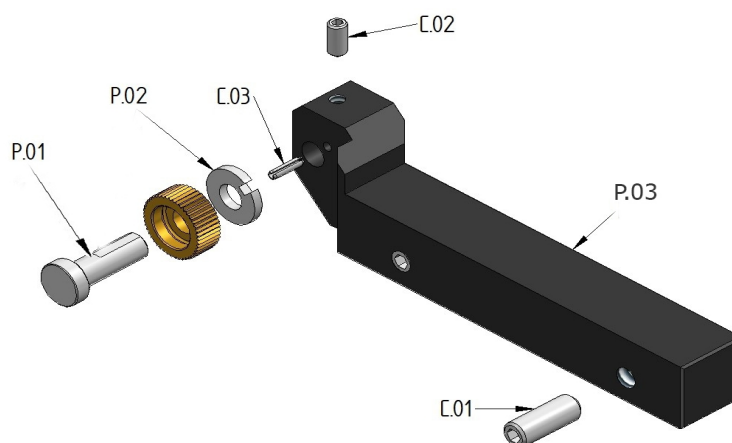




# M20 INSTRUCTION MANUAL

## 1. TOOL PARTS



**Drawing 1**

ITEM	CODE	REFERENCE	DESCRIPTION	ELEMENTS INCLUDED	
SET.01	01983220	EAM20/M21	Knurl axle and washer kit M20/M21	P.01+P.02	
*P.01	-		Knurl pin		
*P.02	-		Washer		
C.02	01900175	EA M4-5	Stud screw DIN 913 M4x5	C.02	
C.03	01900060	PE D2-8	Elastic pin DIN 1481 Ø2x8	C.03	
6 options					
M20 15.06.10 R	*P.03	-	M20 15.06.10R&L	Right shank 10 mm	-
	C.01	01900070	EA M4-10	Sutd screw DIN 913 M4x10	C.01
M20 15.06.12 R	*P.03	-	M20 15.06.12R&L	Right shank 12 mm	-
	C.01	01981100	EA M6-16	Stud screw DIN 913 M6x16	C.01
M20 15.06.16 R	*P.03	-	M20 15.06.16R&L	Right shank 16 mm	-
	C.01	01981100	EA M6-16	Stud screw DIN 913 M6x16	C.01

\*This item is not sold individually

**Table 1**

## 2. FEASIBLE PATTERNS

The M20 form knurling tool is conceived for knurling on pieces with diameters between 3 and 10 mm.

The performed pattern depends on the knurls used as shown on the table below.

KUNRLING PROFILE	DESCRIPTION	KNURLING WHEEL	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

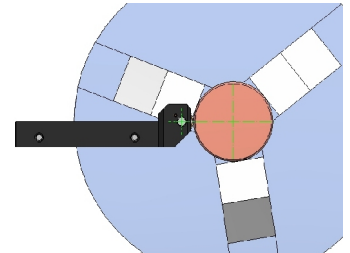
First, we need to make sure that the knurl rotates freely around the pin. Spread graphite grease if necessary.

Clamp the tool to the turret of the lathe.

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 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 on stepped workpieces, it is not possible to knurl up to a shoulder. Using this tool, no knurling should be performed closer to 0,5 mm from the shoulder itself.

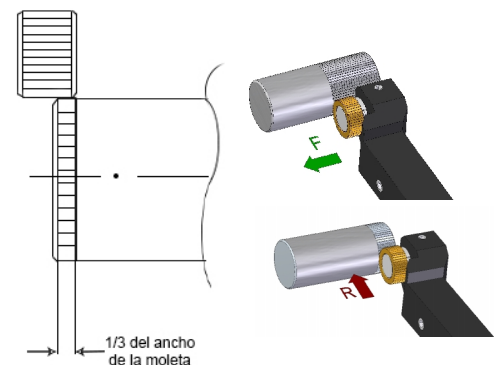
## 5. BEGINNING TO KNURL

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 point 8 (next page). After that, you will be able to feed longitudinally.

To calculate up to what diameter we must deepen with the knurls, 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.

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



**Drawing 3**

## 6. BEFORE AND DURING THE WORKING PROCESS

- Make sure that the knurl pin is firmly fastened.
- Make sure that the axis of the knurl is aligned with the axis of the workpiece.
- Check that the knurling wheel runs free and lubricate it with graphite grease.
- Always apply plenty of coolant, lubricant or cutting oil flowing in order to sweep the swarf away.
- 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 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/mm <sup>2</sup>	<10	15	20÷50	0.05÷0.10	0.15	0.10	0.08	0.07
	10÷50		25÷55		0.20	0.15	0.13	0.10
	50÷100		30÷60		0.25	0.20	0.15	0.13
Steel 900 N/mm <sup>2</sup>	<10	15	15÷40	0.04÷0.08	0.12	0.08	0.05	0.04
	10÷50		20÷45		0.15	0.10	0.08	0.06
	50÷100		25÷50		0.20	0.15	0.10	0.08
Stainless steel	<10	15	15÷40	0.04÷0.08	0.12	0.08	0.05	0.04
	10÷50		20÷45		0.15	0.10	0.08	0.06
	50÷100		25÷50		0.20	0.15	0.10	0.08
Cast steel	<10	15	20÷40	0.05÷0.10	0.15	0.10	0.08	0.07
	10÷50		25÷45		0.20	0.15	0.13	0.10
	50÷100		30÷50		0.25	0.20	0.15	0.13
Aluminium	<10	15	25÷45	0.05÷0.10	0.12	0.08	0.05	0.04
	10÷50		30÷50		0.20	0.15	0.10	0.06
	50÷100		35÷60		0.25	0.20	0.15	0.13
Brass	<10	15	30÷50	0.05÷0.10	0.20	0.15	0.12	0.10
	10÷50		35÷55		0.25	0.20	0.18	0.15
	50÷100		40÷65		0.30	0.25	0.20	0.18


Table 4



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



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