN

CONTROL
RESET

FAULT RESET



Rockwell Automation's PNC System Features

- Standard M and G –code set, including...

- Linear interpolation
- Dwell
- Offsets
- Unit selection
- Absolute/Incremental positioning
- Cutter RADIUS Compensation

- Math and Boolean operations
- IF/THEN, GOTO
- Part Program Editor
- Recipe Management
- State Machine/ Diagnostics
- Transfer Utility
- Create custom G/M – codes
- Modular PLC architecture

PNC will search
for these Characters:

G	G Codes
M	M Codes
Add	Math Function
Sub	Math Function
Mul	Math Function
Div	Math Function
Sin	Math Function
Cos	Math Function
:	Block Comment
(Start Bracket - Comment
)	End Bracket - Comment
_ /	Block Delete
P	Dwell Time
S	Spindle Reference
T	Tool number & Tool Offset
#	Parameters
IF	Conditions
N	Sequence Number
GOTO	Jump to
"=	Set a Value
EQ	Equal
GT	Grater then
LT	Less Than
NE	Not Equal
F	Feedrate
X	Axis Coordinates
Y	Axis Coordinates
Z	Axis Coordinates

Standard G codes that are translated:

G00 Rapid
G01 Linear Interpolation
G02 Circle CW
G03 Circle CCW
G04 Dwell
G33 Multi Pass Threading
G52 Cancel Work Coordinates
G53 Work Coordinates 1
G54 Work Coordinates 2
G55 Work Coordinates 3
G56 Work Coordinates 4
G57 Work Coordinates 5
G58 Work Coordinates 6
G59 Work Coordinates 7
G45 Touch Probe1 Routine
G46 Touch Probe 2 Routine
G50 Call Pcam Routine
G54 Fixture Offsets
G65 Call Sub
G80 Cancel Can Cycle
G81 Drill Cycle
G82 Tap Cycle
G90 Absolute Mode
G91 Incremental Mode
G92 Axis Preset
G93 Inverse Time
G94 Feed per Minute
G95 Feed per Rev.
G96 Constant Surface On
G97 Constant Surface Off

Standard M codes that are translated:

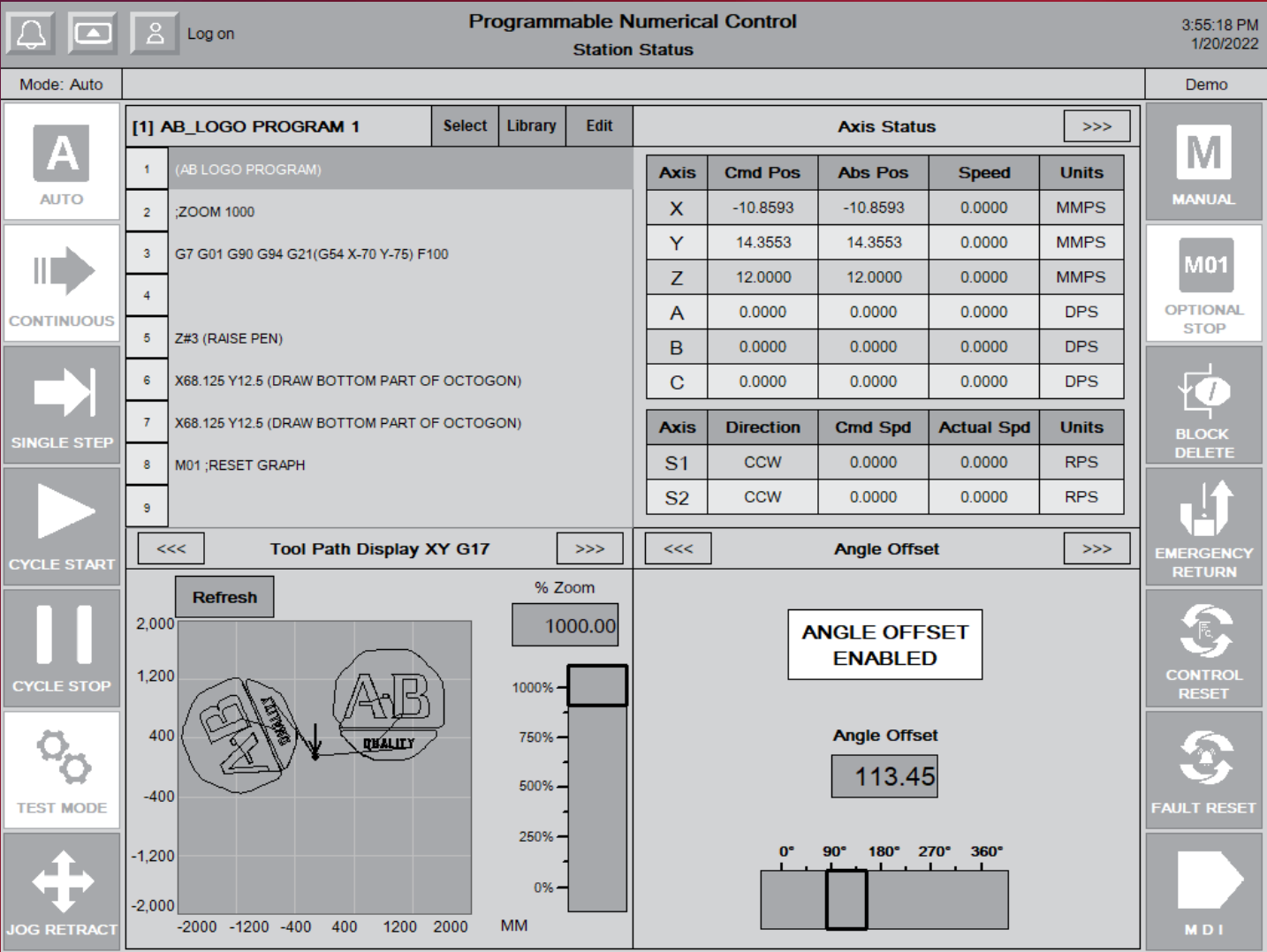
M00 Program Stop
M01 Optional Stop
M02 Program End
M03 Spindle On CW
M04 Spindle On CCW
M05 Spindle Off
M07 Coolant On Mist
M08 Coolant On Flood
M09 Coolant Off
M20 Laser On
M21 Laser Off
M30 Program End - Rewind
M99 Return from Sub

(PanelView™ 5500)

Overview: System Functionality

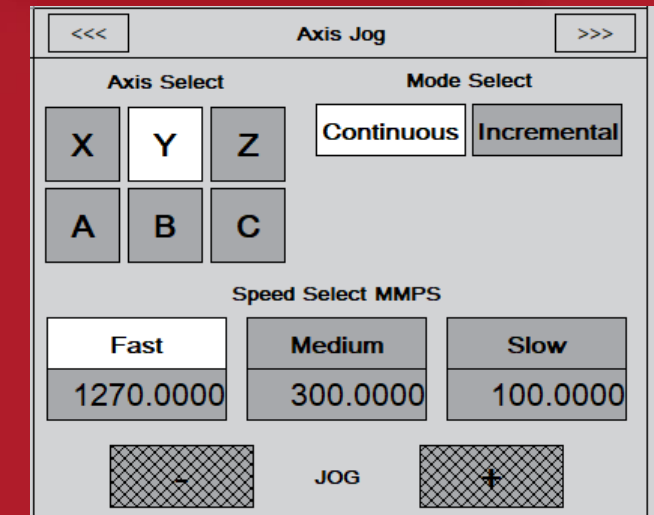
Execute part programs

- Tool Path Graphics
- Part Rotation – Angle offset



Rich User Interface Popup Windows

Parameters		
Select # (1-300)	Value	Name
10	100.0000	X Amount
11	112.0000	Y Amount
20	16.0000	Column Amount
30	4.0000	Row Amount
295	-10.8593	Ax01 Command Position






- PUBLIC • Copyright ©2022 Rockwell Automation, Inc.

Overview: System Functionality

Part Program Edit

- Display Complete Part Program
- Custom Keypad
- Insert/Modify a Line
- Insert or Delete Lines
- Teach a Part Program, Select Line or RADIUS, Teach Point.

 Log on

Programmable Numerical Control
Part Program Edit

12:24:07 PM
1/21/2022

Mode: Auto

Demo

Program[1]: AB_LOGO PROGRAM 1

[0] (AB LOGO PROGRAM)

[1] :ZOOM 1000

[2] G7 G01 G90 G94 G21(G54 X-70 Y-75) F100

[3]

[4] Z#3 (RAISE PEN)

[5] X68.125 Y12.5 (DRAW BOTTOM PART OF OCTOGON)

[6] X68.125 Y12.5 (DRAW BOTTOM PART OF OCTOGON)

[7] M01 ;RESET GRAPH

[8]

[9] Z#4 (LOWER PEN)

[10] X106.875 Y12.5 Z#4 (DRAW BOTTOM PART OF OCTOGON)

[11] X118.3 Y15 (DRAW BOTTOM PART OF OCTOGON)

[12] X128.125 Y21.75 (DRAW BOTTOM PART OF OCTOGON)

[13] X152.5 Y45.625 (DRAW BOTTOM PART OF OCTOGON)

[14] X152.5 Y50.625 (DRAW BOTTOM PART OF OCTOGON)

[15] X148.75 Y51.875 (DRAW BOTTOM PART OF OCTOGON)

Edit Program Select

X

-10.8593

Y

14.3553

G7 G01 G90 G94 G21(G54 X-70 Y-75) F100

◀

Space

▶

Delete Character

Transfer Edit

◀

;

(

)

X

G

1

2

3

#

Modify Mode

Y

M

4

5

6

[

Insert Mode

Z

T

7

8

9

]

+

=

A

F

P

D

0

.

-

^

B

S

R

I

N

GOTO

*

/

C

H

J

K

Insert Block

Delete Block

Insert String >

Q12

LINE

CW

CCW

Teach Point

Teach Via

◀
Previous Page

Overview: System Functionality

Part Program Offsets

- Fixture Offsets
- Tool Length and Diameter Offsets
- Tool Geometry and Wear offsets
- Set Offset Limits

Programmable Numerical Control
Fixture Offsets

Mode: Auto

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

X Offset >

0.0000 MM

- X - Minus

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Y Offset >

0.0000 MM

- Y - Minus

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Z Offset >

0.0000 MM

- Z - Minus

Fixture

	X	Y	Z
G52	0.0000	0.0000	0.0000 MM
G54	0.0000	0.0000	0.0000 MM
G55	0.0000	0.0000	0.0000 MM
G56	0.0000	0.0000	0.0000 MM
G57	0.0000	0.0000	0.0000 MM
G58	0.0000	0.0000	0.0000 MM
G59	0.0000	0.0000	0.0000 MM

Teach Fixture Offset

Teach X

-10.8593 MM

Teach Y

14.3553 MM

Teach Z

12.0000 MM

Programmable Numerical Control
Offset Limits

Machine Type: Mill

Linear Units: Millimeters

Length Offsets

Mill Diameter and Length Offsets

D

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Z

Axis = 3

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Wear Offsets

Mill Wear Offsets

X

Axis = 1

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Z

Axis = 3

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Fixture Offsets

X

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Y

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Z

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Programmable Numerical Control
Length and Diameter Offsets

Mode: Auto

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

D Offset >

1.0000 MM

- D - Minus

Active Offset

123.0000 MM

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Z Offset >

1.0000 MM

- Z - Minus

Active Offset

2.0000 MM

Mill Diameter and Length Offsets

Tool Number	D	Z	Description
H0	0.0000 MM	0.0000 MM	
H1	1.0000 MM	1.0000 MM	
H2	2.0000 MM	2.0000 MM	
H3	3.0000 MM	3.0000 MM	
H4	4.0000 MM	4.0000 MM	
H5	0.0000 MM	0.0000 MM	
H6	0.0000 MM	0.0000 MM	
H7	0.0000 MM	0.0000 MM	
H8	0.0000 MM	0.0000 MM	
H9	0.0000 MM	0.0000 MM	

Programmable Numerical Control
Wear Offsets

Mode: Auto

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

X Offset >

0.0000 MM

- X - Minus

Active Offset

0.0000 MM

High Limit: 200.0000 MM

Low Limit: 0.0000 MM

Z Offset >

0.0000 MM

- Z - Minus

Active Offset

0.0000 MM

Mill Wear Offsets

Tool Number	X	Z	Description
H0	0.0000 MM	0.0000 MM	
H1	0.0000 MM	1.0000 MM	
H2	0.0000 MM	2.0000 MM	
H3	0.0000 MM	3.0000 MM	
H4	0.0000 MM	4.0000 MM	
H5	0.0000 MM	0.0000 MM	
H6	0.0000 MM	0.0000 MM	
H7	0.0000 MM	0.0000 MM	
H8	0.0000 MM	0.0000 MM	
H9	0.0000 MM	0.0000 MM	

Overview: System Functionality

Part Program Management

- Select a Part Program from the Controllers Memory
- Create or rename
- Save, Copy, Delete

The screenshot displays the 'Programmable Numerical Control' interface, specifically the 'Part Program Library' section. The top status bar includes a 'Log on' button, the title 'Programmable Numerical Control Part Program Library', and a timestamp of '12:53:36 PM 1/21/2022'. Below this, a 'Mode: Auto' indicator is shown on the left and a 'Demo' label on the right. The main interface is divided into two primary panels. The left panel, titled 'Select Part Program', contains a list of programs with indices from [0] to [15]. The list includes programs like 'AB_LOGO PROGRAM 1', 'loop test1', 'CALL LOOP SUB PROGRAM 4', 'SUB PROGRAM LOOP', 'Call Sub Program 15 FULL CIRCLE', 'ROW AND COLUMN LOOP 6', 'Drill Cycle G81 PROGRAM 7', 'Peck Drill Cycle G82 PROGRAM 8', 'Tap Cycle G84 PROGRAM 9', 'GUESS WHO PROGRAM 10', 'GUESS WHO PROGRAM 12', 'cc test curve 13', and 'Sub Program 15 FULL CIRCLE'. A 'Refresh' button is located at the bottom of this list. The right panel, titled 'Rename or Create New Part Program', features a 'New Program Name:' input field with 'Test Program' entered, a 'Save New Program Name' button, a 'Copy Program' button, and a 'Delete Program' button. A 'Previous Page' button with a left arrow is positioned at the bottom right of the interface.

Log on

12:53:36 PM
1/21/2022

Mode: Auto

Demo

Select Part Program
Use empty position for new program

[0]
[1] AB_LOGO PROGRAM 1
[2] loop test1
[3] CALL LOOP SUB PROGRAM 4
[4] SUB PROGRAM LOOP
[5] Call Sub Program 15 FULL CIRCLE
[6] ROW AND COLUMN LOOP 6
[7] Drill Cycle G81 PROGRAM 7
[8] Peck Drill Cycle G82 PROGRAM 8
[9] Tap Cycle G84 PROGRAM 9
[10] GUESS WHO PROGRAM 10
[11]
[12] GUESS WHO PROGRAM 12
[13] cc test curve 13
[14]
[15] Sub Program 15 FULL CIRCLE

Refresh

Rename or Create New Part Program

New Program Name:
Test Program

Save New Program Name

Copy Program

Delete Program

Previous Page

Overview: System Functionality

Configure/Setup

- Axis and Spindle Parameters
- Axis Home
 - Machine Type – Lathe or Mill
 - Set Speeds and Feeds
 - Linear and Rotary Axis Parameters

Log on

Programmable Numerical Control

Machine Parameters

12:58:34 PM
1/21/2022

Mode: Auto

Demo

Axis Motion Parameters

Linear

Rotary

Return Speed

500.0000

MMPS

360.0000

DPS

Acceleration

20000.0000

MMPS^2

36000.0000

DPS^2

Deceleration

20000.0000

MMPS^2

36000.0000

DPS^2

Acc/Dec Jerk

200000.0000

MMPS^3

36000.0000

DPS^3

Spindle Motion Parameters

S1

S2

100.0000

RPS^2

100.0000

RPS^2

100.0000

RPS^2

100.0000

RPS^2

1000.0000

RPS^3

1000.0000

RPS^3

Axis Unit/Timebase

Linear Units

Linear Timebase

Millimeters

Millimeters

Minutes

Seconds

Inches

Inches

Minutes

Seconds

Rotary Units

Rotary Timebase

Revolutions

Revolutions

Minutes

Seconds

Degrees

Degrees

Minutes

Seconds

Spindle Unit/Timebase

Units

Timebase

Revolutions

Revolutions

Minutes

Seconds

Degrees

Degrees

Minutes

Seconds

Machine Type

Mill

Lathe

Axis Parameters

Max Position

Min Position

Return Position

Home Position

Rapid Speed

X

2000.0000

MM

-2000.0000

MM

0.0000

MM

0.0000

MM

1000.0000

MMPS

Y

2000.0000

MM

-2000.0000

MM

0.0000

MM

0.0000

MM

1000.0000

MMPS

Z

254.0000

MM

-254.0000

MM

0.0000

MM

0.0000

MM

1000.0000

MMPS

A

360.0000

DEG

0.0000

DEG

0.0000

DEG

0.0000

DEG

3600.0000

DPS

B

360.0000

DEG

0.0000

DEG

0.0000

DEG

0.0000

DEG

3600.0000

DPS

C

360.0000

DEG

0.0000

DEG

0.0000

DEG

0.0000

DEG

3600.0000

DPS

←

Previous Page

Programmable Numerical Control

Home Axes

1:03:55 PM
1/21/2022

Demo

Password to Enable Axis Rehome

Enter Password:

Password Valid
(Rehome Enabled)

MANUAL

FAULT RESET

E-STOP

Axes

Edit

Home Pos

Home Offset

Abs Pos

Units

Homed

X

0.0000

0.0000

-10.8593

MM

Y

0.0000

0.0000

14.3553

MM

Z

0.0000

0.0000

12.0000

MM

A

0.0000

0.0000

0.0000

DEG

B

0.0000

0.0000

0.0000

DEG

C

0.0000

0.0000

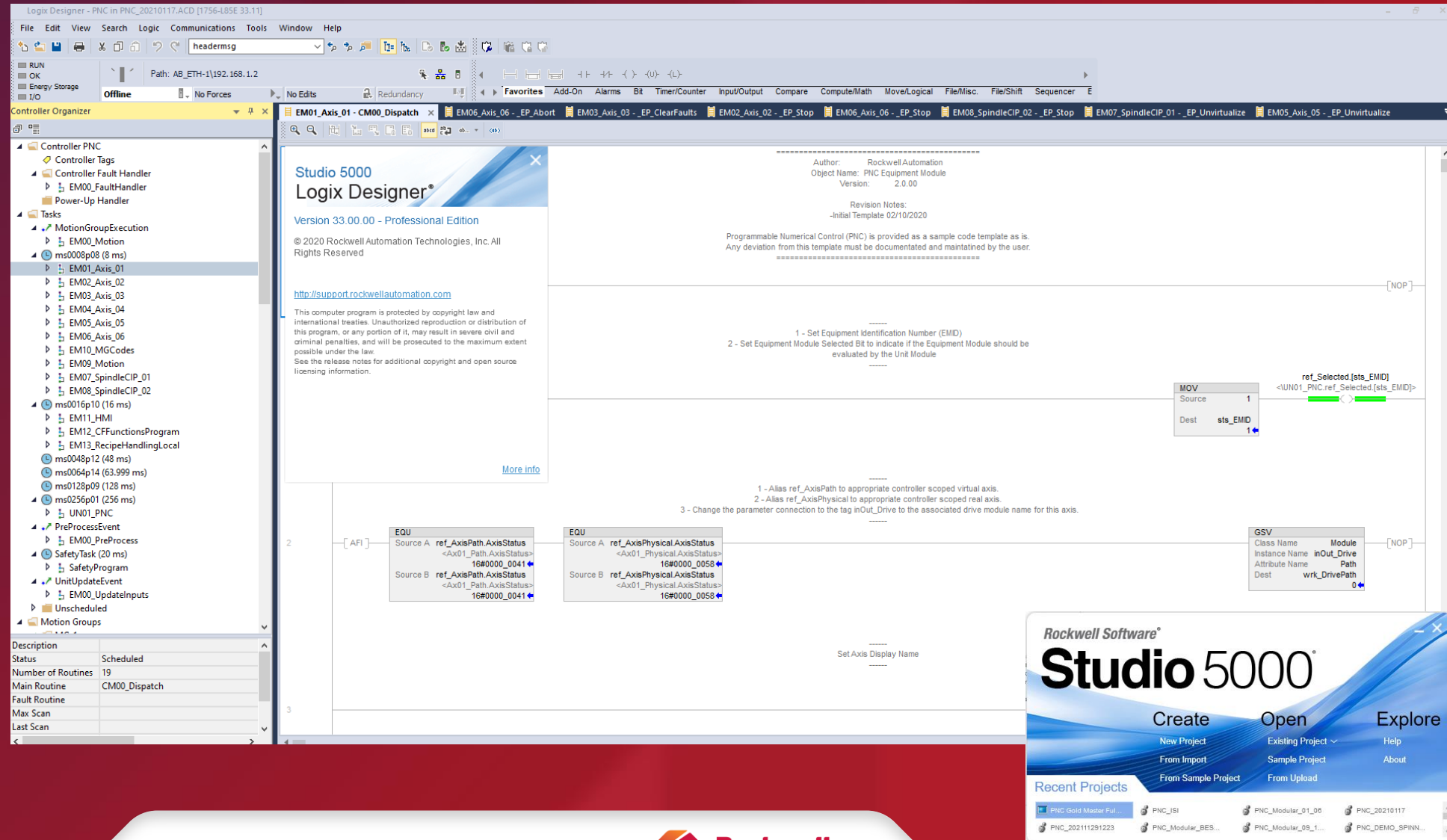
0.0000

DEG

Overview: System Functionality

Modular Control Program {Logix}

- Core functionality uses native motion instructions
- Add-On Instruction for incremental functionality
- Easily modified to match application requirements





- Manual entry
- SD Card – Directly into Logix processor
- Download through PNC Transfer Tool

Overview: System Functionality

PNC: RS274 Code Support

- Based on Fanuc CNC, Post Processor
- Recently added Codes:
 - G40 G41 G42 Cutter Comp
- Consult OEM Team for codes not shown

Math/Compare

-	Negation/Subtraction
SUB	Subtraction
**	Exponentiation
*	Multiplication
MUL	Multiplication
/	Division
DIV	Division
+	Addition
ADD	Addition
MOD	Modulo
ABS	Absolute Value
FIX	Round Down (ex. 2.8 => 2, -2.8 => -3)
FUP	Round Up (ex. 2.8 => 3, -2.8 => -2)
SQRT	Square Root
LN	Natural Log
EXP	Exponential Function e ^x
ASIN	Arcsine
ACOS	Arccosine
ATAN	Arctangent
SIN	Sine
COS	Cosine
TAN	Tangent
LOG	Log base 10
DEG	Radian to Degree
RAD	Degree to Radian
TRUNC	Truncate
EQ	Equals Comparator
GT	Greater Than Comparator
GE	Greater Than or Equals Comparator
LT	Less Than Comparator
LE	Less Than or Equals Comparator
NE	Not Equals Comparator
NOT	Not Boolean Operator
XOR	Exclusive Or Boolean Operator
AND	And Boolean Operator
OR	Or Boolean Operator

Standard G Codes

G00	Rapid Move
G01	Linear Move
G02	CW Circular Move
G03	CCW Circular Move
G04	Dwell
G07	Blended Moves On
G08	Blended Moves Off
G10	Vector A On
G11	Vector A Off
G12	Vector B On
G13	Vector B Off
G14	Vector C On
G15	Vector C Off
G17	Plane Select XY
G18	Plane Select XZ
G19	Plane Select YZ
G20	Programming in Inches
G21	Programming in mm
G40	Cutter Compensation Cancel
G41	Cutter Compensation Left
G42	Cutter Compensation Right
G43	Tool Height Offset Negative
G44	Tool Height Offset Positive
G49	Tool Height Offset Cancel
G52	Fixture Offset #1
G53	Cancel Fixture Offset
G54	Fixture Offset #2
G55	Fixture Offset #3
G56	Fixture Offset #4
G57	Fixture Offset #5
G58	Fixture Offset #6
G59	Fixture Offset #7
G85	Call Subprogram
G80	Cancel Cycle
G81	Drill Cycle
G82	Peck Drill Cycle
G84	Tapping Cycle
G90	Absolute Mode
G91	Incremental Mode
G92	Preset Max Spindle Speed
G94	Feed per Time
G95	Feed per Spindle Rev
G96	Constant Surface Speed On
G97	Constant Surface Speed Off

Standard M Codes

M00	Program Stop
M01	Optional Stop
M02	Program End
M03	Spindle On CW
M04	Spindle On CCW
M05	Spindle Off
M30	Program End Rewind
M48	Feedrate Override Enable
M49	Feedrate Override Disable
M99	Return From Subprogram

Characters

/	Block Delete
:	Block Comment
(Begin Comment in Parenthesis
)	End Comment in Parenthesis
N	Line Number
IF	Begin Compare
THEN	End Compare
GOTO	Go To Line Number
#	Parameter
=	Set a Parameter Value
F	Feedrate
P	Dwell Time
S	Spindle Speed
H	Length Offset
T	Tool Wear Offset
D	Tool Diameter
[Begin Extended Math
]	End Extended Math

Overview: System Functionality

■ CNC modes

- Auto
- Manual
- MDI – Manual Data Input
- Emergency Return
- Fault Reset
- Control Reset
- Test Mode
- Manual Jog
- Tool Path Graphics
- Jog Retract
- Production Data
- Controller State Model
- Controller/Machine Alarms
- Machine Setup Screen
- Machine Control Status
 - Active G codes
 - Active M Codes
 - Active feed rate
 - Active Offsets
 - Active Tool

■ Axis and Spindle

- Command Position
- Absolute Position
- Speed, and Units
 - IPM IPS MMPM MMPS
 - RPM RPS DPS DPM
- Servo Status
 - Axis Enabled
 - IN Position
 - Homed
 - Returned
 - Faulted
 - Position Error
 - Motor Current
 - Motor Capacity
 - Inverter Capacity
- Diagnostics:
 - Display Fault Information
 - Display fault recovery information
 - Display axis Inhibit and recovery action

■ Part Program

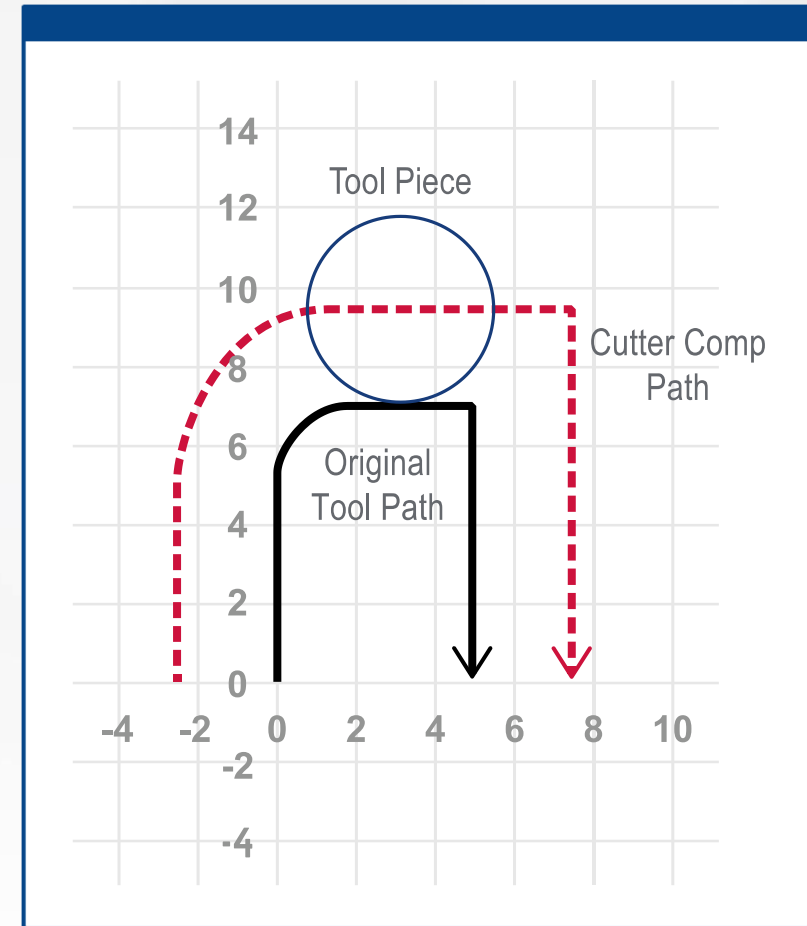
- Continuous or Single-step mode
- Cycle Start / Stop
- Program Stop
- Optional Stop
- Block Delete
- Part Rotation
- Feed rate Override
- Full function Editor
 - Insert, delete
 - Teach Position
- Library Management
 - Program select
 - Copy, Delete, Rename
- Part Program Syntax
- Part Program Parameter display

■ Offsets

- Fixture offsets
- Tool Length offsets
- Tool Diameter offsets
- Tool Wear offsets
- Geometry offsets
- Offset Limits

What is cutter compensation?

- Also known as Tool RADIUS Compensation
- A CNC function
 - **Inputs**
 - Original part program tool path
 - Diameter of the tool piece
 - Cutting plane
 - Side of the cutting path
 - **Outputs**
 - Cutting path offset by the RADIUS of the tool path



Value propositions for PNC solution

MODULAR/FLEXIBLE EQUIPMENT

Adaptable/customizable for new or rebuild machines – wide variety of machines supported

Scalable standard control and safety solutions to meet application specific requirements

COMPATIBLE WITH INDUSTRY STANDARD RS274D CNC PROGRAMS

Broad compatibility across design tools and utilities

Expandable to meet application requirements

DESIGN FLEXIBILITY AND PRODUCTIVITY

Workflow can be customized

Standards conformity and modular programming

Faceplates, code libraries / Add-On Instruction, Integrated Architecture[®] system, EtherNet/IP offers a pre-engineered solution

LOWER-COST SOLUTION

Can provide a lower-cost TCD3 than traditional or PC-based CNC solutions

Right sized solutions for medium axis count machines

Rockwell Automation Solution capabilities

Machine optimization

ControlLogix & CompactLogix PAC



- Scalable Logix platform with Integrated or Component Safety solution
- Highly flexible control and safety solution optimized for system requirements

Kinetix® Servo Drives & Motors



- Kinetix and PowerFlex integrated motion for precise position control
- Smooth motion operation & precise motion control w/ built-in Safety

PanelView 7, PanelView 5500 Mobile HMI solutions

PanelView™ 7
Graphic Terminal



PanelView™ 5500
Graphic Terminal

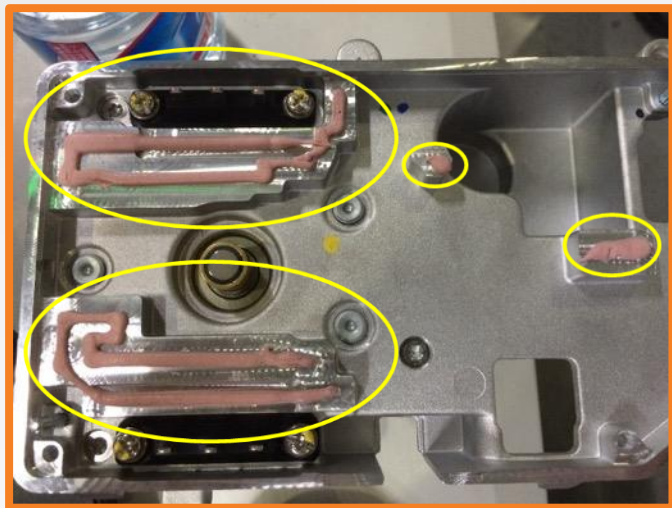


- Modular code and HMI displays compliant with industry standards
- Third-party device integration support with Add-on Profile, Add-On Instruction
- Pre-configured information-enabled code for data collection needs
- Remote connectivity/diagnostics/troubleshooting

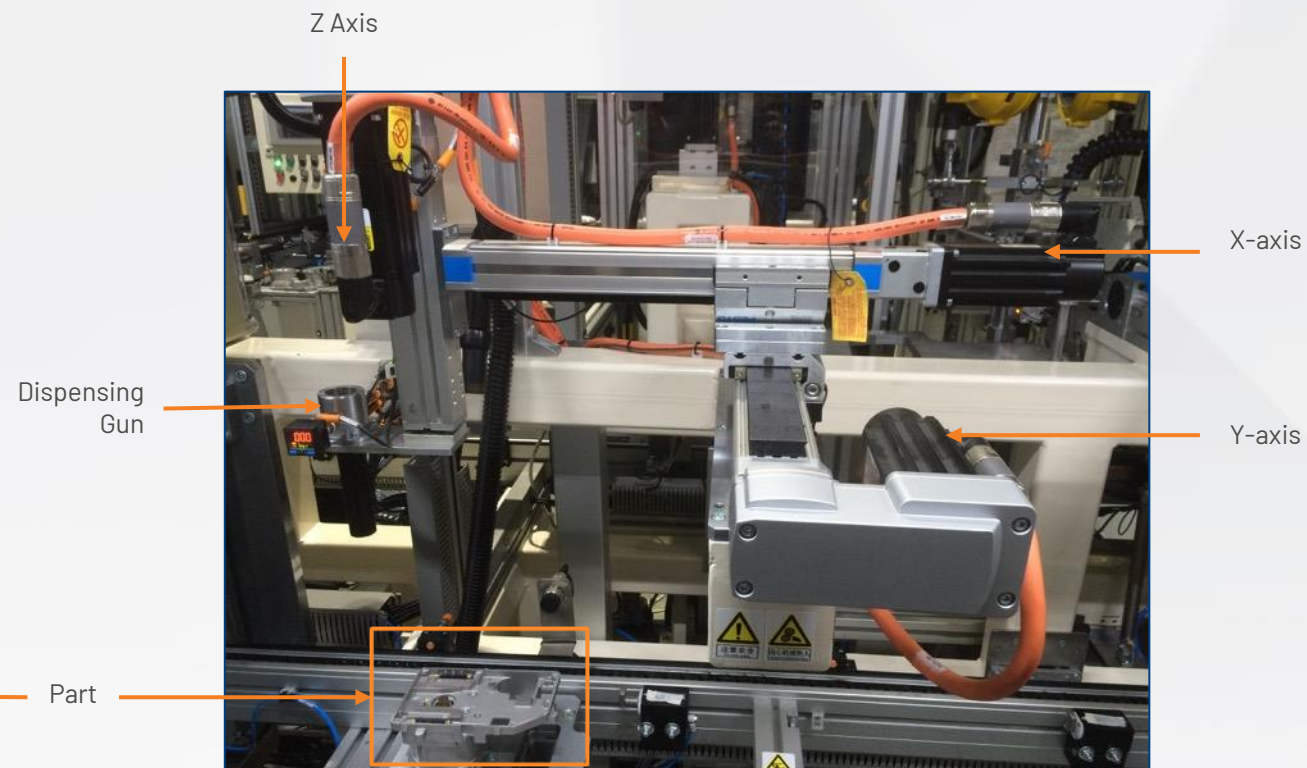
Compatible machine types

Abrasive flow finishing machines	Laser welding and cladding machines	Riveting machines
Boring machines	Lathes, cutoff	Roll finishing machines
Boring machines, jig	Lathes, manual	Roll forming and bending machines
Broaching machines	Machining centers, horizontal spindle (up to four-axis)	Sawing machines, contour
Buffing and polishing machines	Machining centers, horizontal spindle, five-axis	Super (micro) finishing machines
Centrifugal barrel and disk finishing machines	Machining centers, universal	Superabrasive machining systems
Deburring machines	Machining centers, vertical spindle (up to four-axis)	Thread cutting machines
Drilling and tapping machines, CNC	Machining centers, vertical spindle, five-axis	Thread rolling machines
Drilling and tapping units, fixtures	Marking and engraving machines	Threading and cutoff machines, pipe and bar
Drilling machines, bench and column	Micro machining equipment	Turn/mill machines, CNC
Drilling machines, deep hole (gun drilling)	Milling machines, bed-type	Turning centers, horizontal, CNC
Drilling machines, multi-spindle	Milling machines, graphite	Turning centers, inverted vertical, CNC
Drilling machines, radial arm	Milling machines, knee and column, non-ATC	Turning centers, twin-spindle/twin-turret
End finishing equipment, bar and tube	Milling machines, planer, gantry and bridge type	Turning centers, vertical, CNC
End turning machines	Milling machines, profile and duplicating	Ultrasonic machining equipment
Grinding machines (all types)	Milling machines, universal	Water jet cutting machines
Honing machines, vertical spindle	Notching and slotting machines	Welding machines and equipment
Lapping machines, eternal cylindrical	Pipe and tube bending machines	Welding machines, electron-beam
Lapping machines, flat surface/special purpose	Plasma-arc/Plasma cutting machines	Welding machines, friction
Laser cutting or drilling systems	Plastic cutting and slitting	Woodworking equipment
Laser marking systems		

Application Ex. – Glue Dispense



Glue dispensed according to the tool path program – M&G codes



Modern Machine: Lathe Style, High Speed Cut off Machine



CHALLENGE

- Meeting customer demands for precision, and additional functionality more cost effectively; Provide equipment that is more intuitive for the operators to use and maintain.

SOLUTION

- Standardization on single control platform/HMI with an integrated servo and standard drive motion solution all based on EtherNet/IP
- PNC – to provide a pre-canned intuitive HMI program with built-in recipe management and storage

RESULTS

- **EASIER** integration with other equipment production equipment
- **QUICKER** changeover time
- **ENHANCED** diagnostic coverage to help ease maintenance activities and reduce support needs

[LEARN MORE](#)

Machine Rebuilder 12 Station Rotary Dial Milling Machine



CHALLENGE

- Current machine no longer meeting productivity goals. Replacement parts from overseas supplier scarce, technical support expensive and purchasing a new custom machine was cost prohibitive. Closed system made machine modifications

SOLUTION

- Standardization on single control platform with an integrated servo and standard drive motion solution all based on EtherNet/IP, PanelView and MobileView™ HIM
- PNC – to provide a pre-canned intuitive HMI program with built-in recipe management and storage

RESULTS

- **TRIPLED** production throughput
- **IMPROVED** workflow from CAD software
- **ENABLED** operators to access HMI applications and maintain 'line of sight' when making tooling adjustments

[LEARN MORE](#)

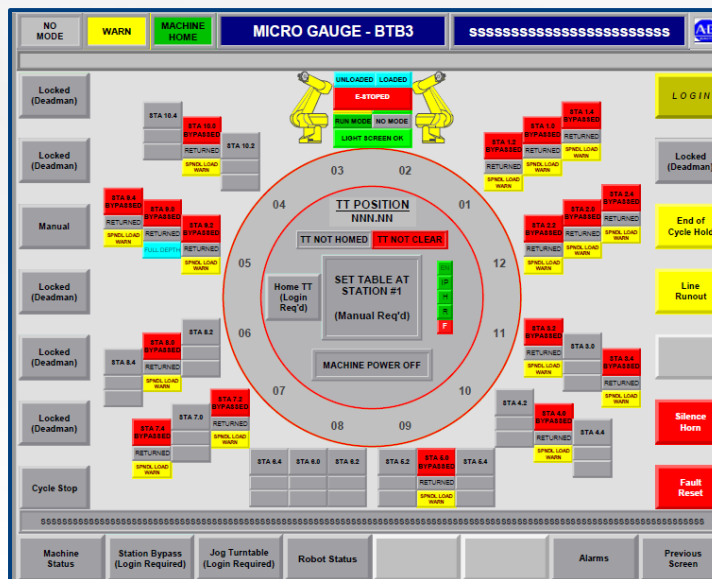
CUSTOMER CASE STUDY



Henshaw: Machine Rebuilder 12 Station Rotary Dial Milling Machine

SOLUTIONS

- 17 Stations require functionality PNC provides
- GuardLogix® - Safety and cell control in one controller
- Logix L8 for PNC application
- 30+ Kinetix Servo Axis
- 15 PowerFlex Axis
- #2 Robots for load/unload
- Manual entry of part programs
- Total panel price \$260K Net



Concept Systems Inc.

Programmable Numerical Control for Flexible Manufacturing with Machine Tool

Rockwell Automation was well suited for this application with standard hardware and software, which would be easy for the plant personnel to own and manage through their lifecycle.

Additionally, the solution utilized the pre-configured program and project files of Rockwell Automation's Programmable Numerical Control (PNC) to simulate the machine control methodology of a traditional CNC, while also providing additional features to the machine control and HMI that Studio5000 could provide over traditional CNC's.

CHALLENGE

Global Manufacturer of hand tools purchased a machine that had limited flexibility for milling multiple SKU's without significant Tool Changeover affecting production rates.

SOLUTION

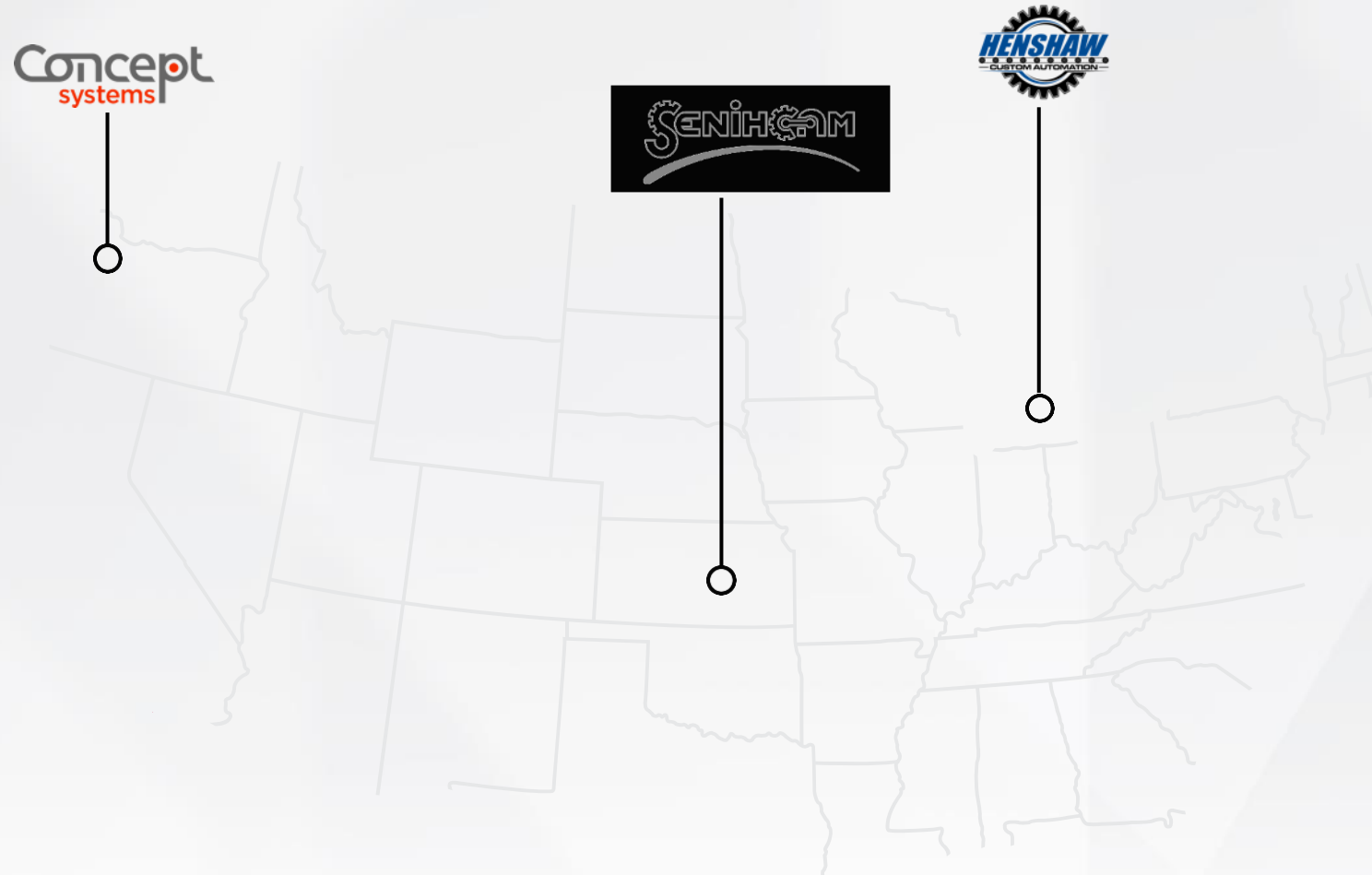
Concept Systems, Inc., a Rockwell Automation Solution Partner based out of Albany, OR offered the Customer a delivery partner with not only CNC and PLC expertise, but a reference of already delivered PNC systems on similar applications that helped reduce any perceived risk with the solution. The PNC Portfolio for this migration was:

- CompactLogix 5380
- Compact 5069 IO
- PanelView 7 Performance
- Studio5000
- FactoryTalk ME
- Kinetix 6500 (existing)

CUSTOMER OUTCOME

Customer was able to leverage keeping some of the existing machine control in place to minimize the cost of the upgrade which helped with the overall ROI of the project. Additionally, facility personnel already familiar with other CNC's in the plant were able to onboard quickly and helped leverage this workforce competency across a broader number of plant assets.

Rebuilders/SI



Thank you



www.rockwellautomation.com





expanding **human possibility**[®]

