



HEIDENHAIN



Addendum

ND 1200 QUADRA-CHEK

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Information contained in this manual

This Operating Instructions addendum covers additional operating features included in the ND 1200 software v2.19.x.

1

Operation

1.1 Operation

Remote Operation from a PC

The ND 1200 can be issued commands from a PC connected to the RS-232 port.

Two sets of commands are available:

- Key emulation commands
- Unit control commands

Refer to the ND 1200 Operating Instructions for information on connecting a computer and sending data over the RS-232 port.



Remote keypad commands are only available if a remote keypad is attached

Key Emulation Commands

Key emulation commands emulate pressing an ND 1200 key or button.

Key emulation commands are available in two syntaxes:

- **@<value>**, the key is defined by the text contained in **value**
- **KEY <#>**, the key is defined by its numeric value contained in **#**

Key Emulation Example

To emulate pressing the Print button:

- ▶ Type **@PRINT** or **KEY 16** at the command line
- ▶ Press the **ENTER** key on the computer keyboard

The following key emulation commands are available:

Command Syntax 1	Command Syntax 2	Function
@0	KEY 21	0 key
@1	KEY 22	1 key
@2	KEY 23	2 key
@3	KEY 24	3 key
@4	KEY 25	4 key
@5	KEY 26	5 key
@6	KEY 27	6 key
@7	KEY 28	7 key
@8	KEY 29	8 key
@9	KEY 30	9 key
@+	KEY 32	+/- key
@-	KEY 32	+/- key
@.	KEY 31	. key
@ENTER or @E or @e	KEY 33	ENTER key
@FINISH or @F or @f	KEY 34	FINISH key
@CANCEL or @C or @c	KEY 35	CANCEL key
@QUIT or @Q or @q	KEY 36	QUIT key
@PRINT or @P or @p	KEY 16	PRINT key
@WIDE1 or @W1 or @w1	KEY 1	WIDE1 key
@WIDE2 or @W2 or @w2	KEY 2	WIDE2 key

Command Syntax 1	Command Syntax 2	Function
@ AXIS1 or @ D1 or @ d1	KEY 3	Dimension key 1
@ AXIS2 or @ D2 or @ d2	KEY 4	Dimension key 2
@ AXIS3 or @ D3 or @ d3	KEY 5	Dimension key 3
@ MENU	KEY 6	Menu key
@ LEFT or @ L or @ l	KEY 7	Left Arrow key
@ UP or @ U or @ u	KEY 8	Up Arrow key
@ RIGHT or @ R or @ r	KEY 9	Right Arrow key
@ DOWN or @ D or @ d	KEY 10	Down Arrow key
@ SOFT1 or @ S1 or @ s1	KEY 11	Soft key 1
@ SOFT2 or @ S2 or @ s2	KEY 12	Soft key 2
@ SOFT3 or @ S3 or @ s3	KEY 13	Soft key 3
@ SOFT4 or @ S4 or @ s4	KEY 14	Soft key 4
@ SOFT5 or @ S5 or @ s5	KEY 15	Soft key 5
@ MM	KEY 17	mm key
@ INC	KEY 18	INC/ABS Datum key
@ POLAR	KEY 19	Polar/Cartesian coordinates key
@ HELP	KEY 20	Help key
@ POINT	KEY 37	Point key
@ LINE	KEY 38	Line key
@ CIRCLE	KEY 39	Circle key
@ DISTANCE	KEY 40	Distance key
@ ANGLE	KEY 41	Angle key
@ SKEW	KEY 42	Skew key
@ MAGIC	KEY 43	Measure Magic key
@ !	KEY 44	Power key
@ REMOTE0 or @ R0 or @ ro	KEY 46	Remote keypad 0 key
@ REMOTE1 or @ R1 or @ r1	KEY 47	Remote keypad 1 key
@ REMOTE2 or @ R2 or @ r2	KEY 48	Remote keypad 2 key
@ REMOTE3 or @ R3 or @ r3	KEY 49	Remote keypad 3 key

Command Syntax 1	Command Syntax 2	Function
@REMOTE4 or @R4 or @r4	KEY 50	Remote keypad 4 key
@REMOTE5 or @R5 or @r5	KEY 51	Remote keypad 5 key
@REMOTE6 or @R6 or @r6	KEY 52	Remote keypad 6 key
@REMOTE7 or @R7 or @r7	KEY 53	Remote keypad 7 key
@REMOTE8 or @R8 or @r8	KEY 54	Remote keypad 8 key
@REMOTE9 or @R9 or @r9	KEY 55	Remote keypad 9 key
@REMOTE . or @R. or @r.	KEY 56	Remote keypad . key
@REMOTE + or @R+ or @r+	KEY 57	Remote keypad +/- key
@REMOTE - or @R- or @r-	KEY 57	Remote keypad +/- key
@REMOTE ENTER or @RE or @re	KEY 58	Remote keypad ENTER key
@REMOTE FINISH or @RF or @rf	KEY 59	Remote keypad FINISH key

Unit Control Commands

Unit control commands control the behavior of the ND 1200. These commands follow the syntax **<command>** or **<command><space><value>** where the action to be performed by the unit is defined by the text contained in the **command**. This action can have an argument associated with it, which is given in **value**.

Unit Control Command Example

To print axis data remotely:

- ▶ Type **PRINT** at the command line of a serial emulation program
- ▶ Press the **ENTER** key on the computer keyboard

The following unit control commands are available:

Command	Description
BAUD?	Returns the serial port baud rate.
BAUD <value>	Sets the serial port baud rate, where value is one of the following: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200.
PARITY?	Returns the serial port parity as an integer. 0 is None, 1 is Odd, and 2 is Even.
PARITY <value>	Sets the serial port parity, where value is one of the following: NONE, ODD, EVEN.
DATABIT?	Returns the serial port data length.
DATABIT <value>	Sets the serial port data length, where value is either 7 or 8.
STOPBIT?	Returns the number of serial port stop bits.
STOPBIT <value>	Sets the number of serial port stop bits, where value is either 1 or 2.
NAME?	Returns the product name, in this case ND 1200 .
CONTRAST <value>	Sets the contrast of the display, where value ranges from 0 to 255.
BRIGHTNESS <value>	Sets the brightness of the display, where value ranges from 0 to 99.
RETURN KEYS ON	Enables the key return function. When a subsequent key is pressed the key value is written to the serial port.
RETURN KEYS OFF	Disables the key return function.

Command	Description
HELP	Returns a listing of the available serial port commands.
BEEP	Sounds the keypress beep.
VERSION	Returns the product name and the software version of the unit.
FACTORYRESET	Clears the product memory to a default state and reboots the unit.
POSTLINE <value>	Clears the product memory to a default state and reboots the unit.
POSTLINE <value>	Sets the post line print characters. Value can be one of the following: 10, 13, 10.13.
AUTOSETUP?	Returns the current autosetup value.
AUTOSETUP <value>	Sets the machine options according to the autosetup number provided. Value can be one of the following: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 89, 90, 91, 92, 93, 94, 95, 101, 102.
AXIS TYPE <axis> <value>	Sets the encoder type of the axis. Axis can be either: X, Y, Z, Q, F. Value can be either: 0, 1, 2, 3, where 0 is TTL, 1 is analog, 2 is serial, and 3 is serial 2.
MDE?	Returns a number which represents the unit's measurement mode.
REVERSE?	Returns a number which represents the reversal of the axes counting directions.
REVERSE <value>	Sets the unit's axis reversals described by the number in value , which are added together. The valid reversal numbers are: 1 X Axis reversed 2 Y Axis reversed 4 Z Axis reversed 8 Q Axis reversed 16 F Axis reversed
INTERPOLATION <axis> <value>	Sets the interpolation of the axis for units with the NIKON option enabled. Axis can be either: X, Y, Z. Value can be either: 0, 1, 2, where 0 is 20X, 1 is 10X, 3 is 5X.

Command	Description
DRO	Clear the units menu state (returns to the DRO) by pressing the QUIT key twice followed by the ENTER key.
RESET <axis>	Resets the counter value of the axis. Axis can be either X, Y, Z, Q, F, or ALL.
ZERO <axis>	Performs a zero of the axis. Axis can be either X, Y, Z, Q, F, or ALL.
DISP RES MM	Changes the display resolution to millimeters.
DISP RES IN	Changes the display resolution to inches.
PRINT	Prints the DRO values of all the axes.
PRINT <axis>	Prints the DRO value of the axis. The value is preceded by the axis label and followed by the units label (mm or in). Axis can be either X, Y, Z, Q, F, or ALL.
CLOCK <value>	Sets the clock time and date. Value is a string of 6 number fields separated by spaces. The fields of value are: <ol style="list-style-type: none"> 1. Years since 2000. 2. Month. January is 0 and December is 11. 3. Day of the month. 0 is the first and 30 is the 31st. 4. Hours. Valid values are from 0 to 23 in 24 hour format. 5. Minutes. 6. Seconds.

Data Formats

The ND 1200 provides six data formats for exporting data reports. Refer to the Data Formats table below for descriptions of the Data Format options.

Refer the ND 1200 Operating Instructions for information on setting up and printing a report.

Command	Function
Display	Data that is exported as is on the DRO.
Report	Data is exported with line dividers for rows and columns.
Tol Rpt	Data of tolerated features is exported with line dividers for rows and columns.
CSV	Data is exported with Comma Separated Values.
Tab	Data is exported with Tab delimited values.

Data Format Examples

Character Output

The number of characters is the same per line of data for data type. Each line may contain different characters depending on the data being exported.

The following measured value is used to illustrate each report type:

Circle Feature

Circle feature	
Coefficients	X =68.1235 mm Y =-42.4320 mm Z =0.0000 mm R =7.5036 mm F =0.0035 mm
True Position tolerance nominal coefficients	X =68.1500 mm Y =-42.4500 mm Z =0.0000 mm R =7.5000 mm
True Position value	+/- 0.1000 mm for position and size

Send▶ Command **PRINT X**

1	2	3	4	5	6	7	8	9	10
X	<SP>		68	.	1235	<SP>	mm	<CR>	<LF>

▶ Command **PRINT Y**

1	2	3	4	5	6	7	8	9	10
Y	<SP>	-	42	.	4320	<SP>	mm	<CR>	<LF>

Char	Description
1	Coordinate axis
2, 7	Space
3	Sign (positive sign is not displayed)
4	1 to 9 places before the decimal point
5	Decimal point
6	0 to 6 places after the decimal point
8	2 characters for units: in for Inch and mm for Millimeters
9	Carriage return
10	Line feed

Display

► Command @PRINT

1	2	3	4	5	6	7	8	9	10
X	<SP>		68	.	1235	<SP>	mm	<CR>	<LF>
11	12	13	14	15	16	17	18	19	20
Y	<SP>	-	42	.	4320	<SP>	mm	<CR>	<LF>
21	22	23	24	25	26	27	28	29	30
r	<SP>		7	.	5036	<SP>	mm	<CR>	<LF>
31	32	33	34	35	36	37	38	39	40
d	<SP>	-	15	.	0072	<SP>	mm	<CR>	<LF>
41	42	43	44	45	46	47	48	49	50
F	<SP>		0	.	0035	<SP>	mm	<CR>	<LF>

Character	Description
1, 11, 21, 31, 41	Coefficient label
2, 7, 12, 17, 22, 27, 32, 37, 42, 47	Space
3, 13, 23, 33, 43	Sign (positive sign is not displayed)
4, 14, 24, 34, 44	1 to 9 places before the decimal point
5, 15, 25, 35, 45	Decimal point
6, 16, 26, 36, 46	0 to 6 places after the decimal point
8, 18, 28, 38, 48	2 characters for units: in for Inch and mm for Millimeters
9, 19, 29, 39, 49	Carriage return
10, 20, 30, 40, 50	Line Feed.

Report

► Command **@PRINT**

1	2	3	4	5	6	7	8	9
	<SP>	001	<SP>		<SP>	Circle	<SP>	
10	11	12	13	14	15	16	17	18
<SP>	1		<SP>	mm	<SP>		<SP>	x= 68.1235
19	20	21	22	23	24	25	26	27
	<SP>	r= 7.5036		<SP>	F= 0.0035		<CR>	<LF>

Character	Description
1, 5, 9, 12, 16, 19, 22, 25	Column dividing lines
2, 4, 6, 8, 10, 13, 15, 17, 20, 23	Space
3	Feature ID number on a page (three characters long)
7	Feature name (up to nine characters long)
11	Feature ID (up to three characters long)
14	Units (up to five characters long)
18	Position (up to 15 characters long)
21	Dimension (up to 15 characters long)
24	Form (up to 13 characters long)
26	Carriage return
27	Line Feed.

```

+-----+
|                                     ND 1200 Feature Print Out                                     |
+-----+
| Date 5/8/2014           Time 11:24:24 AM           Operator _____ |
| Job _____           Part _____           |
+-----+-----+-----+-----+-----+-----+-----+
| NO. | FEATURE | ID | UNITS | POSITION          | DIMENSION          | FORM          |
+-----+-----+-----+-----+-----+-----+-----+
| 001 | Circle  | 1  | mm    | X = 68.1235 | r = 7.5036 | F =          |
|     |         |    | 1 DMS | Y = -42.4320 | d = 15.0072 |              |
+-----+-----+-----+-----+-----+-----+-----+

```

Report Example

Tol Rpt

► Command @PRINT

1	2	3	4	5	6	7	8	9	10
	<SP>	C1		<SP>	TP		<SP>	0.0641	
11	12	13	14	15	16	17	18	19	20
0.1000		<SP>	0.0641		<SP>	0.0000		<SP>	0.1000
21	22	23	24	25	26	27	28	29	-
	<SP>			<SP>			<CR>	<LF>	

Character	Description
1, 4, 7, 10, 12, 15, 18, 21, 26, 27	Column dividing lines
2, 5, 8, 13, 16, 19, 22, 25	Space
3	Feature ID (up to four characters long)
6	Feature tolerance type (up to three characters long)
9	Tolerance actual (up to nine characters long)
11	Tolerance nominal/zones (up to nine characters long)
14	Tolerance deviations (up to nine characters long)
17	Tolerance low limits (up to nine characters long)
20	Tolerance high limits (up to nine characters long)
23	Tolerance bonus/reference feature (up to eight characters long)
26	Tolerance pass/fail (shows "F" if fails, otherwise blank)
28	Carriage return
29	Line Feed.

```

+-----+
|                                     ND 1200 Feature Print Out                                     |
+-----+
| Date 5/8/2014           Time 2:48:53 PM           Operator _____ |
| Job _____           Part _____           |
+-----+
| NO. | L | Actual  | Nom/Zone | Deviation| Lo Limit | Hi Limit | Bon/Ref| T |
+-----+
| C1  | TP| 0.0641 | 0.1000 | 0.0641 | 0.0000 | 0.1000 |      | |
|     | r | 7.5036 | 7.5000 | 0.0036 | 7.4000 | 7.6000 |      | |
|     | X | 68.1235| 68.1500 | -0.0265|         |         |      | |
|     | Y | -42.4320| -42.4500| 0.0180 |         |         |      | |
+-----+

```

Tol Rpt Example

CSV

▶ Command **@PRINT**

"Circle",1,68.1235,-42.4320,,7.5036,15.0072,,,,,,,,

Tab

▶ Command **@PRINT**

"Circle" 168.1235 -42.4320 7.5036 15.0072

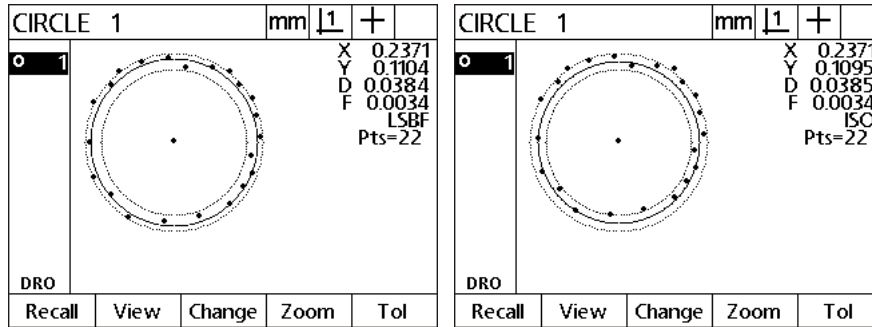
ISO Fit

ISO fit is performed to minimize form errors of a feature.

The algorithm in the ND 1200 performs the following:

- Uses the LSBF (Least Squares Best Fit) algorithm to formulate a feature from the probed data cloud.
- Adjusts the resultant feature until it achieves minimum form errors.

This is the ND 1200 interpretation of the ISO fit standard. In the following circle example, notice the difference in feature coefficients from the same data cloud.



LSBF Circle

ISO Fit Circle

The X, D and F are different in the two features above due to adjustments made to the first circle in the LSBF example to minimize the form (F) as in the ISO Fit example.

Tolerances

Brief descriptions of tolerances:

- Position
- Form
- Orientation
- Concentricity
- Runout
- Width

Refer to the ND 1200 Operating Instructions for information on which tolerance can be applied to which feature.

Position

Position tolerances are a set of tolerances that use a feature control frame to specify the tolerance zone required to accurately locate a feature or group of features such as center point(s), center axis, or the center of a plane.

The tolerances include Bi-directional, True position, Least (Minimum) Material Condition and Most (Maximum) Material Condition

BiDir (Bi-directional)

A tolerance applied on the position coefficients of the feature.

CIRCLE 1	mm	1	+	
Tolerance:		BiDir		
	Norminal	±		
X	0.2371	+0.1000		
		-0.1000		
Y	0.1095	+0.1000		
		-0.1000		
D	0.0385	+0.5000		
		-0.5000		
BiDir	TP	MMC	LMC	None

Bi-directional Tolerance

TP (True Position)

True Position is a tolerance that defines a radius around the nominal position on which the position of a feature can lie.

CIRCLE 1	mm	1	+	
Tolerance: TP				
Nominal				
X	0.2371	Tol. Zone	0.5000	
Y	0.1095			
+/-				
D	0.0385	+0.1000	-0.1000	
BiDir	TP	MMC	LMC	None

True Position Tolerance

MMC/LMC (Material condition)

MMC and LMC tolerances can be applied to bosses or to bores, compare measured center locations to the nominal centers and compare measured diameters to nominal diameters. MMC and LMC tolerances can be applied to circles.

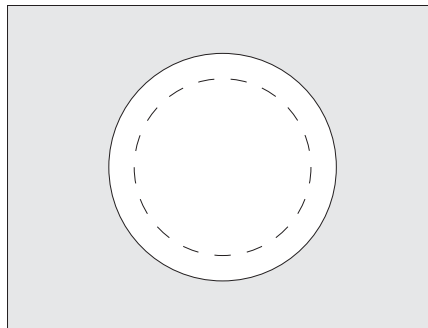
MMC (Most Material Condition) Circles and arcs

The MMC tolerance screens for circles are used to specify the maximum material that can exist within a bore or on the surface of a boss.

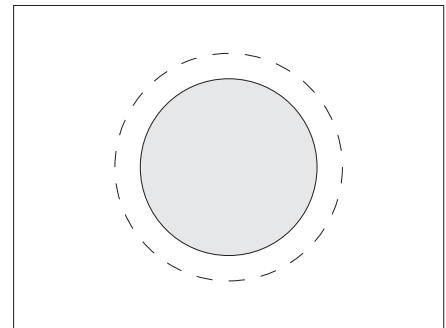
MMC tolerances generate position bonuses as a result of size tolerance surpluses. For example, when the size of a bore is larger than MMC, but within the acceptable tolerance range, a position tolerance bonus is generated for the bore and its acceptable location is given more flexibility. However, if a bore is within the position tolerance diameter, no position bonus is generated and the bore must be located exactly as specified.

CIRCLE 1	mm	1	+	
Tolerance: MMC				
Circle Type: Bore				
Nominal				
X	0.2356	Tol. Zone	0.5000	
Y	0.1101			
+/-				
D	0.0358	+0.1000	-0.1000	
BiDir	TP	MMC	LMC	None

MMC Tolerance



Maximum material within a bore



Maximum material on a boss

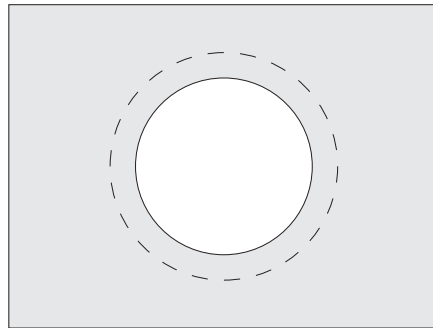
LMC (Least Material Condition) Circles and arcs

The LMC tolerance screens for circles are used to specify the minimum material that can exist within a bore or on the surface of a boss.

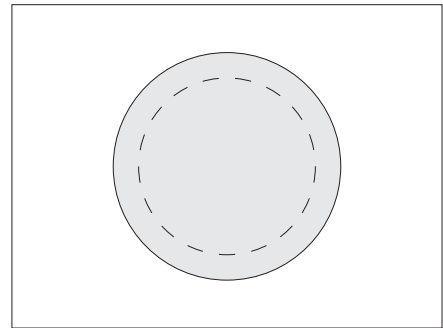
LMC tolerances can generate position bonuses as a result of size tolerance surpluses. For example, when the size of a bore is smaller than LMC, but within the acceptable tolerance range, a position tolerance bonus is generated for the bore and its acceptable location is given more flexibility. However, if a bore is within the position tolerance diameter, no position bonus is generated and the bore must be located exactly as specified.

CIRCLE 1		mm	1	+
Tolerance:		LMC		
Circle Type:		Bore		
Nominal				
X	0.2371	Tol. Zone	0.5000	
Y	0.1095			
D	0.0385	+/-	0.1000	
			-0.1000	
BiDir	TP	MMC	LMC	None

LMC Tolerance



Minimum material within a bore



Minimum material on a boss

Form

Form is a geometric tolerance that limits the amount of error in the shape of a feature. The form tolerances include Straightness and Circularity (roundness).

Straightness

Straightness is a form tolerance that describes allowable variability in the shape and appearance of a line in a section view.

LINE 2	mm	1	+	
Tolerance: Form				
Tol.Zone				
0.1				
None				

Straightness Tolerance

Circularity

Circularity (roundness) is a form tolerance that describes the allowable variability in the shape and appearance of a circle.

CIRCLE 1	mm	1	+	
Tolerance: Form				
Tol.Zone				
0.2000				
None				

Circularity Tolerance

Orientation

Orientation is a geometric tolerance that limits the direction, or orientation, of a feature in relation to other features. Orientation tolerances are related tolerances.

Angle

Angle is the allowable size variation of the angle feature.

ANGLE	6	mm	1	+						
Tolerance: Angle										
Nominal										
A	84°17'33"	+	0°10'00"	-	0°10'00"					
<table border="1"> <tr> <td>Angle</td> <td>None</td> <td></td> <td></td> <td></td> </tr> </table>						Angle	None			
Angle	None									

Angle Tolerance

Perp (Perpendicularity)

Perpendicularity is an orientation tolerance that describes the allowable variability in the 90° angular relationship between a surface and a datum.

LINE	3	mm	1	+						
Tolerance: Perp										
TolZone										
0.5000										
Reference Feature 2										
<table border="1"> <tr> <td>Angle</td> <td>Perp</td> <td>Para</td> <td>None</td> <td></td> </tr> </table>						Angle	Perp	Para	None	
Angle	Perp	Para	None							

Perpendicularity Tolerance

Para (Paralellism)

Parallelism is an orientation tolerance that describes the equal distance between pairs of points or lines. Parallelism is a related tolerance.

LINE 3	mm	1	+	
Tolerance: Para				
Tol.Zone 0.2000				
Reference Feature 2				
Angle	Perp	Para	None	

Paralellism Tolerance

Concentricity

Concentricity is a locational tolerance that describes the location of opposing points in circular features with respect to a datum reference. Concentricity is a related tolerance.

CIRCLE 4	mm	1	+	
Tolerance: Concentricity				
Tol.Zone 0.5000				
Reference Feature 1				
None				

Concentricity Tolerance

Runout

Runout is a geometric tolerance that simultaneously limits the form, location, and orientation of circular parts. Runout tolerances are related tolerances requiring a datum axis.

CIRCLE 4	mm	1	+	
Tolerance: Runout				
TolZone 0.1000				
Reference Feature 1				
None				

Runout Tolerance

Width

Width is the allowable size variation of the distance feature.

DISTANCE 5	mm	1	+	
Tolerance: Width				
Nominal +/-				
X	0.1810	+0.1000	-0.1000	
Y	0.0440	+0.1000	-0.1000	
Z	0.0000	+0.1000	-0.1000	
L	0.1863	+0.1000	-0.1000	
Width	None			

Width Tolerance

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