

# Mill Operator Users Guide



Mike Cope  
*Product Technical Specialist*  
copem@hurco.com

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- › Absolute Tool Length Calibration Defined

# Performing a Toolchange

# Performing a Manual Toolchange

1. Press the MANUAL mode button on the control panel
2. Press INPUT on control panel
3. Select TOOL REVIEW softkey
4. Select TOOL SETUP softkey
5. Enter the desired tool number and press ENTER



TOOL SETUP

MACHINE	PART	
X 0.0000	0.0000	SPINDLE 0
Y 0.0000	0.0000	FEED (STOPPED) 0.0
Z 0.0000	0.0000	TOOL IN SPINDLE 0

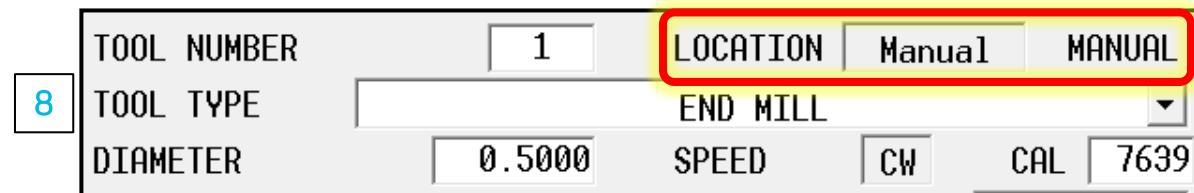
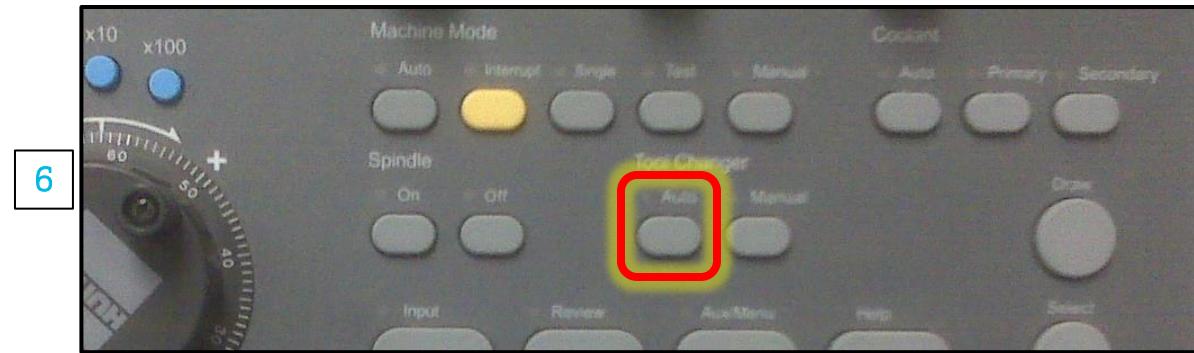
5

TOOL NUMBER	LOCATION	MANUAL
1	Manual	

TOOL TYPE END MILL  
DIAMETER 0.5000 SPEED CW CAL 7639  
COOLANT PRIMARY SURFACE SPEED 1000

# Performing a Manual Toolchange

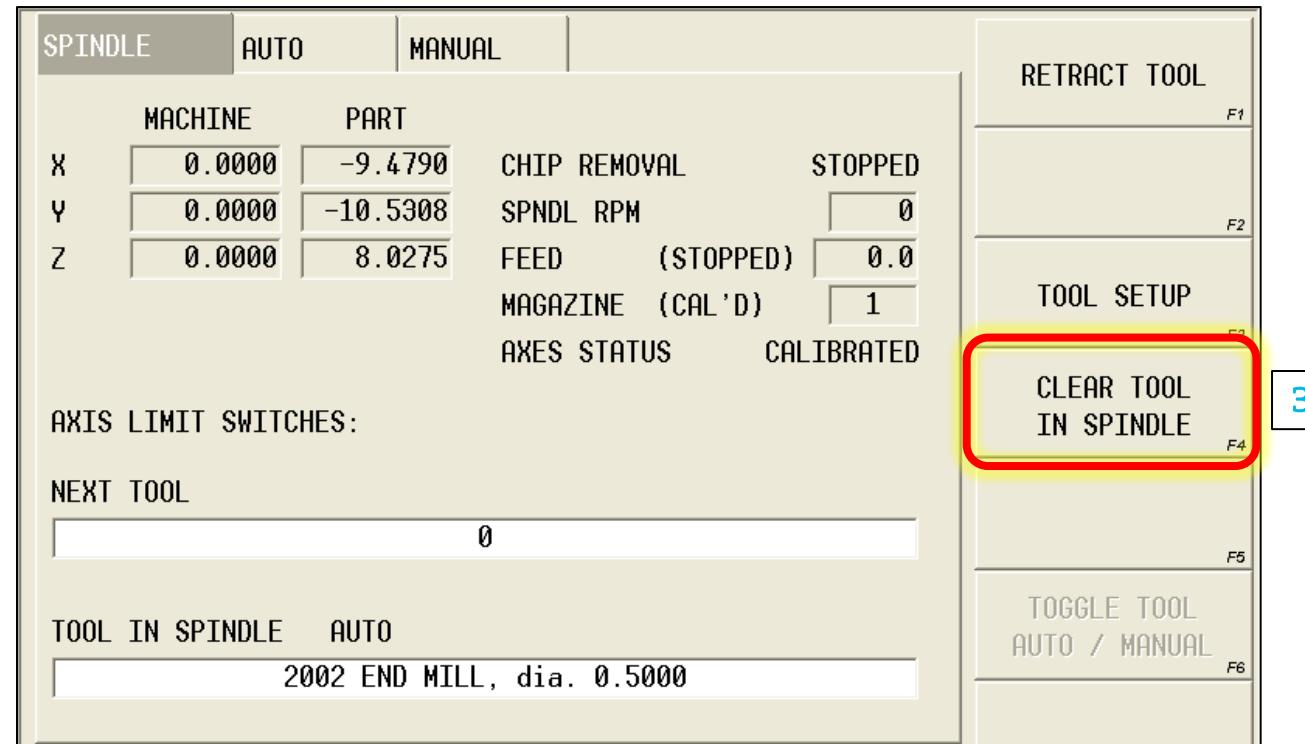
6. Press the Tool Changer AUTO button – START CYCLE should begin to flash
7. Press the flashing START CYCLE button
8. Verify the AUTO/MANUAL state of the current tool – use the Tool Changer Auto button to toggle the AUTO/MANUAL condition of the tool



# Clear Tool in Spindle

# Clearing the Tool in Spindle

1. Press the MANUAL mode button on the control panel
2. Select TOOL MANAGEMENT softkey
3. Select CLEAR TOOLIN SPINDLE softkey
4. Press the flashing START CYCLE button



4



# Tool Touch-off

Without Tool Touch Probe

**Note:** the tool setup and touch-off procedures in this manual assume that the machine control has been setup in *Absolute Tool Length* mode. Please refer to the separate section at the end of this document for more details.

TOOL SETUP	
MACHINE	PART
X	0.0000
Y	0.0000
Z	0.0000
TOOL NUMBER	1
TOOL TYPE	END MILL
DIAMETER	0.5000
TOOL CAL LENGTH	6.2531
TOUCH-OFF DEVICE	1 GAUGE
CUTTING TIME	21
DIAMETER WEAR	0.0000

The absolute length of the tool, measured from the spindle gage-line.

Amount of time in minutes that the tool has been in the rotating spindle.

PRESS MANUAL MODE, POWER, AND START CYCLE TO RESTORE POWER.

# Step 1

## Verify the Active Device

1. Press INPUT on control panel
2. Select TOOL REVIEW softkey
3. Select TOOL SETUP softkey
4. Select MORE softkey
5. Select TOOL MEASUREMENT SETTINGS softkey
6. Select the active Touch-off device

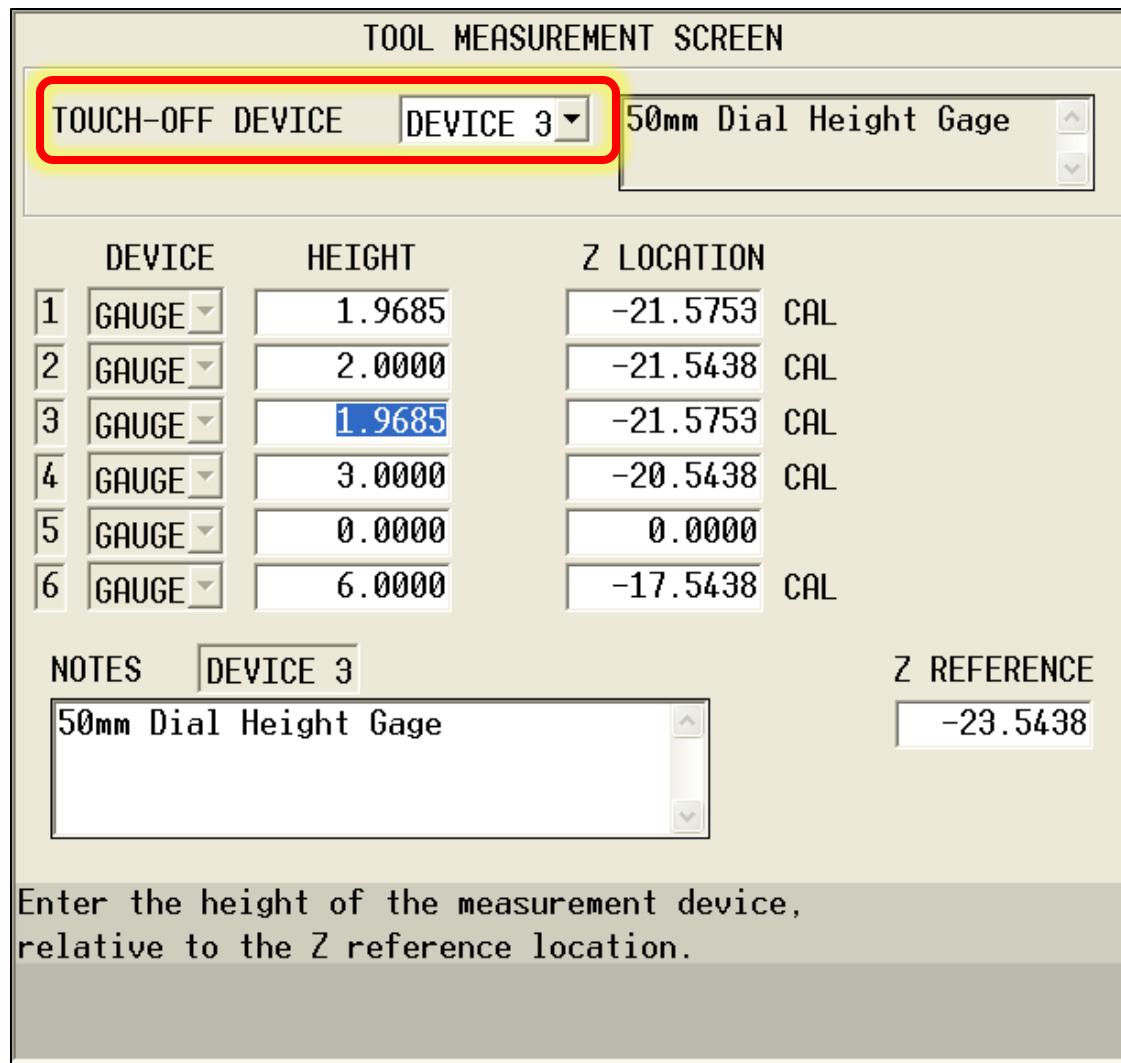
TOOL MEASUREMENT SCREEN

	TOUCH-OFF DEVICE	DEVICE 3	50mm Dial Height Gage
1	GAUGE	1.9685	-21.5753 CAL
2	GAUGE	2.0000	-21.5438 CAL
3	GAUGE	1.9685	-21.5753 CAL
4	GAUGE	3.0000	-20.5438 CAL
5	GAUGE	0.0000	0.0000
6	GAUGE	6.0000	-17.5438 CAL

NOTES DEVICE 3  
50mm Dial Height Gage

Z REFERENCE -23.5438

Enter the height of the measurement device, relative to the Z reference location.



# Step 2

## Calibrate the Tool

1. Jog the tool into contact with the active touch-off device using the hand-wheel
2. Store the tool length by pressing the SET LENGTH softkey (F6)



TOOL SETUP

MACHINE	PART	A	B
X 15.0000	-0.0672	0.000	-0.000
Y 20.0000	10.7971	0.000	-0.000
Z 0.0000	17.5638	TOOL IN SPINDLE	0

DELETE TOOL F1

TOOL NUMBER 10 LOCATION Manual

TOOL TYPE END MILL

DIAMETER 0.5000 SPEED CW CAL 8403

COOLANT PRIMARY

SURFACE SPEED 1100

FEED/FLUTE 0.005000

TOOL CAL LENGTH 7.6255 FLUTES 2

TOUCH-OFF DEVICE 3 GAUGE FEED CAL 84.0

CUTTING TIME 21

DIAMETER WEAR 0.0000

SET LENGTH USING TOUCH-OFF DEVICE F6

Enter or store the tool calibration value.  
'P' designator indicates values set by probing.

MORE → F7

EXIT F8

PART SETUP F2

PART PROGRAMMING F3

TOOL OFFSETS F4

TOOL HOME F5

# Tool Touch-off With Tool Touch Probe

**Note:** the tool setup and touch-off procedures in this manual assume that the machine control has been setup in *Absolute Tool Length* mode. Please refer to the separate section at the end of this document for more details.

TOOL SETUP	
MACHINE	PART
X	0.0000
Y	0.0000
Z	0.0000
TOOL NUMBER	1
TOOL TYPE	END MILL
DIAMETER	0.5000
TOOL CAL LENGTH	6.2531
TOUCH-OFF DEVICE	1 GAUGE
CUTTING TIME	21
DIAMETER WEAR	0.0000

The absolute length of the tool, measured from the spindle gage-line.

Amount of time in minutes that the tool has been in the rotating spindle.

PRESS MANUAL MODE, POWER, AND START CYCLE TO RESTORE POWER.



# Step 1

## Verify Probing Cycle Defaults

1. Press INPUT on control panel
2. Select TOOL REVIEW softkey
3. Select TOOL SETUP softkey
4. Select MORE softkey
5. Select TOOL PROBING softkey
6. Select TOOL PROBE SETUP softkey
7. Select TOOL PROBING CYCLE DEFAULTS softkey

TOOL PROBING CYCLE DEFAULTS

**Recommended Default Settings**

SPINDLE USAGE	MANUAL	LENGTH OFFSET X	0.0000
SPINDLE SPEED	0	LENGTH OFFSET Y	0.0000
FAST FEED	25.0	Z DROP DOWN DEPTH	0.2500
SLOW FEED	3.0	SPINDLE CLEARANCE	0.1250
RAPID CLEARANCE	0.3937		
MIN LENGTH DELTA	1.0000		

STORE RESULT AS

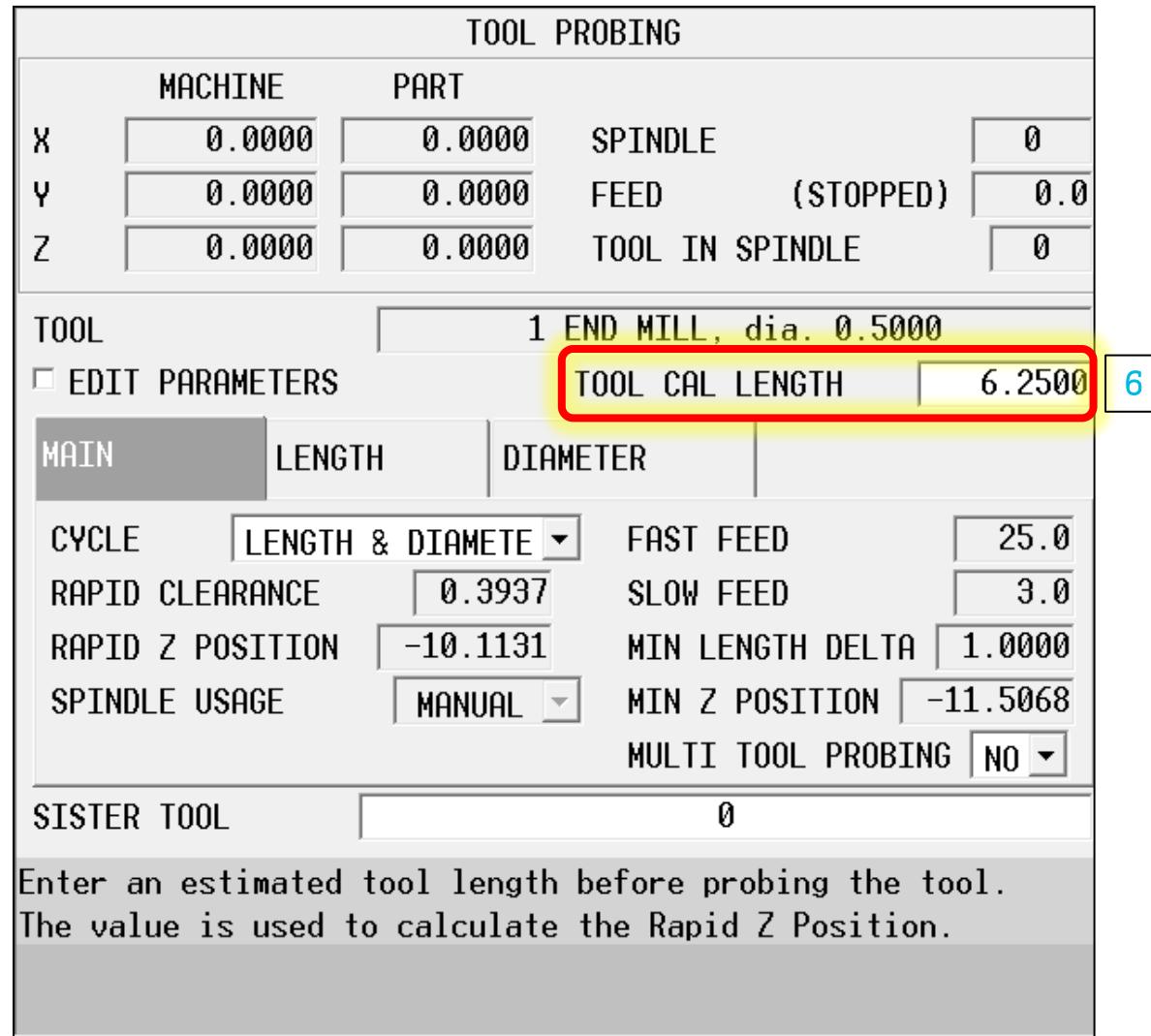
LENGTH	TOOL LENGTH
DIAMETER	DIAMETER WEAR

Specify how the spindle will operate during the tool probing cycle.

# Step 2

## Probe the Tool

1. Press INPUT on control panel
2. Select TOOL REVIEW softkey
3. Select TOOL SETUP softkey
4. Select MORE softkey
5. Select TOOL PROBING softkey
6. Measure tool for reference length, and enter the value in the TOOL CAL LENGTH field

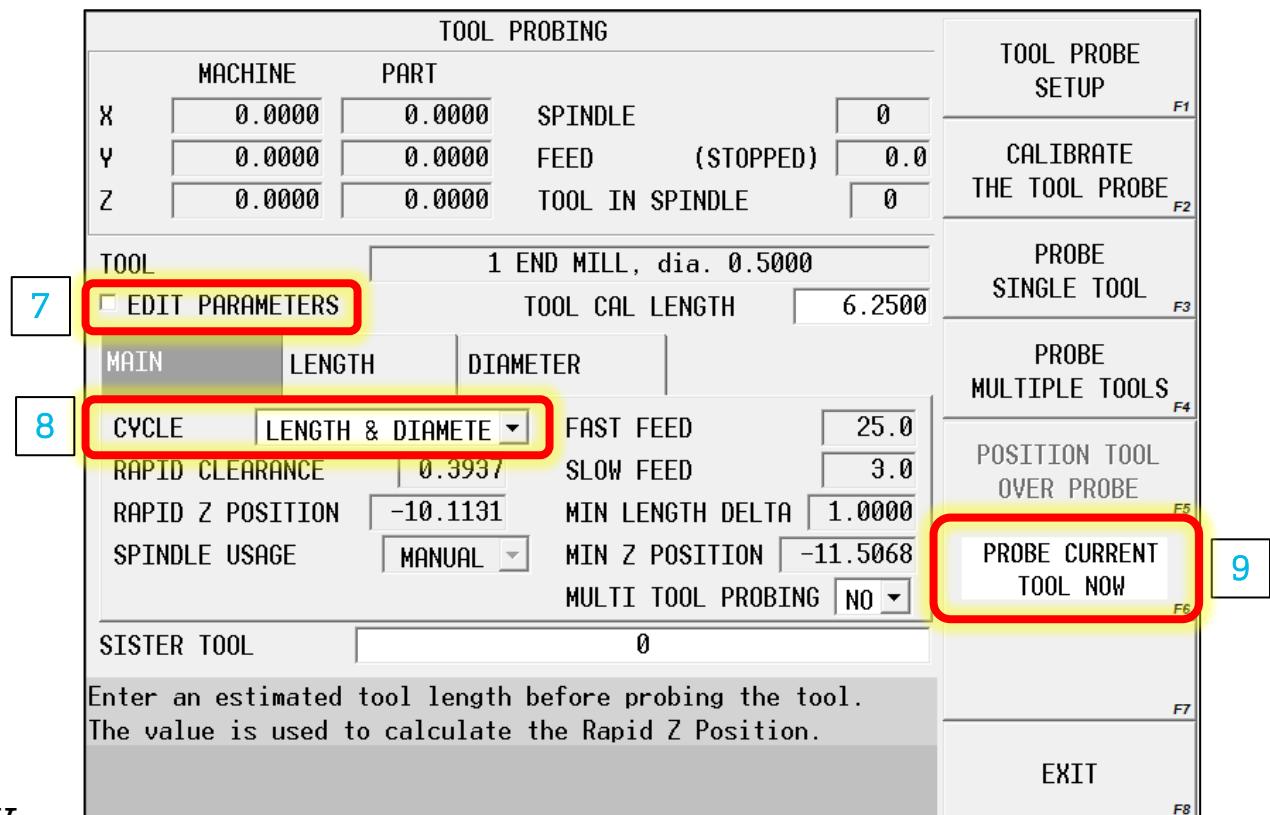


# Step 2 - Continued

## Probe the Tool

7. Check the EDIT PARAMETERS box to allow editing of the default probing parameters – only if needed – be sure to check all 3 tabs (Main, Length, Diameter).
8. Select the desired cycle type
9. Select the PROBE CURRENT TOOL NOW softkey

**Note:** the travel speed of the probe is controlled by the FEED knob only.



# Part Setup

## Without Part Probe

# Part Setup Screen

Note: the default configuration for the part setup screen is in the Universal Rotary setting. Regardless of the machine configuration (3-axis, 4-axis, or 5-axis) there will be data fields for a IV and V axis. This is normal, and the fields can be ignored for standard 3-axis machines.

PART SETUP							
MACHINE		PART		SPINDLE			
X	0.0000	0.0000		0			
Y	0.0000	0.0000	FEED	(STOPPED)	0.0		
Z	0.0000	0.0000	TOOL IN SPINDLE		0		
PART ZERO		SHIFT		SAFETY WORK REGION			
X	0.0000			(-)	(+)		
Y	0.0000			Z	-399.0000	399.0000	
Z	0.0000		0.0000	X	-399.0000	399.0000	
IV	0.000			Y	-399.0000	399.0000	
V	0.000						
X/Y SKEW (DEG) 0.0000							
Enter part zero.							

WORK OFFSETS F1

TOOL SETUP F2

PART PROGRAMMING F3

PROGRAM PARAMETERS F4

PART PROBING F5

STORE MACHINE POSITION F6

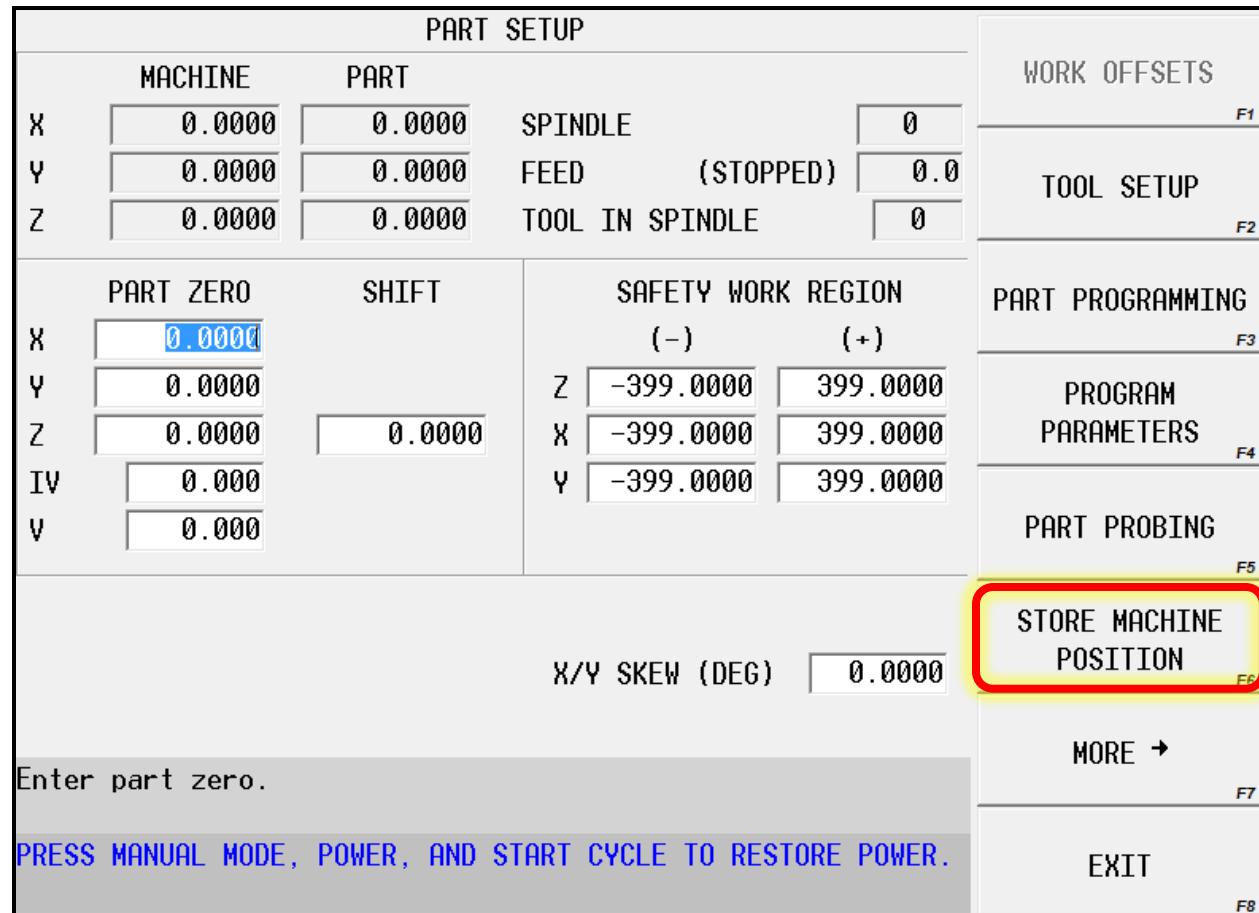
MORE → F7

EXIT F8

# Part Setup

## Without Part Probe

1. Press INPUT on control panel
2. Select PART SETUP softkey
3. Jog the desired axis into position using the handwheel
4. Place the cursor in the corresponding data field for the desired axis
5. Select the STORE MACHINE POSITION softkey
6. Verify the data is correct



# Part Setup Screen

Note: the SHIFT field can be used to incrementally shift the Z-axis. For example: a value of 2.0000" will shift the Z-axis zero in the positive direction by two inches. Both positive and negative values can be input.

PART SETUP					
MACHINE		PART			
X	0.0000	-18.6155	SPINDLE	0	
Y	0.0000	-12.4577	FEED	(STOPPED)	0.0
Z	0.0000	16.4932	TOOL IN SPINDLE	0	
PART ZERO		SHIFT		SAFETY WORK REGION	
X	18.6155			(-)	(+)
Y	12.4577			Z	-399.0000 399.0000
Z	-18.4932	2.0000		X	-399.0000 399.0000
IV	0.000			Y	-399.0000 399.0000
V	0.000				

# Absolute Tool Length Calibration

**HURCO®**

Mike Cope  
Product Technical Specialist  
[copem@hurco.com](mailto:copem@hurco.com)

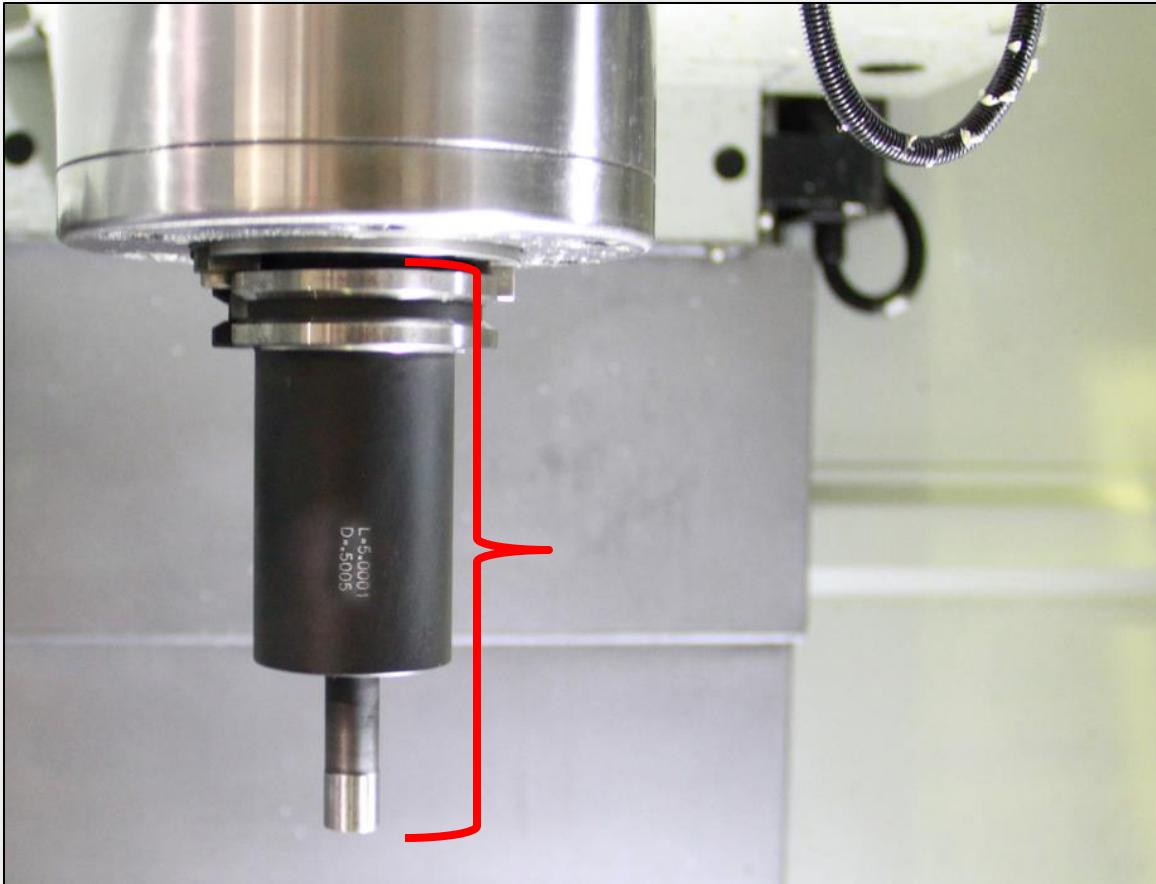
# Contents

- What is Absolute Tool Length
- What is the Spindle Gage-line
- What is a Master Reference Tool
- How is the Gage-line calculated
- Why is it important to use the Gage-line for tool lengths
- How to establish a Probe or Gauge device.

# Absolute Tool Length

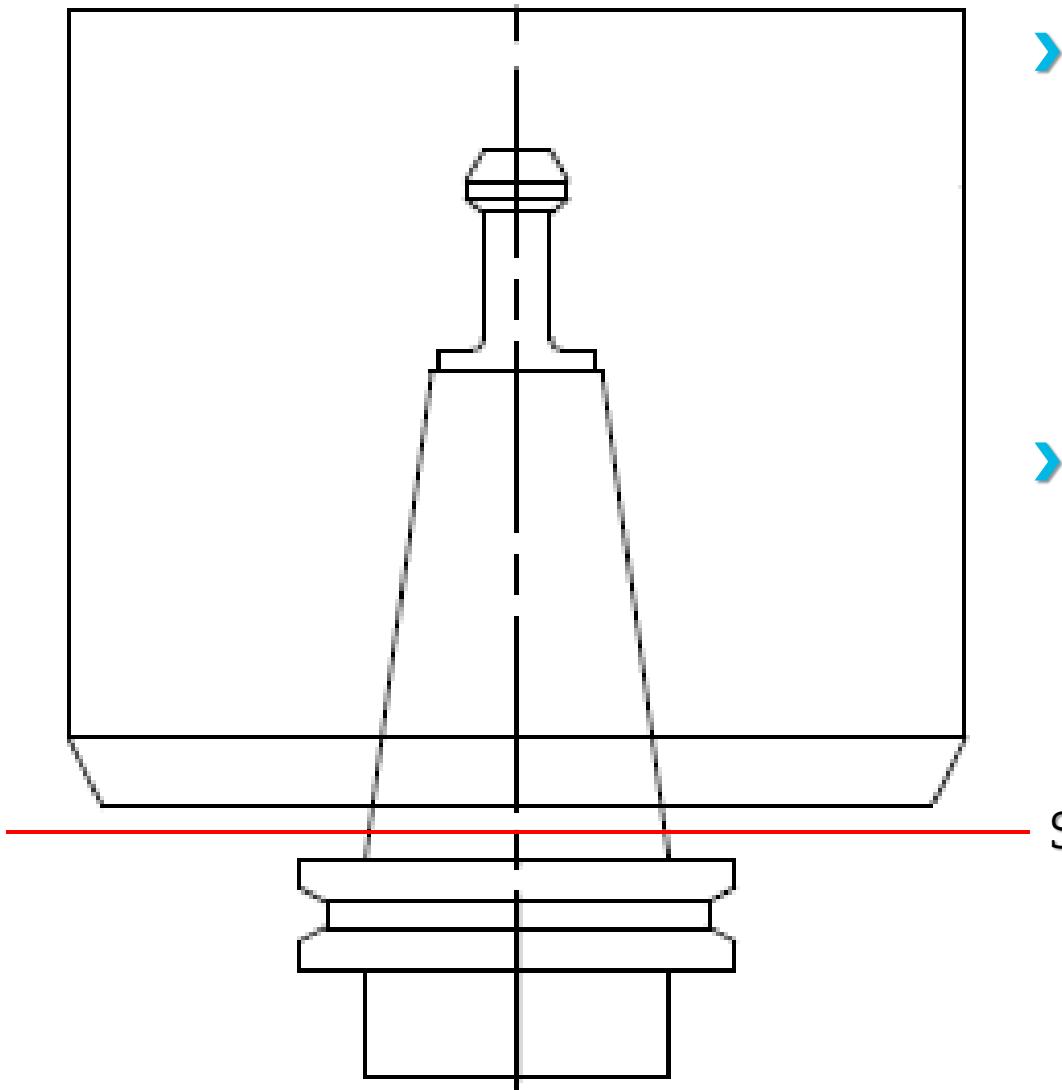
What is it?

*Absolute Tool Length* - is the actual measured length of a tool sticking out of the spindle, and is typically measured from the spindle gage-line.

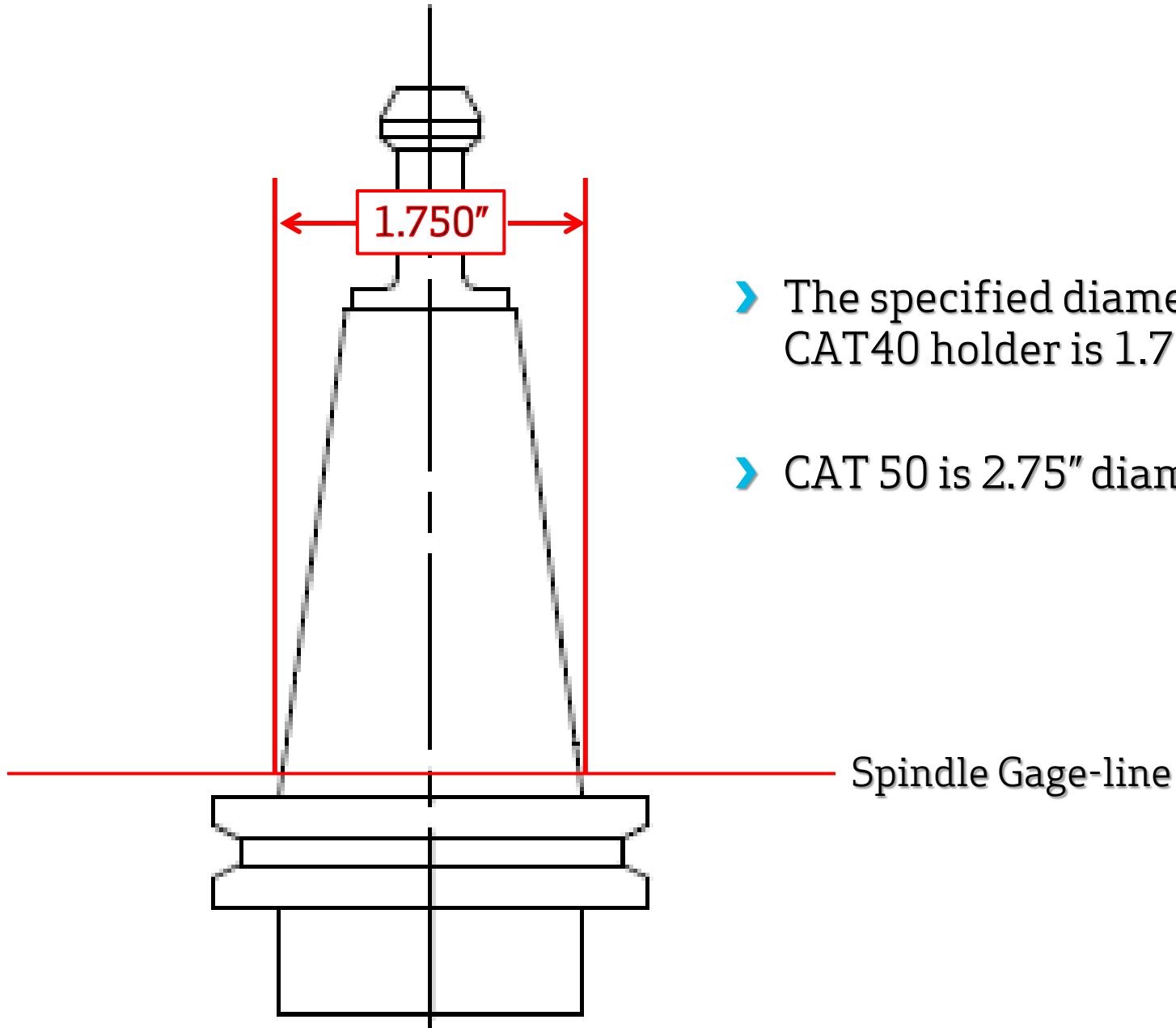


# Spindle Gage-line

What is it?



- The spindle gage-line falls somewhere within the gap between the spindle nose face and the V-flange on the tool holder.
- The location is determined by a specified diameter along the ground taper of the tool.



- The specified diameter on a CAT40 holder is 1.75" diameter
- CAT 50 is 2.75" diameter

# Master Reference Tool

What is it?

*Master Reference Tool*- is a tool of calibrated length that can be mounted in the spindle and used to accurately reference a machine's spindle gage-line. The length is stenciled on the body.



# Purchase a Master Reference Tool

Renishaw, Inc. • 5277 Trillium Blvd. • Hoffman Estates, IL 60192 • 847-286-9953

[www.renishaw.com](http://www.renishaw.com)

## Description:

CAT40 Calibration Master

CAT50 Calibration Master

BT30 Calibration Master

HSK63 Calibration Master

## Part No.

M2253-0954

M2253-0955

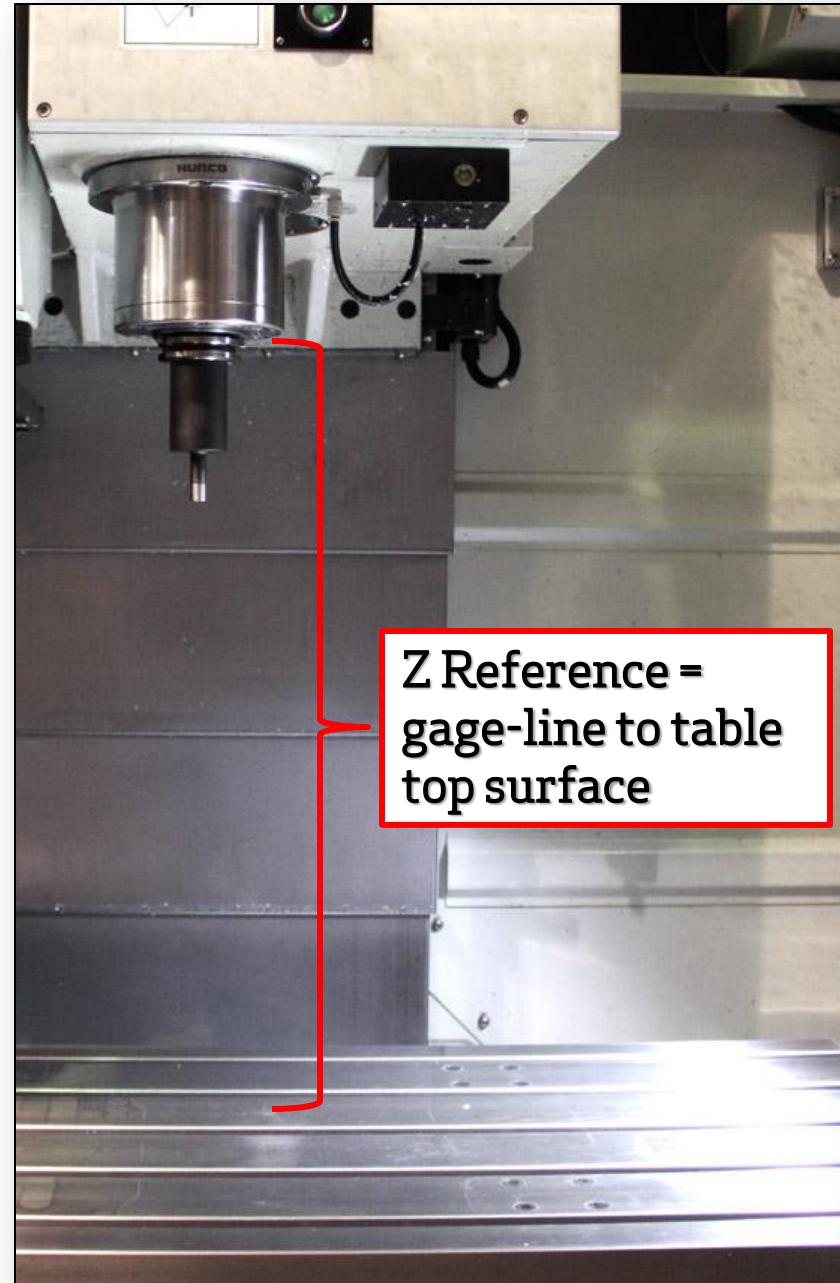
M2253-1562

M2253-1558

# Setting the Z-Reference

## Applying the gage-line

The Z-reference dimension is the measured distance between the spindle gage-line and the machine table surface.



TOOL MEASUREMENT SCREEN

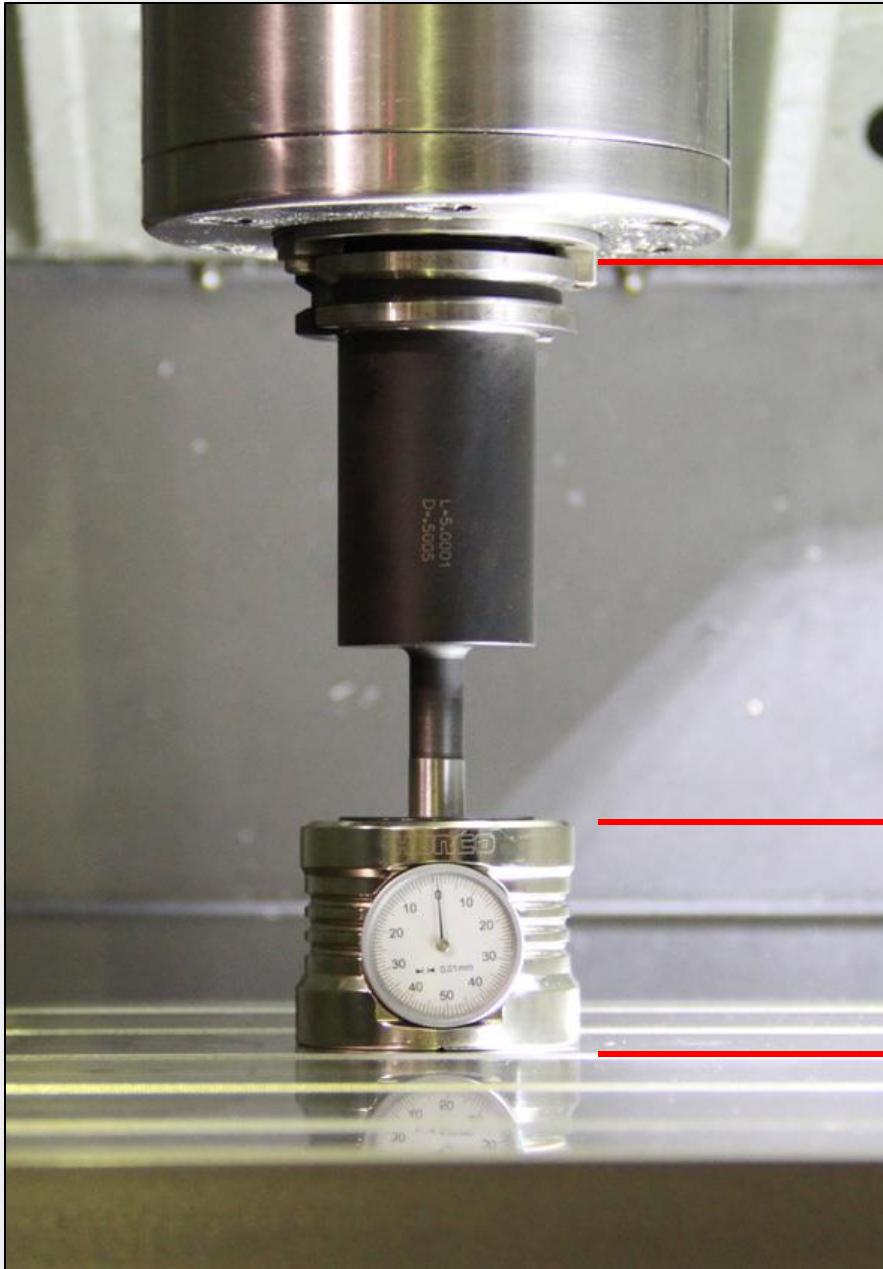
	TOUCH-OFF DEVICE	DEVICE 2	Z LOCATION
1	PROBE	3.5966	-16.0389 CAL
2	GAUGE	1.9685	-17.6670 CAL
3	GAUGE	3.0000	-16.6355 CAL
4	GAUGE	0.0000	0.0000
5	GAUGE	0.0000	0.0000
6	GAUGE	0.0000	0.0000

NOTES DEVICE 1

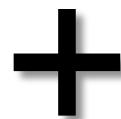
Z REFERENCE -19.6355

# Measuring the Z-Reference

## How is it calculated?



Z-axis Machine Position



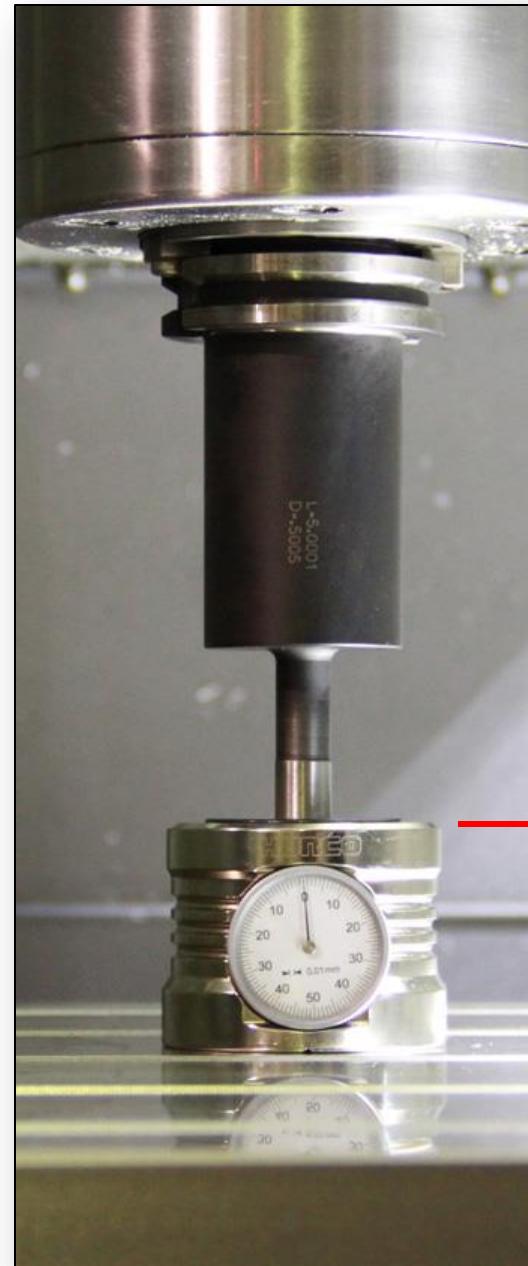
Master Reference Tool Length



Dial Gage Height



Z- Reference Dimension



TOOL MEASUREMENT SCREEN

TOUCH-OFF DEVICE

DEVICE	HEIGHT	Z LOCATION
1 PROBE	3.5966	-16.0389 CAL
2 GAUGE	1.9685	-17.6670 CAL
3 GAUGE	3.0000	-16.6355 CAL
4 GAUGE	0.0000	0.0000
5 GAUGE	0.0000	0.0000
6 GAUGE	0.0000	0.0000

Z REFERENCE

Top of active device = a calculated location

$$-19.6355 - 1.9685 = -17.6670$$

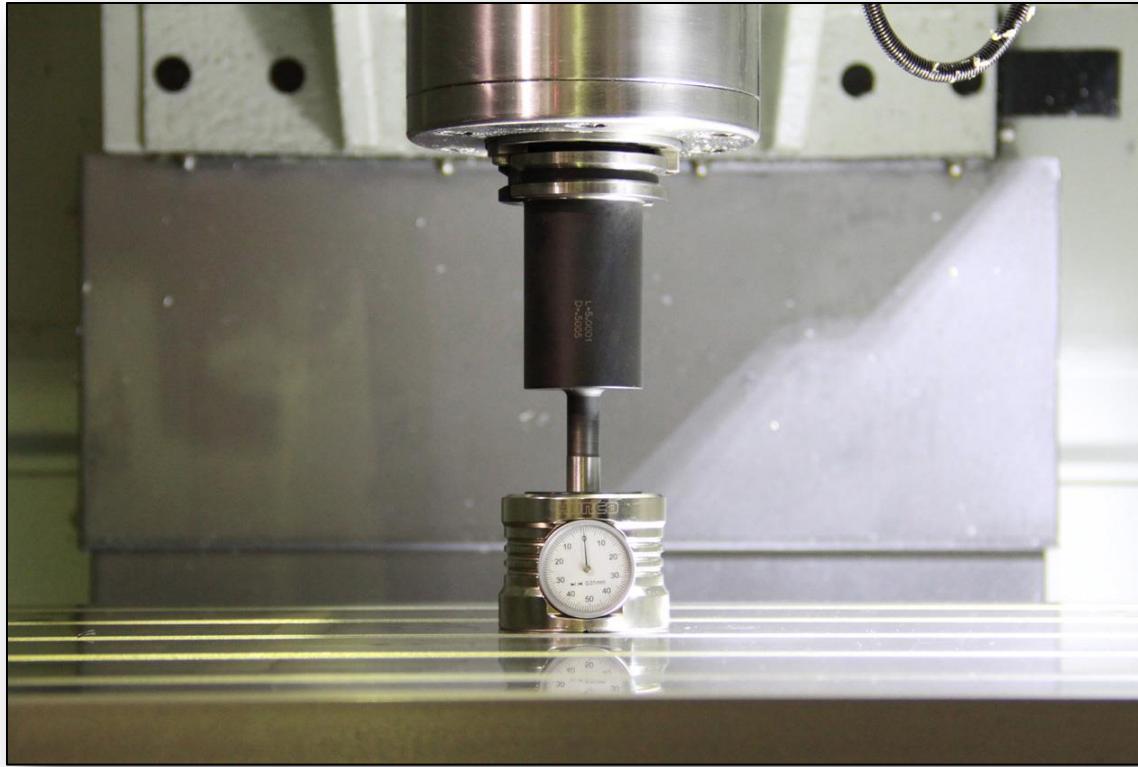


Z-axis Machine Position (-12.6669)

Tool Length  $(17.6670 - 12.6669 = 5.0001")$

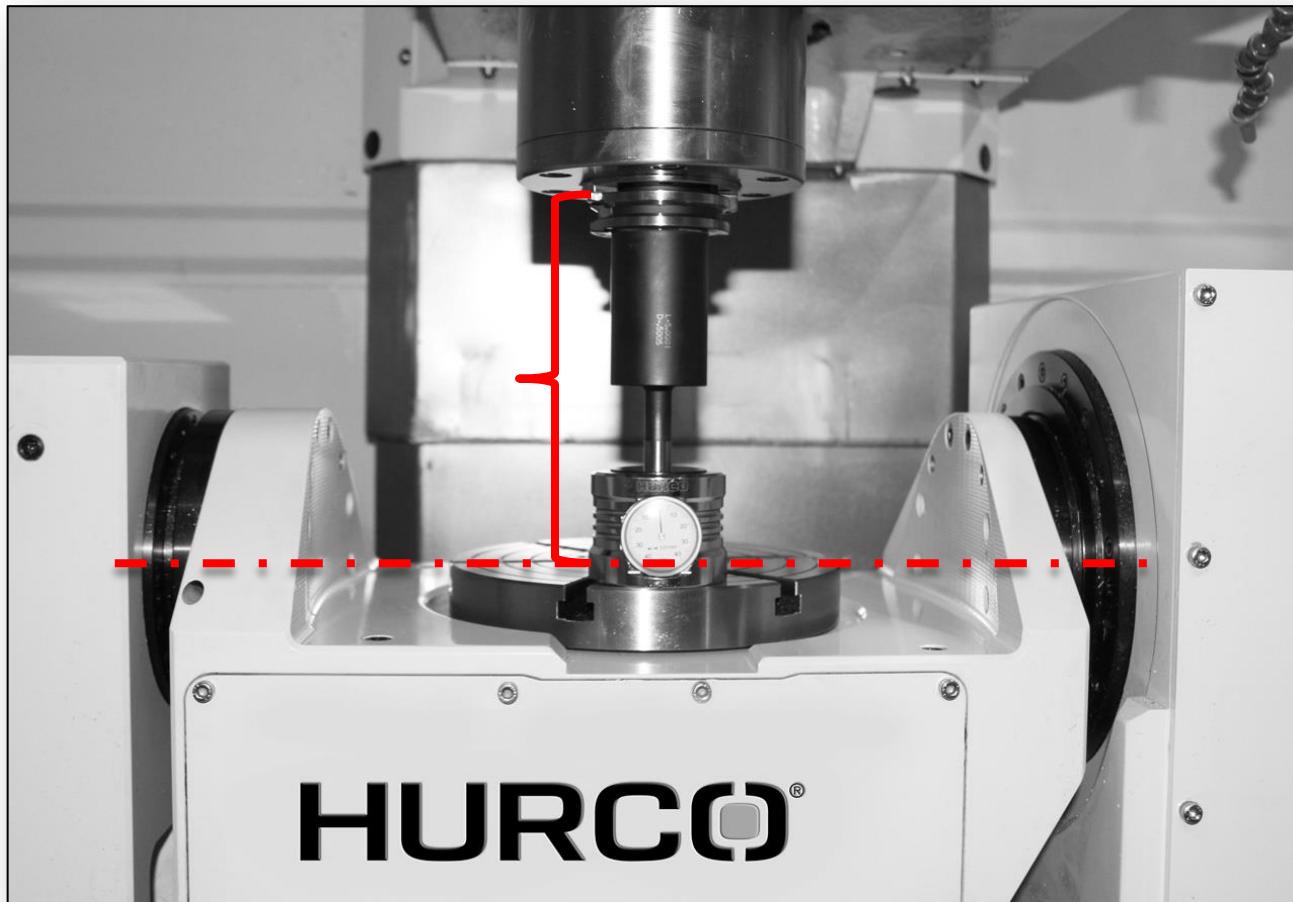
Calculated Device Location (-17.6670)

- In 3-axis setups the spindle nose CAN be used, but calculated tool lengths will be “machine specific”, and the tools cannot be shared between other machines.
- Also, offline tool pre-setters cannot be used if tool lengths do not reference the spindle gage-line.



Apply this to 5-axis  
Measuring Centerlines

- Rotary axis centerlines are measured from the spindle gage-line in the Z-axis direction.
- Tool lengths **MUST** be measured from the same reference point - or positioning is off location when the part is rotated.



# Establish a Setup Device

How do I?

- Absolute Tool Length allows the operator to define and use (6) six different devices to establish a tool's calibrated length.
- The device height is simply an actual measured height of any object to be used to touch-off tools (example: 123 block).

**TOOL MEASUREMENT SCREEN**

TOUCH-OFF DEVICE	<b>DEVICE 2</b> ▾	
<b>DEVICE</b>	<b>HEIGHT</b>	<b>Z LOCATION</b>
1 PROBE ▾	3.5966	-16.0389 CAL
2 GAUGE ▾	1.9685	-17.6670 CAL
3 GAUGE ▾	3.0000	-16.6355 CAL
4 GAUGE ▾	0.0000	0.0000
5 GAUGE ▾	0.0000	0.0000
6 GAUGE ▾	0.0000	0.0000

NOTES	<b>DEVICE 3</b> ▾	
123 Block on Table Surface		

Z REFERENCE	<b>-19.6355</b>	
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F1  
F2  
F3  
F4  
F5  
F6

- Select the active Touch-Off Device.
- Verify the correct device is active when calibrating tools.

**TOOL MEASUREMENT SCREEN**

TOOL SETUP		TOUCH-OFF DEVICE	DEVICE 3
MACHINE	PART		
X	0.0000	A	0.0
Y	0.0000	C	0.0
Z	0.0000	TOOL IN SPINDLE	
TOOL NUMBER	1	LOCATION	Ma
TOOL TYPE	END MILL		
DIAMETER	0.5000	SPEED	CW
COOLANT			
SURFACE SPEED			
FEED/FLUTE			
FLUTES			
FEED			
TOOL CAL LENGTH		5.3266	
TOUCH-OFF DEVICE		3	GAUGE
NOTES DEVICE 3			
123 Block on Table Surface			
CUTTING TIME		12 /	0
DIAMETER WEAR		0.0000	

- If one of the devices to be used is a probe, the device type will be set to Probe instead of Gauge.
- Height is the distance from the table surface to the probe stylus surface or laser beam – should be established at install.

