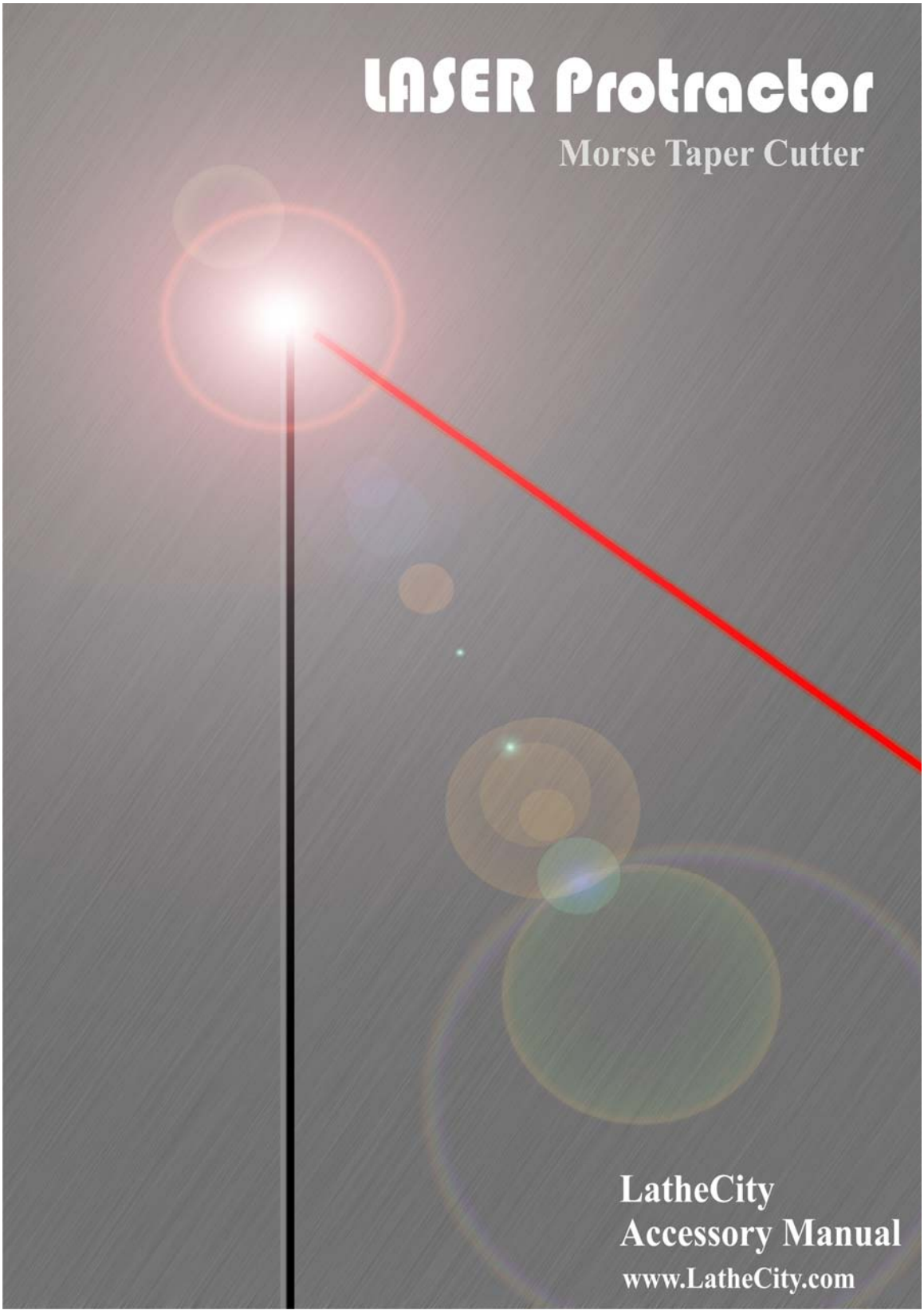
LASER Protractor
Morse Taper Cutter
LatheCity
Accessory Manual
www.LatheCity.com

Preview
Promo-version

LASER Protractor

-Morse Taper / Adapter Cutter-
-Precision Dovetail Cutter-

What is this tool good for?

Lathe

- ⇨ Easily machine your own tailstock accessories.
- ⇨ Set the cutting angles of your tabletop lathe with a precision of 0.2° (zero-point-two degrees)! – no kidding.
- ⇨ Cut precise and reproducible Morse tapers and other difficult to machine taper shapes.
- ⇨ Cut Morse arbors.

Mill

- ⇨ Set the angle of your vertical milling column with a precision of 0.5° degrees.

What are the requirements?

√ Accessory for **17" or 8" Sherline lathes** and systems that allow rotation of the headstock.

(The English and Metric as well as DRO Lathe versions have the same distance between centers. The LASER protractor should work for all of these models.)

√ Accessory for **Sherline milling** machines or

√ **Sherline milling** column lathe attachments.

Fig. M1 - project example: cutting a perfect Morse taper. Extended tailstock center. (Morse #0 Taper cut with the help of the LASER Protractor.)

Fig. M2 - project example: inexpensive chucks for center drills. A good Jacobs drill chuck with Morse adapter would cost you probably close to $50. (Morse #0 Tapers were cut utilizing the LASER Protractor.)

Fig. M3 – project example: Jacobs chuck (1/2-20) to tailstock Morse #0 adapter. Less expensive Jacobs chucks, including larger sizes, are often available. However, typically they come with a tapered hole and not with a Morse #0 taper. (Morse #1 are easily commercially available, but Morse #0 ...) This type of an adapter is shown here: $1 for materials, 20 min work. (Morse #0 Taper was cut with the help of the LASER Protractor.)

Fig. M4 – project example: Endmill holder. Perhaps the best way to perfectly center an endmill is to use a Morse type holder and drawbar, as shown here. (Morse #1 Taper was cut with help of the LASER Protractor.)

Fig. M5 – project example: Morse #0 blank adapters are the starting point for most tailstock tools. These shown here have O.D. ½" and are 3" long. However, you can now make whatever size you may need. These typically cost $7-$20/piece. (Morse #0 Taper was cut with help of the LASER Protractor.)

Fig. M6 – project example: Center with a concave end. This is sometimes useful when modifying a work piece with a pin end. (Morse #0 Taper was cut with help of the LASER Protractor.)

Fig. M7 – project example: Morse #0 to ¾"-16. Allows mount of a lathe chuck into the tailstock for, e.g., headstock drilling. A piece like that sells for around $40. (Morse #0 Taper was cut with help of the LASER Protractor.)

Fig. M8 – project example: You can now make Morse taper by the dozen – easily. Morse blanks in different sizes and different materials. (Morse #0 Taper was cut with help of the LASER Protractor.)

Fig. M9 – project example: Left to right Morse #0, #1, and #2 blanks. Although a #2 Morse taper is more common on full size systems, it is actually simpler cutting it precisely on a small lathe. (Morse Tapers were cut with help of the LASER Protractor.)

Fig. M10 – project example Morse #1 and Morse #0 to Jacobs chuck (½”-20) adapters. Morse #0 to ½”-20 is quite uncommon and hard to find. You can now make whatever size you need. Use a hex bar if you want to use a wrench. (Morse Tapers were cut with help of the LASER Protractor.)

Fig. M11 – project example Morse #1 and Morse #0 arbors. (Internal Morse tapers were cut with help of the LASER Protractor.)

LatheCity Series
Safely Working with Benchtop Lathes
Manual – LASER Protractor
By Uwe Burghaus

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Dr. Uwe Burghaus
4465 47th St S
Fargo, ND 58104
USA
E-mail: sales@lathecity.com
URL www.LatheCity.com **(On-line shop)**

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Disclaimer

Our lawyers let us write the following.

This manual does not replace training and/or books about metalwork. The LASER protractor is not a lathe cutting tool on its own. In fact, **the lathe needs to be switched off** at all times when using the LASER protractor.

However, while machining parts, after setting the cutting angle with the LASER protractor, all relevant safety precautions need to be obeyed. This manual has been written carefully and all procedures have been thoroughly tested. However, as always, the author and manufacturer cannot guarantee that the procedures are perfect and error-free. In addition, it is impossible to predict and prevent all the possible problems that might be encountered when working with a lathe. **Using a motor tool can be dangerous and the proper use is the responsibility of the user. Neither the author nor manufacturer shall be liable for damage arising from this use.** If you are not perfectly comfortable working with power tools, then don't do it! In this case, take a metal working class rather than following a do-it-yourself outline. Or, find a different hobby. We cannot jump in if you make a mistake that results in harm to yourself or damage to the tools you use. Don't use broken or damaged tools, perhaps purchased cheaply at a secondhand store or who knows where. **Thoughtful work will be your responsibility.**

The author makes no representations or warranties with respect to the accuracy or completeness of the contents.

The author is not a professional machinist or engineer. In fact, the author holds a PhD in physics and teaches physical chemistry at a college. Therefore, no information provided herein represents professional advice or best practices in machining. All information is provided to help hobbyists and other non-professionals gain a better understanding of using mini benchtop tools for hobby type work.

This manual and accessories features the Sherline lathe and milling machines in particular. However, none of the statements or procedures may coincide with Sherline Inc.'s opinion or interests.

The author is not an employee of or agent for any of the vendors referenced in the text, nor does not sell or represent any of the third party products that may be discussed.

Web addresses are given without any warranty or guarantee; web sites may be infected by computer viruses and/or may not provide the best service. Websites

and their content may have changed since the time the author described them in this manual and when this manual is read. **Neither the author nor manufacturer shall be liable for damage arising therefrom.**

All relevant safety precautions for working with LASER pointer need to be obeyed. A list of some safety concerns in this regard is given below.

You will perform all operations described herein at your own risk in any regard.

This disclaimer is/was available to any customer before purchasing the product.

SAFETY FIRST

CAUTION – LASER operation

LASER pointer instructions – read before using the LASER pointer.

1) Read and obey the operation instructions from the manufacturer of the LASER pointer that came with the LASER pointer. See the label printed on the LASER pointer and the instructions card. In addition, consider the following.
2) A LASER pointer is not a toy. Keep out of reach of children and mentally handicapped people as well as pets.
3) Do not stare into LASER light beam. This will cause damage to your eyes.
4) Do not direct the LASER light beam towards the eyes of another person or animal.
5) Remember that a LASER light beam reflected from an object will be as dangerous as the primary LASER beam.
6) Remove batteries if the LASER is not in use for an extended period of time in order to prevent corrosion.
7) Do not disassemble or try to repair the LASER pointer. The LASER pointer does not contain replaceable parts.
8) Protect against water, dust, heat, and sunlight.
9) Do not direct the LASER pointer towards the sky or streets. This can interfere with traffic, airplanes, etc.

Further safety notes can be found e.g. here
http://en.wikipedia.org/wiki/Laser_safety

CAUTION – lathe / mill operation

Do NOT switch on the lathe/mill. The LASER protractor accessory is NOT a cutting tool. It is NOT required to switch on the lathe/mill for any calibration procedure with the LASER protractor.

However, a metalwork safety booklet is included for free for first-time customers. This booklet can also be downloaded free of charge from the LatheCity website.

The accessory is tested on the 17” Sherline lathe, primarily for cutting small numbered Morse taper requiring small (<5°) angle settings of the headstock. Do not use the tool to set large angles of the headstock. This can generate unstable conditions. By the same token, do not use the tool to set large angles of a (vertical) milling column.

Please note that it is not advisable to work on large diameter and long stock on a small lathe since this can result in unstable and dangerous cutting conditions.

The disadvantage of cutting tapers by rotating the headstock of a lathe is that a center cannot be used easily to support the work at both ends! Therefore, you cannot cut a taper in long work pieces or those with large diameters. As a rule of thumb, we limit our accessory to set the cutting angle for stock metal no longer than 3” and no wider than ½”, to stay on the safe side.

In addition, a benchtop lathe allows you, at least theoretically, to work with materials that are difficult to machine (see LatheCity Booklet 2 or Vol. 2). However, this requires advanced machining skills, special turning tools, and very careful operations!

Some Morse tapers have an end style that prevents rotations of the Morse Adapter. This is often missing for tabletop tailstock accessories. Therefore, these can start to rotate, for example, in the tailstock. If this happens, switch off the lathe. Do not try to stop the rotating adapter with your fingers. Use cutting oil for drilling operations. Do NOT use oil on the taper side.

Obeying all relevant safety regulations and precautions is your responsibility. Our LASER protractor is not a cutting tool on its own. Consult the literature and/or obtain professional training.

LatheCity Vol. 1 provides an introduction into basic lathe operations.

What is a LASER?

LASER is short for *light amplification by stimulated emission of radiation* and it is a very intense and highly focused light source. State-of-the-art scientific equipment uses LASER. A good drill press or cut-off saw also is equipped with LASER based adjustment features. LASERs can be dangerous when not handled properly: read the safety notes given above and those that came with your LASER pointer.

Pictograms used in this manual

Internet addresses of potentially useful sites. However, web sites may be infected by computer viruses. Use them at your own risk.

Safety notes. It is not my intention to bother you and this tool is meant for adults with advanced machining skills, not for children. Therefore, it's your decision whether you read the safety notes or not. However, don't blame me if you did not take the few minutes to do this and end up in hospital. All procedures are performed at your own risk.

Engineering type notes. You may skip these if you are only interested in the operation of the tool. Remember, though, that knowledge also always provides protection (safety), if you know what you are doing... right.

Science / science-history type notes. You are probably more in the engineering field; however, this might still be of some interest.

Fast entry/start for advanced machinists. Look for this arrow if you are a professional machinist.

Contents

Fast entry

What Does This Tool Do?

The included accessory is designed for the following applications on a benchtop lathe:

- ⇨ Setting the cutting angles of your tabletop lathe with a precision of 0.2 degrees by rotating the headstock.
- ⇨ Cutting precisely and reproducible Morse taper and arbors.
- ⇨ The LASER protractor is a high precision tool for making your own high precision tools.

The accessory can also be used for precision setting of small angles of a vertical milling column:

- ⇨ Since this is not a common application, we only provide an angle scale in this manual that can simply be copied onto paper and placed on the cross-slide of the lathe or mill table. Note that large angles, such as the 55.5° dovetail used on Sherline's lathe bed, cannot be cut directly or safely by rotating the milling column. A combination of a tilt table and column rotation may do the trick, or use a dovetail cutter.

Lathe: Note that Sherline's lathe has a 5° protractor scale for the tailstock and the compound's slide protractor scale is divided in 2° increments. Therefore, it is basically impossible, in our opinion, to cut a taper with a precision of better than perhaps 2.5° and 1°, by rotating the headstock or compound slide, respectively. In other words, without additional tools, there is no easy way to cut Morse tapers or other intricate shapes that are frequently used for machining tools. With our accessory, you can easily make these shapes by yourself.

NOTE: **This version of the tool will not work with every lathe!** The tool is designed specifically for 17" or 8" Sherline lathes. The tool may work for other systems, but it was tested only on the Sherline lathes. Contact us: perhaps we can help and adapt our system for other lathe models. Upgrades of the current tool for the compound slide will be available soon from LatheCity.com. Interested? Contact us at sales@lathecity.com

Mill: Sherlines standard mill columns also use 5° protractor scales, as far as we know. This makes precision cutting of slopes nearly impossible unless other accessories or tools are used.

Requirement:

Accessory for 17" and/or 8" Sherline lathe and systems that allow rotation of the headstock.

Troubleshooting tip – compatibility:

As far as we know, Sherline offers (did offer) the following lathe models, which differ by the distance between centers.

17": Yes, the LASER protractor you have will work with these models: 4400 (English) & 4410 (Metric) series. DRO versions have the same lathe bed length. CNC machines appear to differ from the standard size, but you would probably not in any case use a LASER protractor on CNC systems. The angle settings will work for both English & Metric lathes, as the length of the lathe bed and tailstock design are identical. (A 17" (= distance between centers) lathe has a lathe bed length of 24".)

8": Yes, the LASER protractor you have will work with these models. 4000 (English) & 4100 (Metric), DRO as well as 4500/4530 (with adjustable hand wheels). (A 8" lathe has a lathe bed length of 15".)

[You can switch from 17" to 8" by flipping the protractor scale around. One tool works for both lathe bed versions.]

3": 1000 Model. These are the very old versions with a brass bed. Apparently, these were/are 3" lathes – we've never had one in our hands (you can find them occasionally on e-Bay). We could make a protractor screen for this lathe, too. However, due to the small length, the precision of the angle setting would be reduced. (Still much better than the original 5° scale, but…)

The LASER protractor is tested on a 17" 4400/English-DRO lathe. In addition, we measured a 8" lathe bed. If you have a totally different model that we are not aware of, then we will likely be able to send you a protractor scale for that lathe – free of charge. Send us an e-mail at sales@lathecity.com

Unpacking – Included Components

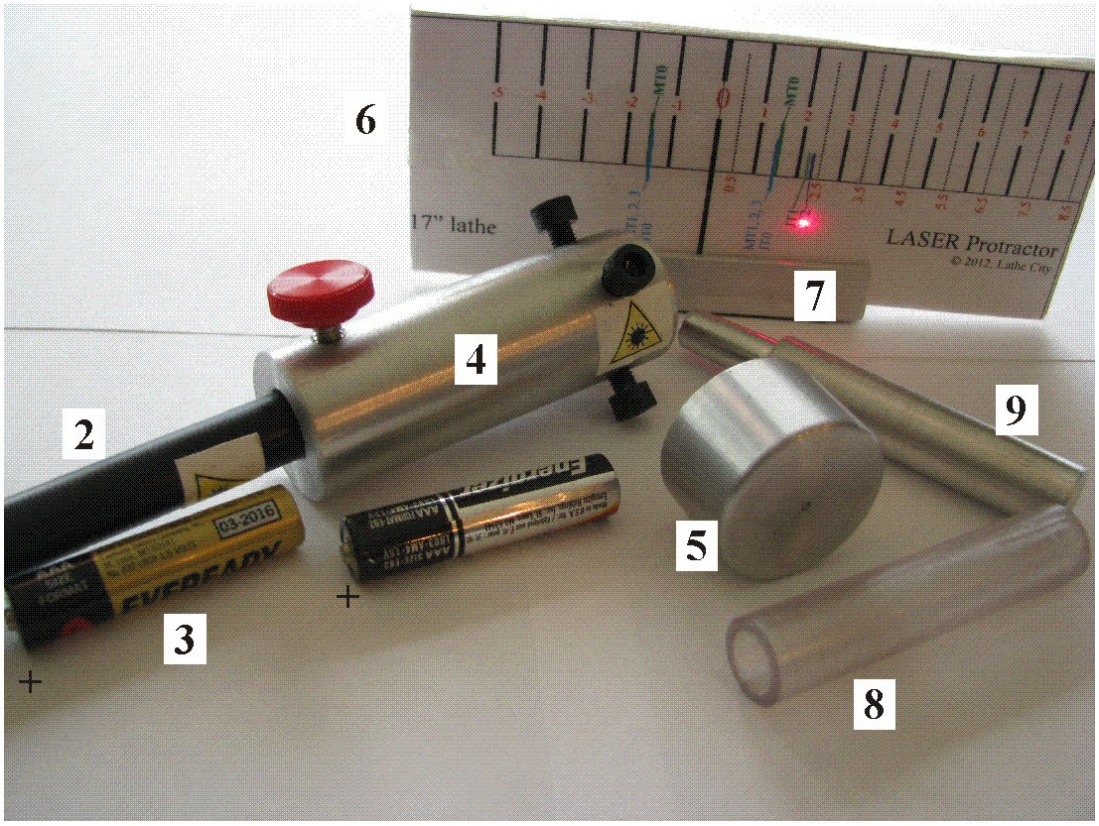

Fig. 1: *Included components.*

The following components are included in the LASER protractor package (see Fig. 1):

1. This manual (not shown)
2. LASER pointer
3. Batteries for LASER pointer (they are mounted as shown here)
4. Mounting adapter for LASER pointer
5. Focussing aperture
6. Angle scale for 17” (front) and 8” (back) Lathe *(other scales available on request)*
7. Mounting bracket for Angle scale with magnetic tag
8. Transparent Morse #0 arbor to serve as a template (other sizes are available separately)
9. Morse #0 blank used to adjust the LASER protractor (this one was made with your accessory as a final test)
10. Scale for vertical mill column attachment (at the end of this manual)

The manual is also available separately (i.e., without the hardware). However, lathe scales are not included in this manual. For safety reasons, we do not offer the

hardware without a manual, i.e., we will check our sales files accordingly in case that we obtain "hardware only" orders. If you have purchases the manual before, then you may purchase the hardware at a later time separately.

If You are a Pro on a Lathe

A brief summary of the working procedure starts at page 37. Look for this arrow

If you are rather new to metalwork, then, PLEASE, read the following sections carefully as they also include safety notes as well as tips & tricks.


17" lathe
LASER Protractor
EVEREADY
03-2018

Lathe City Series
Safely Working with Benchtop Lathes
Manual – LASER Protractor

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Synopsis: Ever purchased some kind of Morse adapter for $30 or more? Rather ridiculous, since you can cut these shapes easily even on a small home shop lathe. Since labor costs are not an issue for hobby type work, you can make these accessories yourself for close to zero dollars. All you need to do is set the angle precisely enough. Our LASER protractor is exactly the tool to do this for you, making the entire process a piece of cake. Cutting a perfectly fitting Morse taper takes less than 10 min.

www.LatheCity.com sales@lathecity.com