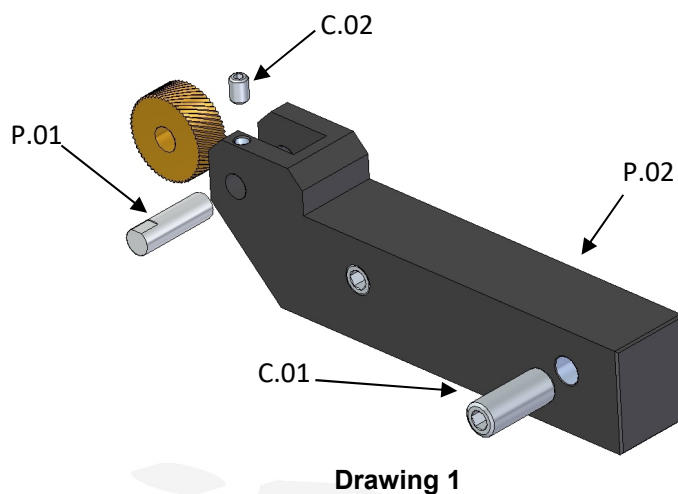




# M4 INSTRUCTION MANUAL

## 1. TOOL SPARE PARTS



ITEM	CODE	REFERENCE	DESCRIPTION	ITEMS INCLUDED
<b>M4 20.08 / M4 20.10</b>				
P.01	01990601	E 20.6 HM	Axis HM ø6x20	P.01
C.02	01988500	EA M4-6	Socket set screw DIN 913 M4x6	C.02
*P.02	-	MM4 20.08.16	Shank M4 20.08.16	-
		MM4 20.08.20	Shank M4 20.08.20	
		MM4 20.08.25	Shank M4 20.08.25	
		MM4 20.10.20	Shank M4 20.10.20	
		MM4 20.10.25	Shank M4 20.10.25	
C.01	01900075	EA M8-20	Stud screw DIN M8x20	C.01
<b>M4 25.08 / M4 25.10</b>				
P.01	01986001	E 20.8 HM	Axis HM ø8x20	P.01
C.02	01988500	EA M4-6	Socket set screw DIN 913 M4x6	C.02
*P.02	-	MM4 25.08.20	Shank M4 25.08.20	-
		MM4 25.08.25	Shank M4 25.08.25	
		MM4 25.10.20	Shank M4 25.10.20	
		MM4 25.10.25	Shank M4 25.10.25	
C.01	01900075	EA M8-20	Stud screw DIN M8x20	C.01
<b>M4 25.12</b>				
P.01	01992501	E 25.8 HM	Axis HM ø8x25	P.01
C.02	01988550	EA M4-6	Socket set screw DIN 913 M4x6	C.02
*P.02	-	MM4 25.12.20	Shank M4 25.12.20	-
		MM4 25.12.25	Shank M4 25.12.25	
C.01	01981400	EA M8-25	Stud screw DIN M8x25	C.01

\*This item is not sold individually

**Table 1**

## 2. FEASIBLE PATTERNS

The M4 form knurling tool is conceived for knurling on pieces:

- If the knurling wheel used is Ø 20 mm: for diameters between 8 and 200 mm.
- If the knurling wheel used is Ø 25 mm: for diameters between 8 and 300 mm.

The obtained pattern depends on the knurls used as shown below.

KNURLING PROFILE		DESCRIPTION	KNURLING WHEEL	FEED	
				AXIAL FEED	RADIAL FEED
	RAA	Right	AA knurl	✓	✓
	RBL 30°	30° Left helical	BR30° knurl	✓	✓
	RBL 45°	45° Left helical	BR45° knurl	✓	✓
	RBR 30°	30° Right helical	BL30° knurl	✓	✓
	RBR 45°	45° Right helical	BL45° knurl	✓	✓
	RGE 30°	30° diamond pattern male	GV30° knurl	✗	✓
	RGE 45°	45° diamond pattern male	GV45° knurl	✗	✓
	RGV 30°	30° diamond pattern female	GE30° knurl	✗	✓
	RGV 45°	45° diamond pattern female	GE45° knurl	✗	✓
	RKE	90° diamond pattern male	KV knurl	✗	✓
	RKV	90° diamond pattern male	KE knurl	✗	✓

Table 2

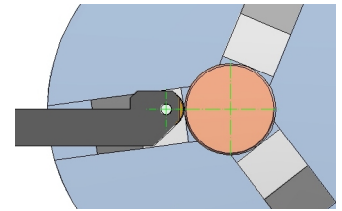
## 3. CLAMPING AND SETTING THE TOOL INTO THE MACHINE

First, we need to make sure that the knurl rotates freely around the pin.  
Spread graphite grease if necessary.

While the chuck rotates very slowly, approach the tool to the workpiece until the knurl makes contact with the workpiece.

Approach the knurling wheel to the workpiece following the 'F' direction up until the teeth plunge a little into it. Check out the resulted print. The printed width (h) must be equal to the width of the teeth on the knurl. If the width isn't correct, change the clearance angle.

The tool and the workpiece need to be aligned as shown on the drawing 2.



**Drawing 2**

## 4. KNURLING ON STEPPED WORKPIECES

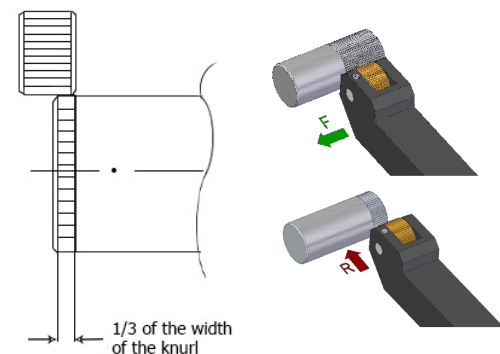
When knurling stepped workpieces, it is not possible to knurl up to a shoulder. Using this tool, no knurling should be performed closer to 5,5 mm from the shoulder itself.

## 5. BEGINNING TO KNURL

While the chuck is rotating at the speed recommended at point 8, feed the tool so that 1/3 of the width of the knurling wheel gets in contact with the workpiece.

Press the knurl against the workpiece. The value of the radial feed must be according to the conditions recommended on the table 4 (next page). After that, you will be able to feed longitudinally.

To calculate up to what diameter we must deepen with the knurl, we must take into account the height of the tooth (in the case of standard knurls is always equal to half the step) and the increase in diameter that suffers the material.



**Figura 3**

That information is available at [www.integi.com](http://www.integi.com) and in our catalog

## 6. BEFORE AND DURING THE WORKING PROCESS

- Make sure that the knurl pin is firmly fastened
- Check that the knurling wheel runs free and lubricate it with graphite grease
- Make sure that the axis of the knurling wheel is aligned with the axis of the workpiece
- Always apply plenty of coolant, lubricant or cutting oil
- The working direction, longitudinal advance, will always be against the tool

## 7. TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Double knurling	Too slow radial feed at the beginning of the knurling.	Increase radial feed at the beginning of the knurling*.
	Perimeter of the workpiece is not an exact multiple of the pitch.	Turn a diameter that makes the perimeter to be knurled an exact multiple of the pitch*.
Knurling wheels easily breakable	Knurling too deep	Reduce the depth to values according to the pitch.
Knurling wheels wear out too fast	Knurling too deep	Reduce the depth to values according to the pitch.
	Working conditions are not adequate.	Check cutting speed and axial feed.

\* Sometimes, it is not possible to increase the radial feed or radial feed is just impossible because the workpiece is too small or its clamping is too weak.

Table 3

## 8. RECOMMENDED SETTINGS

MATERIAL	Ø Workpiece (mm)	Ø KNURLING WHEEL (mm)	Cutting speed (m/min)	RADIAL FEED (mm/rev)	TRAVERSE FEED (mm/rev)			
					PITCH (mm)			
					0.3÷0.6	0.6÷1.2	1.2÷1.6	1.6÷2.0
Steel 600 N/mm²	10÷50	20 25	25÷55	0.05÷0.10	0.20	0.15	0.13	0.10
	50÷100	20÷25	30÷60		0.25	0.20	0.15	0.13
	100÷200							
	200÷300							
Steel 900 N/mm²	10÷50	20 25	20÷45	0.04÷0.08	0.15	0.10	0.08	0.06
	50÷100	20÷25	25÷50		0.20	0.15	0.10	0.08
	100÷200							
	200÷300							
Stainless steel	10÷50	20 25	20÷45 25÷50	0.04÷0.08	0.15	0.10	0.08	0.06
	50÷100	20÷25	25÷50		0.20	0.15	0.10	0.08
	100÷200							
	200÷300							
Cast steel	10÷50	20 25	25÷45	0.05÷0.10	0.20	0.15	0.13	0.10
	50÷100	20÷25	30÷50		0.25	0.20	0.15	0.13
	100÷200							
	200÷300							
Aluminium	10÷50	20 25	30÷50 35÷60	0.05÷0.10	0.20	0.15	0.10	0.06
	50÷100	20÷25	35÷60		0.25	0.20	0.15	0.13
	100÷200							
	200÷300							
Brass	10÷50	20 25	35÷55	0.05÷0.10	0.25	0.20	0.18	0.15
	50÷100	20÷25	40÷65		0.30	0.25	0.20	0.18
	100÷200							
	200÷300							


Table 4



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