February 6, 2011

TO: publiccomments@bis.doc.gov

RE: Notice of Inquiry - CCL

The Timken Company ("Timken") appreciates the opportunity to provide comments regarding the Commerce Control List ("CCL") and Export Administration Regulations ("EAR"), pursuant to the notice in the Federal Register (Vole. 75, No. 236, December 9, 2010). Our comments primarily relate to bearings.

Introduction

Timken is a 110 year old international business, with an expertise in friction management and power transmission. We are headquartered in Canton, Ohio. Our web site is at: www.Timken.com. Our most famous product is bearings.

In the past 10 years, the global "footprint" of bearing manufacturing has changed dramatically. China is the world's largest bearing manufacturing country, passing the U.S. and Japan in 2007. European and Japanese bearing makers have made significant advancements. Japanese bearing makers have made bearings for spaceflight, using "home grown" capabilities. European aerospace and defense customers want "ITAR free" aircraft and weapons, and our European competitors have been able to provide bearings to accomplish this. Timken continues to lose business with our aerospace and defense customers in Western Europe, as these customers push their preference for "non-ITAR" bearings. A good example is the EC-175 helicopter. A further explanation of that situation, and an overview of our global bearing competitors is attached (Attachment A).

Timken is very concerned about U.S. export controls being a big competitive disadvantage for us. We outlined to Mr. Brian Nilsson what we believe needs to be done regarding revision of U.S. export controls on bearings, to help make U.S. bearing makers more competitive. A copy of our June 30, 2011 letter to Mr. Nilsson is attached (Attachment B).

With this background in mind, Timken is providing comments regarding bearings, the CCL and the EAR, including how to make the CCL more clear and "positive", as well as comments regarding the "tiering" of the CCL, for bearings.

Request for Comments on How To Make the CCL More Clear and "Positive"

a. *Clarify the CCL and EAR relative to bearings and classification thereof.*

Timken believes that the current CCL and EAR permits ambiguity relative to classification of bearings. In large part, this is due to the nature of bearings, which as a general rule, are not application specific. Timken has many bearings which are used in a variety of applications, and our business strategy is that any given bearing could and should be used in multiple applications. Many of our customers want to use an existing bearing, and in some cases, will design the application around an existing bearing geometry. This saves them time and expense. Hence, we have bearings originally used in farm equipment and vehicles, which are also used in helicopter gearboxes or aircraft landing wheels.

We recommend two changes to the CCL and EAR, to clarify that general nature of bearings. First, all bearing ECCNs should be only under Category 2. Second, Interpretation 1 under Part 770 of the EAR should be clarified. The detail of our two recommendations to clarify the CCL and EAR for bearings is attached (Attachment C):

b. *Recommended Revisions to clarify ECCNs 1C999.a and 2A991 (if these ECCNs are not deleted).*

(1) Recommended Modification to ECCN 1C999.a. For reasons cited below, Timken recommends that ECCN 1C999.a be deleted. If BIS believes for policy reasons, that ECCN 1C999.a should be retained, then Timken recommends that the ECCN be revised and moved to Category 2 of the CCL. We recommend that the ECCN apply only to clearly defined precision levels of ball bearings, and should be included under ECCN 2A991 (if it is retained) by adding a new subpart "f.2", as shown on the attached (Attachment D). Timken is aware of no policy reason to maintain ECCNs 1C999.a. or 2A991 on the CCL given the Tiering standards announced by the Administration.

(2) Recommended Revision to ECCN 2A991. For reasons cited below, Timken believes that ECCN 2A991 should be deleted. If BIS believes for policy reasons that ECCN 2A991 should be retained, then Timken recommends ECCN 2A991 be revised to apply to the precision levels of bearings, per the attached (Attachment D), which includes the proposed 2A991.f.2 (which replaces the old 1C999.a), and a new 2A991.f.1. The new 2A991.f.1 is meant to include ball bearings with ISO Class 2 or more precise tolerances, which are not covered by our proposed revision to ECCN 2A001, below.

c. *Recommended Revisions to ECCN 2A001.*

Timken recommends that 2A001 be revised, per the attached (Attachment E), with the understanding that such revision may require approval by the Wassenaar Arrangement. Not every ISO tolerance class 2 (ABEC-9 or more precise class) bearing can work in sensitive applications. For example, Chinese skateboard manufacturers advertise "ABEC-9" tolerance bearings for skateboards, but those bearings are not the types that the Wassenaar controls were intended to cover, nor the type that our customers with sensitive applications, would be willing to use. There has to be more than just ISO definitions, to properly focus on the important bearings.

Timken also believes that defense article bearings, which are "parts" being moved from the USML to the CCL, if not classified as EAR99 (see below) should be classified under the attached revised 2A001 (Attachment E). Refer to "Tier 2" and "Tier 3", below, and to the attached (Attachment F-1).

Requests for Comments on the "Tiering" of Items on the CCL

There has been significant change in the world bearing industry in the past 10 years. The most significant change is that China is now the largest producer of bearings in the world, passing the U.S. and Japan in 2007. India has developed an indigenous bearing industry, capable of providing precision bearings, aerospace bearings, bearings for conventional military applications, and bearings used in nuclear applications. More information on the competitive nature of the world bearing industry is attached (Attachment A). We have included descriptions of bearings under the Tiers, below.

a. Tier 1.

There are no bearings within the scope of the current CCL, which should be Tier 1.

We make bearings which are defense articles on the current USML, which are used in the guidance system of nuclear missiles. We believe these bearings may be included in Tier 1 or Tier 2 of the revised USML (bearings "specially designed" for nuclear weapons delivery systems). In the unlikely event such bearings are moved from USML to the revised CCL, same should be considered as Tier 1, or at least Tier 2 control.

b. Tier 2.

There are no bearings within the scope of the current CCL, which should be Tier 2, on a revised

CCL.

Timken believes that many of the bearings which may be moved from the USML to the CCL pursuant to export reform should be EAR99. However, Timken recognizes that the U.S. may be uncomfortable to make such a rapid move from total export control to virtually no export control. Timken believes that even though all such bearings were previously "parts" on the USML, there is logic to dividing those "parts" into two different groups. Our view of what constitutes Tier 3 controls is set forth below. The "Tier 2" group would consist of all bearings, other than the Tier 3 group, which are moved from the USML to the CCL.

The Tier 2 group would include bearings formerly on the USML, used in gyros, guidance, etc. Note that our recommended "Tier 2" type controls include an "MT" control on former USML Category IV (g) "parts", and for other USML Categories, both AT1 and NS2 controls, with no license exemptions. These bearings can be made by Timken's competitors, primarily (but not exclusively) by our competitors who are headquartered in Wassenaar member countries (Attachment F-1). This may well change in the next 5 years, as India and China expand their bearing capabilities. A "mapping matrix" of former USML "Tier 2 parts" to the CCL is attached (Attachment F-2).

Hence, if the U.S. requires Tier 2 type controls on bearings moved from the USML to the CCL, we believe the bearings subject to Tier 2 controls are the ones described in the attached (Attachment F), while Tier 3 level controls would be satisfactory for the bearings described below.

c. Tier 3.

Timken believes that bearings controlled under the Wassenaar Dual-Use List (2.A.1) should be controlled as a "Tier 3" item on the revised CCL. Refer to our proposed revision to ECCN 2A001, above, and the global availability of such bearings (Attachment A).

If the U.S. requires Tier 3 controls on bearings moved from the USML to the CCL (and not treat such bearings as EAR99), Timken recommends that those bearings be controlled as described in the attached (Attachment G). A "mapping matrix" for such Tier 3 controls is attached (Attachment G-1).

d. EAR99 ("Tier 4").

Timken recommends that all bearings currently under EAR99 remain as EAR99, under the revised CCL and EAR.

Timken recommends that current ECCNs 1C999.a and 2A991 be deleted, and the bearings described by these ECCNs should be "EAR99" under the revised CCL and EAR, for reasons stated in the attached (Attachment H).

The Timken Company

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Mark

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The Timken Company
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Customs Attorney

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GNE-12

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ATTACHMENT A - 1

COMPETITORS WHO CAN MAKE BEARINGS SIMILAR TO TIMKEN, USML CATEGORY VIII(h) - aircraft "parts"

Competitors	HQ county	Plants in India or China?	Landing Wheel Bearings	Gearbox and transmission bearings	Airframe bearings	Gyroscope and navigation bearings	Helicopter Rotorhead assembly bearings	APU bearings	Engine bearings
SKF, SNFA, MRC	Sweden	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FAG, INA, Barden	Germany	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NTN/SNR	Japan	Yes				Yes		Yes	
JTEKT/Koyo	Japan	Yes	Yes		Yes				
NSK	Japan	Yes						Yes	
Minebea/NHBB	Japan	Yes				Yes	Yes		
Aviation Bearings Factory JSC	Russia		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Myonic	Germany	Yes	Yes					Yes	
AVIC/Harbin	China	Yes	?	?	?	?	?	?	?

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- VBF
- SNR
- VNC Bearing Inc.
- EBC - Russia
- THK
- Thomson Industries
- Hartford Ball Bearings
- Universal Bearings Inc.
- Nachi Technology
- ABC Bearings Ltd.
- Hanwha Machinery
- FAG Bearings India Ltd.
- NBC Bearings
- INA Bearings India Private Ltd.
- Sona Group
- SPZ Group
- MGM Bearing Co.

- ZKL Bearings
- PSL, Inc.
- Peer Bearing
- NKE Bearings
- FKL Co.
- Digilube Systems
- Gamet Bearings
- Kharkov Bearing Plant
- Myonic
- Barden
- FAG
- Barden Precision Bearings, UK
- GMN Bearing USA
- GRW: Gebr Reinfurt Wurzburg
- Koyo
- IKO - Nippon Thompson
- American Roller Bearing
- Longxi Bearing
- Asahi Seiko
- Daido Metal
- Daido Metal
- Daibea
- http://www.abbottball.com/
- Danaher
- Hartford Technologies Inc.
- http://www.strindustries.com/
- http://www.danahermotion.com
- http://www.winball.com/
- http://www.cwb-riku.com/index_EN.htm
- http://www.cerobear.de/index.php?id=6&L=1
- http://www.astbearings.com/AST.php
- www.precisionballs.com/
- Danaher Motion
- Hoover
- http://www.ibc-waelzlager.eu/
- NEMB
- http://nhbb.com/index.htm
- http://www.nnbr.com/
- http://www.nsk.com/index.html
- http://www.pacamor.com/index.ssi3.php
- http://www.rbcbearings.com/
- http://www.schaefflergroup.com/flash/start_en.jsp
- Automotive Components Limited
- www.schatzbearing.com
- www.zys.com.cn

ATTACHMENT A - 2

COMPETITORS WHO CAN MAKE BEARINGS SIMILAR TO TIMKEN - COMMERCE CONTROL LIST

Competitors	HQ county	Plants in India or China?	ECCN 1C999 hardened steel/ tungsten precision ball bearings *	ECCN 2A991 Magnetic bearings; high speed, extreme temperature bearings	ECCN 2A001 Super precision radial ball bearings
SKF, SNFA, MRC	Sweden	Yes	Yes	Yes	Yes
FAG, INA, Barden	Germany	Yes	Yes	Yes	Yes
NTN/SNR	Japan	Yes	Yes	Yes	Yes
JTEKT/Koyo	Japan	Yes	Yes	Yes	Yes
NSK	Japan	Yes	Yes	Yes	Yes
Minebea/NHBB	Japan	Yes	Yes	Yes	Yes
Aviation Bearings Factory JSC	Russia		Yes	Yes	Yes
Myonic	Germany	Yes	Yes	Yes	Yes
AVIC/Harbin	China	Yes	Yes	?	?
LYC Bearings	China	Yes	Yes	?	Yes
Wafangdian Bearings	China	Yes	Yes	?	Yes
MAC	India	Yes	Yes	?	Yes

* - there are many other competitors who can make the "1C999.a" bearings, far too many to list

ATTACHMENT C

TIMKEN'S ECOMMENDATIONS TO CLARIFY
CCL AND EAR FOR BEARINGS

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(1) All ECCNs for bearings under Category 2. There are currently three ECCNs that are "bearing specific" under the EAR: 2A001, 2A991 and 1C999. For reasons cited below, Timken believes that ECCNs 1C999.a and 2A991 should be deleted; however, if BIS believes one or both of these ECCNs should be retained for overriding policy reasons, then, if retained, ECCN 1C999.a should be moved to Category 2 (and its ECCN designation be changed to conform to Category 2);

(2) Bearings should only be classified in ECCNs under Category 2 of CCL. The nature of antifriction bearings is that any single bearing can be used in different applications. For example, a bearing for a heavy truck could also be used in a helicopter gearbox. It is rare for our products to be application unique. Also, many manufacturers both inside and outside of the Wasennaar member countries can make the bearings described on the CCL (see below), who are not bound by the CCL and its restrictions. Classifying bearings as something outside of Category 2 will create a competitive disadvantage for Timken (see below). The following is our recommendation to modify Interpretation 1 (Part 770 of the EAR):

(a) Interpretation 1: Anti-friction bearings or bearing systems and specially designed parts

(1) Anti-friction bearings or bearing systems are classified only by ECCNs under Category 2 of the CCL or as "EAR99", including ball, roller, needle-roller, magnetic, tapered roller, or other type of bearings, and components thereof. The ECCNs under the CCL which do not specifically mention "bearings" shall not be interpreted to include bearings. This Interpretation 1 applies to separate shipments of anti-friction bearings or bearing systems, and to shipments where anti-friction bearings or bearing systems are shipped with machinery, equipment or components, for which they are intended to be used as spares or replacements;

(2) same as today, except replace "machine" with "machine, equipment or component";

(3) same as today, except replace "machine" with "machine, equipment or component".

***

ATTACHMENT D

TIMKEN RECOMMENDED REVISION TO 2A991 (IF ECCN NOT DELETED)

(Areas changed from current 2A991 are highlighted)

***

2A991 Bearings and bearing systems not controlled by 2A001.

License Requirements

Reason for Control: AT

Control(s) Country Chart

AT applies to entire entry AT Column 1

License Exceptions

LVS: N/A

GBS: N/A

CIV: N/A

List of Items Controlled

Unit: $ value

Related Controls: 1.) This entry does not control balls with tolerance specified by the manufacturer in accordance with ISO 3290 as grade 5 or lesser precision.

Related Definitions: 1.) (a) DN is the product of the bearing bore diameter in mm and the bearing rotational velocity in rpm. (b) Operating temperatures include those temperatures obtained when a gas turbine engine has stopped after operation.

Items:

a. Ball bearings or Solid ball bearings (except tapered roller bearings), having tolerances specified by the manufacturer in accordance with ISO Standard Class 2 or more precise

tolerances and having any of the following characteristics.

a.1. Manufactured for use at operating temperatures above 573 K (300 °C) either by using special materials (i.e., materials not specified as a "standard grade" by ASM or similar organization) or by special heat treatment (i.e., heat treat processes not generally used on bearings classified as "EAR99") ; *or*

a.2. With lubricating elements or component modifications that, according to the manufacturer's specifications, are specially designed to enable the bearings to operate at speeds exceeding 2.3 million DN.

b. Solid tapered roller bearings, having tolerances specified by the manufacturer in accordance with ISO Standard Class 2 or more precise tolerances and having either of the following characteristics.

b.1. With lubricating elements or component modifications that, according to the manufacturer's specifications, are specially designed to enable the bearings to operate at speeds exceeding 2.3 million DN; *or*

b.2. Manufactured for use at operating temperatures below 219 K (-54 °C) or above 423 K (150 °C).

c. Gas-lubricated foil bearing manufactured for use at operating temperatures of 561 K (288 °C) or higher and a unit load capacity exceeding 1 MPa.

d. Active magnetic bearing systems.

e. Fabric-lined self-aligning or fabric-lined journal sliding bearings manufactured for use at operating temperatures below 219 K(-54 °C) or above 423 K (150 °C).

f. Ball Bearings having either of the following characteristics:

f.1 precision specified by the manufacturer of ISO Tolerance Class of 2 or more precise precision; *or*

f.2. precision specified by the manufacturer of ISO Tolerance Class of 4 or more precise precision (diameter of 3mm or more) and rings and rolling elements all made of corrosion resistant metals, such as AMS 5618, AMS 5530, AMS 5749.

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ATTACHMENT E

TIMKEN RECOMMENDED REVISION TO 2A001
(changes highlighted in red)

2A001 Anti-friction bearings and bearing systems, as follows, (see List of Items Controlled) and components therefor.

License Requirements

Reason for Control: NS, MT, AT

Control(s) Country Chart

NS applies to entire entry NS Column 2

MT applies to MT Column 1

1. radial ball bearings having all tolerances specified in accordance with ISO 492 Tolerance Class 2 or more precise tolerances and having all the following characteristics: an inner ring bore diameter between 12 and 50 mm; an outer ring outside diameter between 25 and 100 mm; and a width between 10 and 20 mm (MT does not apply to angular contact ball bearings);

2. bearings described by 2A001.c.

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AT applies to entire entry AT Column 1

License Exceptions
LVS: $3000, N/A for MT
GBS: Yes, for 2A001.a. 2A001.b, and 2A001.d
N/A for MT
CIV: Yes, for 2A001.a. 2A001.b, and 2A001.d
N/A for MT

List of Items Controlled
Unit: $ value

Related Controls: (1) See also 2A991 [if not deleted].

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Related Definitions: None

Items:

Note: *1) 2A001 does not control balls with tolerances specified by the manufacturer in accordance with ISO 3290 as grade 5 or worse;*

a. Ball bearings and solid roller bearings, having all tolerances specified by the manufacturer in accordance with ISO 492 Tolerance Class 4 or more precise tolerances, and having both rings and rolling elements (ISO 5593), made from alloys with nickel content greater than 50% or alloys with beryllium content greater than 20%;

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Note: *2A001.a does not control tapered roller bearings.*

b. Other ball bearings and solid roller bearings, having all tolerances specified by the manufacturer in accordance with ISO 492 Tolerance Class 2, or more precise tolerances, and with ball grade 3 and roundness of .000006"; and raceway curvature tolerance of less than 0.5%;

Note: *2A001.b does not control tapered roller bearings.*

c. Active magnetic bearing systems using any of the following:

c.1. Materials with flux densities of 2.0 T or greater and yield strengths greater than 414 MPa;
c.2. All-electromagnetic 3D homopolar bias designs for actuators; *or*
c.3. High temperature (450 K (177°C) and above) position sensors.

Note: *2A001.c does not control tapered roller bearings*

d. Bearings previously designated as "parts" under the U.S. Munitions List (USML) Categories VI(g), VII(g) and VIII(h), which were removed from the USML and designated as Department of Commerce export jurisdiction by the U.S. Department of State, Directorate of Defense Trade Controls, [pursuant to Final Rule published in Federal Register XXXX], provided hybrid bearings from the VAATE aircraft engine program are under 2A001.g, below.

Note: *Bearings which are the subject of a Commodity Jurisdiction under the International Traffic in Arms Regulations are excluded from 2A001.d.*

e. Bearings previously designated as "parts" under the U.S. Munitions List (USML) in Category IV(h), which were removed from the USML and designated as Department of Commerce export jurisdiction by the U.S. Department of State, Directorate of Defense Trade Controls, [pursuant to Final Rule published in Federal Register XXXX].

Note: *Bearings which are the subject of a Commodity Jurisdiction under the International Traffic in Arms Regulations are excluded from 2A001.e.*

f. Bearings previously designated as "parts" under the U.S. Munitions List (USML) in Categories other than those Categories set forth in 2A001.d and 2A001.e, which were removed from the USML and designated as Department of Commerce export jurisdiction by the U.S. Department of State, Directorate of Defense Trade Controls, [pursuant to Final Rule published in Federal Register XXXX].

Note: *Bearings which are the subject of a Commodity Jurisdiction under the International Traffic in Arms Regulations are excluded from 2A001.f.*

g. Hybrid bearings with XXXX (fill in specifications for VAATE hybrid bearings).

Competitors	HQ county	Plants in India or China?	Landing Wheel Bearings	Landing Gear Bearings
SKF, SNFA, MRC	Sweden	Yes		Yes
FAG, INA, Barden	Germany	Yes		Yes
NTN/SNR	Japan	Yes	Yes	Yes
JTEKT/Koyo	Japan	Yes		Yes
NSK	Japan	Yes		Yes
Minebea/NHBB	Japan	Yes		Yes
Aviation Bearings Factory JSC	Russia		Yes	Yes
Myonic	Germany	Yes		
AVIC-HRB	China	Yes		
Wafangdian	China	Yes	Yes	
Luoyang research	China	Yes	Yes	Yes
Guizhou HongShan	China	Yes		
Shanghai TianHong	China	Yes		
add others....				

Gearbox and transmission bearings	Airframe bearings	Gyroscope and navigation bearings	Helicopter Rotorhead assembly bearings	APU bearings
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes		Yes	Yes	Yes
	Yes			
				Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
?	Yes		Yes	Yes
				Yes
			Yes	
	Yes		Yes	
	Yes	Yes		

Engine bearings	Space Flight	Avionics	Helicopter Clutch assembly	Tracking bearings
Yes				
Yes				
Yes				
yes				
Yes				
	Yes	Yes		
Yes				
Yes			Yes	
				Yes

ATTACHMENT F-2

MAPPING "FORMER" USML BEARING "PARTS" TO RECOMMENDED CCL

"TIER 2" TYPE CONTROLS

Former USML Category	Proposed New ECCN	New ECCN Policy Controls	License Exception GBS	License Exception CIV	License Exception LVS	License Required for PRC?
IV(g) Missile parts	2A001.e	NS2, MT and AT1	No	No	No	Yes
USML Categories other than IV, VI, VII, and VIII "parts"	2A001.d	NS2 and AT1	No	No	No	Yes

Note: The bearings identified are "parts" under the respective USML Categories. Timken believes that these bearings, if moved from the USML to the CCL, should actually be EAR99 under the EAR. However, if BIS or others believe there is an overriding policy concern about making these bearings EAR99 or Tier 3, Timken recommends that the bearings be under a "Tier 2" type control, similar to what we have outlined. We have suggested modifications to the current ECCN 2A001, by a new 2A001.d, to create "Tier 2" type controls for these bearings. Note that these types of bearings can be made by many of Timken's competitors who are headquartered in NATO countries and countries who are major U.S. Allies (e.g., Japan)., or in Wassenaar Arrangement member countries (Russia). The "No" under the GBS and CIV license exceptions will allow for NLR only to those NATO countries and major U.S. allies' countries.

ATTACHMENT F

TMKEN'S RECOMMENDED TIER 2 CONTROLS ON DEFENSE ARTICLE BEARINGS MOVED TO CCL

Based upon the U.S. government's export reform team's work to date, Timken anticipates that some bearings will be moved from the USML to the CCL. The following are our recommendations for Tier 2 controls on such bearings, if moved from the USML to the CCL:

1. Hybrid (ceramic/metal) bearings from VAATE program. These are specialized bearings for the next generation jet engines, in program funded by USAF. Based on literature provided by Timken's competitors, we believe that at least some of our competitors in the Wassenaar Arrangement member countries can make these, but we do not believe bearing competitors outside of Wassenaar (at least at this time) can make these hybrid bearings. Characteristics of these bearings include use of high temperature resistant alloys with specialized heat treatment processes, special design modifications to meet performance requirements. (fill in VAATE hybrid bearings specifications).

2. Ultra-quiet bearings (primarily used in nuclear submarines). These bearings are described in category "ML9" on the Wassenaar Munitions List. We believe that these bearings will not be moved from the USML to the CCL, however, in the unlikely event that does happen; these bearings should be at least a Tier 2 controlled item on the revised CCL. Based on competitor's literature, we believe that at least some of our competitors in the Wassenaar Arrangement member countries can make these, but we do not believe bearing competitors outside of Wassenaar (at least at this time) can make these ultra-quiet bearings. Characteristics of these bearings include special modifications to bearing designs to ensure low noise performance and use of proprietary manufacturing processes.(specifications may be secret).

3. Bearings moved from the USML to the CCL, that were defense articles described as "parts" under USML Categories IV (Launch Vehicles, etc.), XII (Fire Control, etc.), XV (Spacecraft), and XX (Submersible), not described above.

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ATTACHMENT E-1

MAPPING "FORMER" USML BEARING "PARTS" TO RECOMMENDED CCL

"TIER 3" TYPE CONTROLS

Former USML Category	Proposed New ECCN	New ECCN Policy Controls	License Exception GBS	License Exception CIV	License Exception LVS	License Required for PRC?
VIII(h) Aircraft parts	2A001.d	NS2 and AT1	Yes	Yes	Yes $3000	Yes
VII(g) Tanks & Military Vehicle parts	2A001.d	NS2 and AT1	Yes	Yes	Yes $3000	Yes
VI(g) vessels of war parts	2A001.d	NS2 and AT1	Yes	Yes	Yes $3000	Yes

Note: The bearings identified are "parts" under the respective USML Categories. Timken believes that these bearings, if moved from the USML to the CCL, should actually be EAR99 under the EAR. However, if BIS or others believe there is an overriding policy concern about making these bearings EAR99, Timken recommends that the bearings be under a "Tier 3" type control. We have suggested modifications to the current ECCN 2A001, by a new 2A001.d, to create "Tier 3" type controls for these bearings. Note that these types of bearings can be made by many of Timken's competitors outside the U.S., so there is a practical basis for making these EAR99.

ATTACHMENT G

TMKEN'S RECOMMENDED TIER 3 CONTROLS ON DEFENSE ARTICLE BEARINGS MOVED TO CCL

Based upon the U.S. government's export reform team's work to date, Timken anticipates that some bearings will be moved from the USML to the CCL. The following are our recommendations for Tier 3 controls on such bearings, if moved from the USML to the CCL:

1. Bearings that are currently defense articles, which are "parts" under USML Category VIII(h) - Aircraft. These bearings include landing wheel bearings, helicopter gearbox bearings, airframe bearings, landing gear bearings, helicopter clutch assembly bearings, tracking bearings, APU bearings and helicopter rotorhead assembly bearings. These bearings are identical to their Commerce export controlled counterparts (tapered roller, cylindrical and spherical bearings are all EAR99), have no unique or special military characteristics and are only on the USML due to the "design intent" rule, i.e., if the part number had been originally used for a civil application, the bearings would have been EAR99. Note that the DTAG recommendation was to make these bearings EAR99, or at most, Tier 3 control on the revised CCL, with the exception of "VAATE" hybrid bearings, which should be a Tier 2 control.

2. Bearings that are currently defense articles, which are "parts" under USML Category VII(g) - Tanks and Military Vehicles. These bearings include drive train, transmission and gearbox bearings, and our identical to commercial "EAR99" bearings. DDTC's proposed revision to this USML Category VII(g) eliminates USML coverage for these bearings. We believe that such bearings should be EAR99, or at most Tier 3 control on the revised CCL.

3. Bearings that are currently defense articles, which are "parts" under USML Category VI - Vessels of War. These bearings include rudder control bearings and similar bearings, which are identical to commercial "EAR99" bearings. We anticipate that the U.S. export reform task force will treat Category VI(g) similar to Category VII and VIII. These bearings should be EAR99, or at most, Tier 3 control on the revised CCL.

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ATTACHMENT H

TIMKEN'S RECOMMENDATIONS TO ELIMINATE ECCNs 2A991 AND 1C999.a

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(1) ECCN 1C999.a => EAR99 ("Tier 4"). We recommend that ECCN 1CCC.a, be deleted, and such product be classified as "EAR99" under the EAR. These bearings can be made anywhere in the world. Note that none of the Wassenaar members have a similar control, nor do China or India. Hence, the vast majority of bearing manufacturers are not subject to export controls on "hardened steel and tungsten carbide precision ball bearings (3mm or greater diameter). They do not have to insist their customers maintain these types of ECCN controls on such bearings. This puts U.S. companies, subject to the controls, at a disadvantage to competitors who do not have to worry about such controls, since the competitors do not have the extra administrative cost, nor do competitors have to pass such controls on to their customers. Timken suggests that if U.S. policy makers still have concerns regarding North Korea for such bearings, that the Office of Foreign Asset Controls regulations be revised to prohibit export or reexport of such materials for use in the North Korea nuclear programs, in lieu of retaining ECCN 1C999.a.

(2) ECCN 2A991 => EAR99 ("Tier 4"). For reasons similar to those for ECCN 1C999.a, we recommend that ECCN 2A991 be eliminated, and product be classified as EAR99 under the EAR. This "U.S. unique control" puts Timken and other U.S. bearing makers at a competitive disadvantage against competing bearing makers in Europe, Japan, Russia, China and India (refer to Attachment A), as it adds additional administrative cost, and makes our products less appealing to customers, who do not have to contend with "2A991" controls from our non-U.S. competitors.

***

ATTACHMENT A

TIMKEN'S GLOBAL BEARING COMPETITORS

Timken literally has hundreds of bearing competitors around the world. Many of these competitors can make the same bearings that Timken makes, but are not under the same export controls as Timken, which significantly undermines our ability to compete. A list of major competitors is attached (Attachment A-1), and we have attached a matrix showing some of our leading competitors who can make bearings on the current CCL (Attachment A-2). Please note that all but one of our major competitors have bearing plants in China and of those many plants, one is own by a corporation headquartered in China. (Attachment A-1). See also profiles of Timken competitors who can make some defense articles (Attachment A-3). These facts make clear that Wassenaar members have permitted their national corporations to open plants in China, and this was one factor creating the indigenous production capacity for bearings in China. Timken submits that the Administration should take the Chinese capacity into consideration regardless of the headquarters located in Wassenaar Arrangement member countries. This is consistent with the Export Administration Act of 1979 and consistent with the standards the Administration has published.

Timken believes that U.S. export reform is moving in the right direction, as shown by the proposed revisions to U.S. Munitions List ("USML") Categories VII, VIII, XI and XII, on the U.S. State Department, Directorate of Defense Trade Controls web site. We believe that the export reform team recognizes that many of Timken's global competitors, who are not subject to the ITAR, can make the very bearings controlled on the USML (refer to Attachment A-3). This broad USML control is due to the outmoded "design intent" policy of the ITAR. This puts Timken at a significant competitive disadvantage. We believe the proposed revisions to the USML, above, are good first steps. We understand that there must be further review and Congressional approval, to revise the USML. We believe this information may assist that further review.

Many of the bearings that we make, which are currently export controlled under USML can be made outside the U.S. (refer to Attachment A-3). In fact, there is fierce competition in this area, and the ITAR makes it extremely difficult for Timken to compete, where its competitors are not under ITAR controls. The EC-175 helicopter is an excellent example of how Timken lost out to its non-U.S. competitors. Timken obtained a Commodity Jurisdiction for gearbox (transmission) bearings to go into this helicopter. The response was that the bearings were on the USML Category VIII (Aircraft), despite very similar commercial bearings. Timken's potential customer did not want to have to deal with ITAR controlled product, and went with competitors' bearings (SNR and SNFA/SKF), which were not subject to these types of export controls. The lost business potential is well over $1 million. More than one of our European customers has dropped Timken as a supplier, in an effort to eliminate "ITAR" controlled components in their products.

We have submitted to DDTC information, which outlines our global competitors, and indicates generally where they can make the same bearings that Timken makes, which are under the specified ITAR Category. These competitors are generally not under ITAR controls, and may even be outside the Wassenaar Arrangement member countries.

In addition to the ITAR controls, the U.S. Commerce Control List needs to be reviewed and updated, based upon global bearing suppliers outside of the Wassenaar Arrangement member countries. The growth of bearing manufacturing in China and India make the current controls on bearings under the Commerce Control List impractical. According to the Freedonia Bearing Report (2008), China is not only the world's largest bearing consuming country, it is also the

world's largest bearing manufacturing country. The following are some bits of information regarding China's bearing manufacturing capabilities:

- AVIC and Harbin Bearing announced a joint venture (AVIC Harbin Bearing Co. Ltd.) to manufacture precision aerospace and specialty bearings (eBearing news June 21, 2010), including building a new 350,000 square meter facility in Harbin, China to make these bearings;

- There are more than 800 bearing and power transmission component manufacturers in Zhejiang province alone, with almost as many in each of the Shandong and Jiangsu provinces, which have a focus on precision bearing infrastructure (eBearing March 19, 2010);

- AAXICO and HHC form a joint venture to export Chinese made bearings to the U.S., including low-noise precision bearings (eBearing July 26, 2010).; and

- Major locally based Chinese bearing manufacturers include C&U Group, Harbin Bearing, Luoyang LYC Bearing, Wafangdian Bearing and Wanxiang Qianchao. Foreign bearing makers with production facilities in China include Daido Metal, Federal-Mogul, GGB Bearing Technology, GKN, Iljin, JTEKT, MAHLE International, Miba, Minebea, Nachi-Fujikoshi, NN, NSK, NTN, Oiles, Rother Erde, Schaeffler, SKF, THK and Timken.

If there are any questions, or additional information is needed, please do not hesitate to contact us.

The Timken Company

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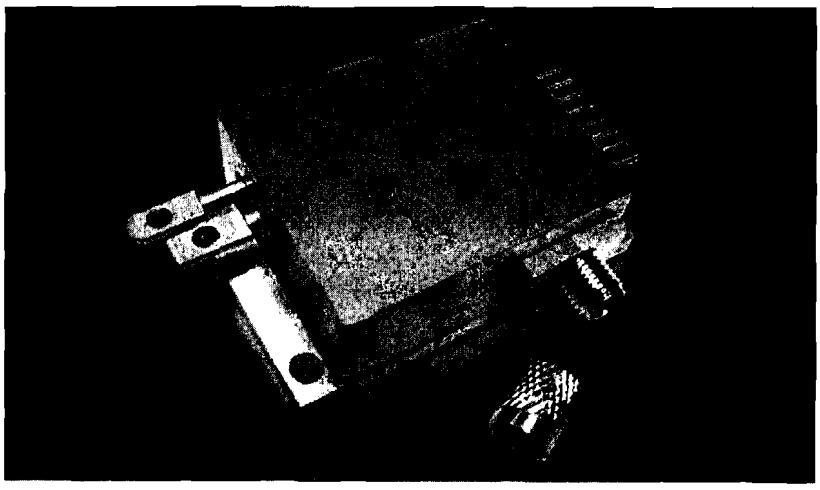
808nm High Brightness Diode Laser

K81DA4C-20.00W-FS K81DA4C-30.00W-FS



Key Features:

- 20W, 30W output power
- 200μm,400μm detechable fiber
- 0.22NA
- 808nm wavelength
- Compact package

Options:

- Integrated 650nm aiming beam
- Monitor photo diode
- Fiber detection sensor

BWT Beijing's High Power Diode Laser Modules are manufactured by adopting specialized fiber-coupling techniques, resulting in volume products with a high efficiency, stability and superior beam quality. The products are achieved by transforming the asymmetric radiation from the laser diode chip into an output fiber with small core diameter by using special micro optics. Inspecting and burn-in procedures in every aspect come to a result to guarantee each product with the reliability, stability and long lifetime.

Our research staffs are constantly improving and innovating the processing technology in the producing process, based on the professional knowledge and experience accumulated in long-terms. We are also continuously developing new products to meet customers' specific needs.

At BWT Beijing, to provide high quality products with reasonable price is our always goal.

808nm High Brightness Diode Laser

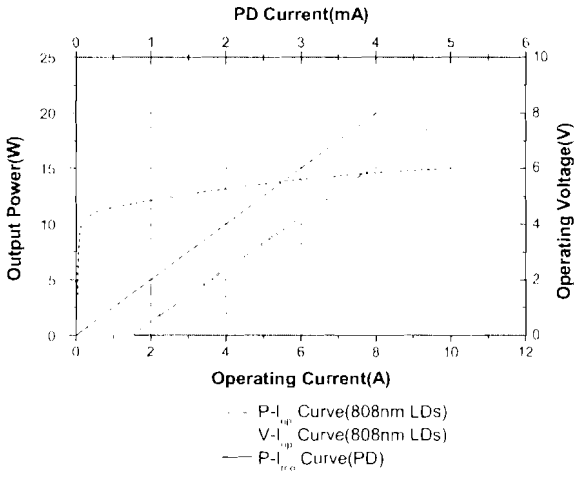
K81DA4C-20.00W-FS K81DA4C-30.00W-FS

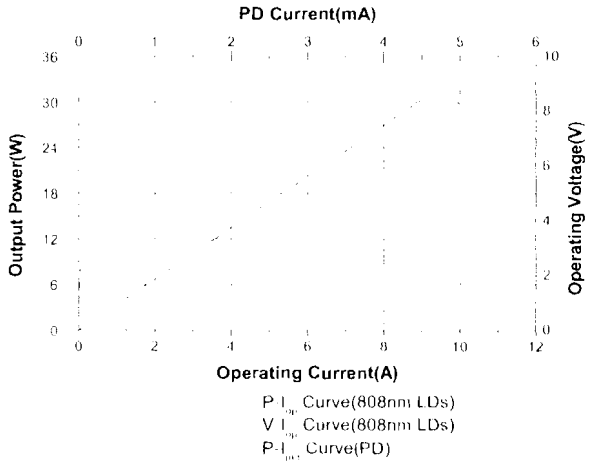
Specifications（25℃）		Symbol	Unit	K81DA4C-20.00W-FS	K81DA4C-30.00W-FS
Optical data	CW-output power	P_o	W	20	30
	Center wavelength	λ	nm	808	
	Tolerance of λ	-	nm	±3, ±10	
	Spectral width (FWHM)	$\Delta\lambda$	nm	<3	
	Temperature drift of λ	-	nm/℃	~0.3	
Connector data	Designed for fiber core diameter	W	μm	200/400	
	Designed for fiber numerical aperture	NA	-	0.22	
	Fiber connector	-	-	SMA 905	
Electrical data	Operation current	I_{op}	A	10	
	Threshold current	I_{th}	A	1.5	1.2
	Conversion efficiency	η	%	40	40
	Slope efficiency	η_s	W/A	2.8	3.8
	Operation voltage	V_{op}	V	5.8	7.8
PD data	Reverse voltage	V_R	V	6	8
	Current	I_{mon}	mA	<0.6	<0.8
Aiming beam data	Output power	P_a	mW	>2	
	Wavelength	λ_a	nm	650±10	
	Voltage	V_a	V	≤2	
	Current	I_a	mA	<30	
Others	Operation temperature	T_{op}	℃	10~30	
	Storage temperature	T_s	℃	-20~+80	
	Expected lifetime	MTBF	h	>10,000	
	Dimensions (fiber and connector not included)	-	mm	52.0×35.0×20.0	
	Lead soldering temperature	T_l	℃	260(10 sec.)	

808nm High Brightness Diode Laser

K81DA4C-20.00W-FS K81DA4C-30.00W-FS

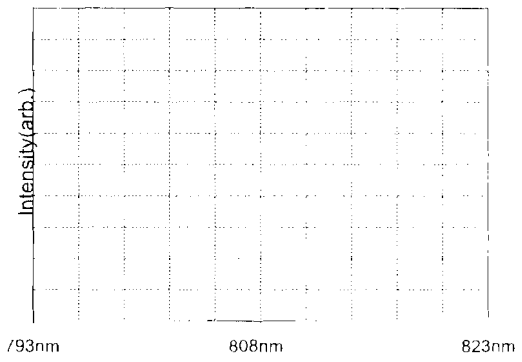
Characteristics



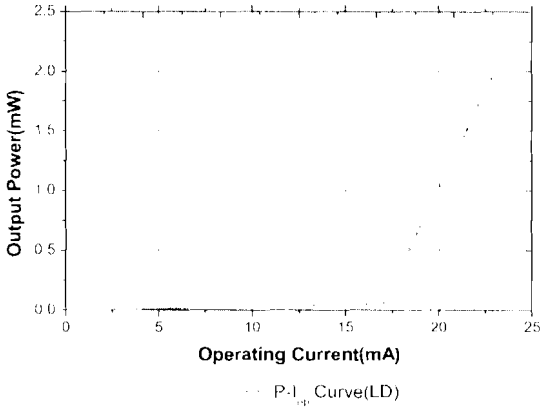


Typ. spectrum (T=25℃)

808nm diode laser modules



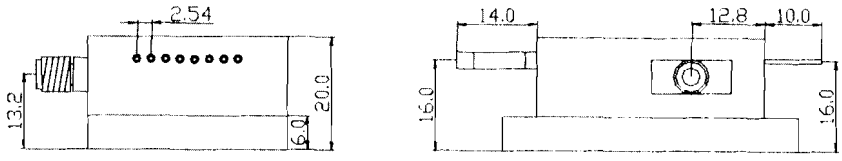
650nm Aiming Beam Characteristics

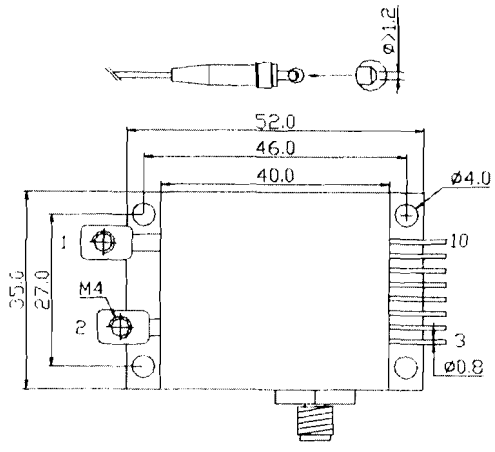


808nm High Brightness Diode Laser

K81DA4C-20.00W-FS K81DA4C-30.00W-FS

Package Dimensions (mm)





Pin	Function	Pin	Function
1	LD (-)	6	Aiming Beam LD (+2.2V) PD (N)
2	LD (+), Case	7	Aiming Beam LD (0V)
3	FCD LED (+)	8	PD (P)
4	FCD LED (-) FCD PD (P)	9	Thermistor
5	FCD PD (N)	10	Thermistor

※FCD: Fiber Connector Detector

OPERATING NOTES

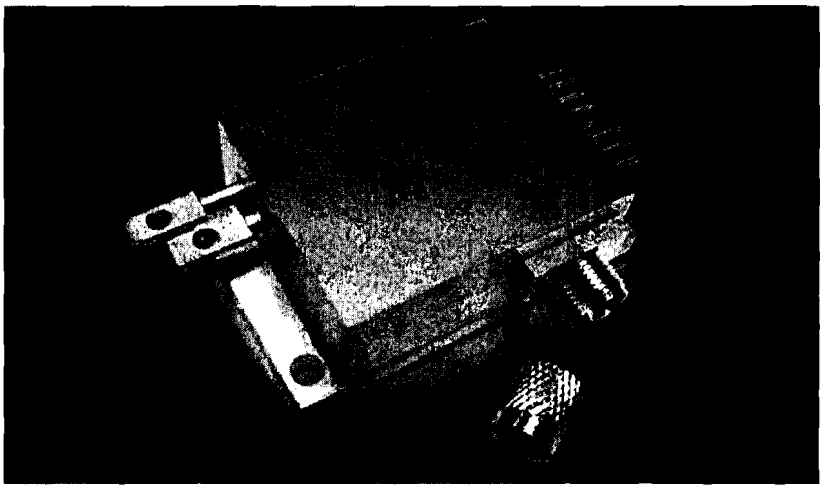
- Avoid eye exposure to direct or scattered radiation.
- ESD precautions must be taken.
- Please connect pins to wires by solder instead of using socket when operation current is higher than 6A. Soldering point should be close to the root of the pins. Soldering temperature should be lower than 260℃ and time shorter than 10 second.
- Use constant current power supply. Avoid surge current.
- Laser diode must be used according to the specifications.
- Laser diode must work with good cooling.
- Operation temperature is 10℃~ 30℃.
- Storage: -20℃~ +80℃, all pins short-circuit.

Information and specifications contained herein are deemed to be reliable and accurate. BWT Beijing reserves the right to change, alter or modify the design and specifications of these products at any time without notice

Tel: +86 10 8368 1053 | Fax: +86 10 8368 1077 | Email: sales@bwt-bj.com | Website: www.bwt-bj.com

976nm High Brightness Diode Laser

K98DA4C-20.00W-FS K98DA4C-30.00W-FS



Key Features:

- 20W, 30W output power
- 200μm/400um detechable fiber
- 0.22NA
- 976nm wavelength
- Compact package

Options:

- Integrated 650nm aiming beam
- Monitor photo diode
- Fiber detection sensor

BWT Beijing's High Power Diode Laser Modules are manufactured by adopting specialized fiber-coupling techniques, resulting in volume products with a high efficiency, stability and superior beam quality. The products are achieved by transforming the asymmetric radiation from the laser diode chip into an output fiber with small core diameter by using special micro optics. Inspecting and burn-in procedures in every aspect come to a result to guarantee each product with the reliability, stability and long lifetime.

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At BWT Beijing, to provide high quality products with reasonable price is our always goal.

976nm High Brightness Diode Laser

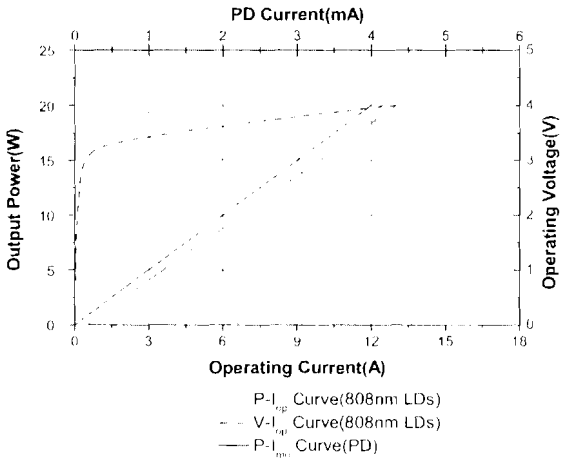
K98DA4C-20.00W-FS K98DA4C-30.00W-FS

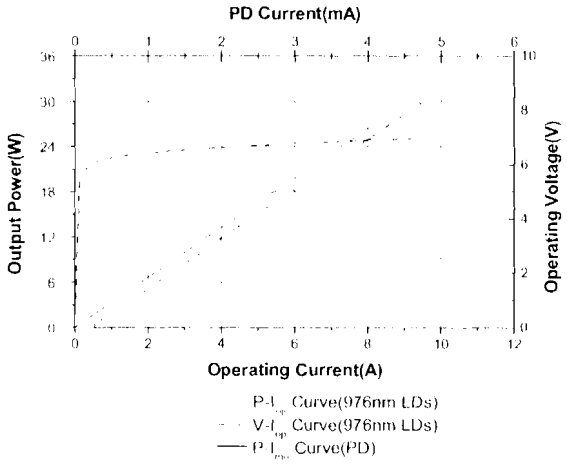
Specifications (25℃)		Symbol	Unit	K98DA4C-20.00W-FS	K98DA4C-30.00W-FS
Optical data	CW-output power	P_o	W	20	30
	Center wavelength	λ_c	nm	976	
	Tolerance of λ_c	-	nm	±3, ±10	
	Spectral width (FWHM)	$\Delta\lambda$	nm	<3	
	Temperature drift of λ		nm/℃	~0.3	
Connector data	Designed for fiber core diameter	W_f	μm	200/400	
	Designed for fiber numerical aperture	NA	-	0.22	
	Fiber connector	-	-	SMA-905	
Electrical data	Operation current	I_{op}	A	13	9.5
	Threshold current	I_{th}	A	0.5	0.5
	Conversion efficiency	η	%	38	48
	Slope efficiency	η_d	W/A	1.6	3.5
	Operation voltage	V_{op}	V	4	7
PD data	Current	I_{PD}	mA	<6.0	<8.0
	Output power	P_{PD}	mW	>2	
Aiming beam data	Wavelength	λ_a	nm	650 ± 10	
	Voltage	V_a	V	2.2	
	Current	I_a	mA	<30	
Others	Operation temperature	T_{op}	℃	10~30	
	Storage temperature	T_s	℃	-20~+80	
	Expected lifetime	MTBF	h	>10,000	
	Dimensions (fiber and connector not included)	-	mm	52.0 × 35.0 × 20.0	
	Lead soldering temperature	T_s	℃	260(10 sec.)	

976nm High Brightness Diode Laser

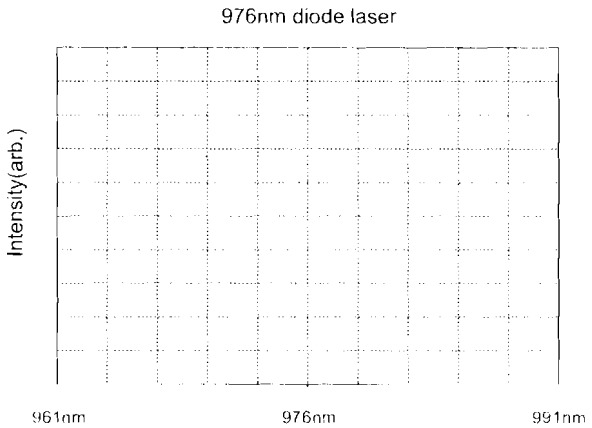
K98DA4C-20.00W-FS K98DA4C-30.00W-FS

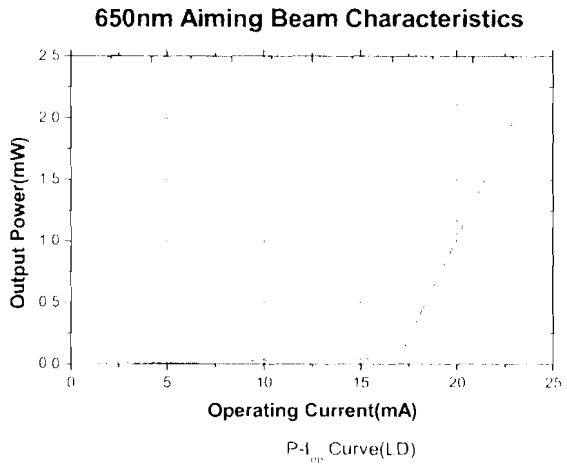
Characteristics





Typ. spectrum (T=25℃)

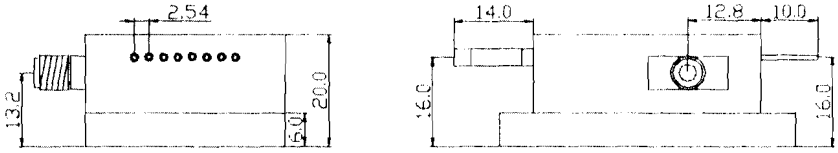


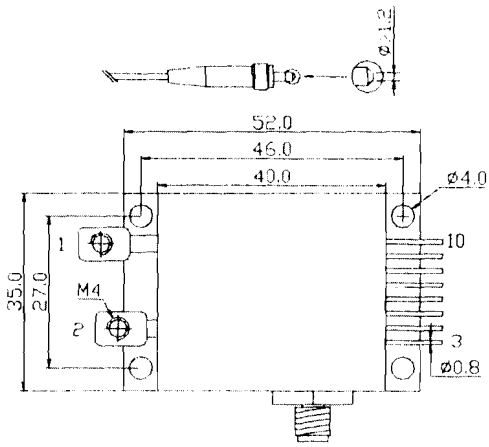


976nm High Brightness Diode Laser

K98DA4C-20.00W-FS K98DA4C-30.00W-FS

Package Dimensions (mm)





Pin	Function	Pin	Function
1	LD (-)	6	Aiming Beam LD (+2.2V) PD (N)
2	LD (+), Case	7	Aiming Beam LD (0V)
3	FCD LED (+)	8	PD (P)
4	FCD LED (-) FCD PD (P)	9	Thermistor
5	FCD PD (N)	10	Thermistor

OPERATING NOTES

- Avoid eye exposure to direct or scattered radiation.
- ESD precautions must be taken.
- Please connect pins to wires by solder instead of using socket when operation current is higher than 6A. Soldering point should be close to the root of the pins. Soldering temperature should be lower than 260℃ and time shorter than 10 second.
- Use constant current power supply. Avoid surge current.
- Laser diode must be used according to the specifications.
- Laser diode must work with good cooling.
- Operation temperature is 10℃~ 30℃.
- Storage: -20℃~ +80℃, all pins short-circuit.

Information and specifications contained herein are deemed to be reliable and accurate. BWT Beijing reserves the right to change, alter or modify the design and specifications of these products at any time without notice.

TIMKEN
Where You Turn

Mark Bump
Mgr - Global Trade & Compliance
Customs Attorney
Empowered Official

June 30, 2010

Mr. Brian Nilsson
Director, Non-Proliferation and Arms Control/
National Security Council
White House
1600 Pennsylvania Avenue N.W.
Washington, D.C. 20500

Dear Mr. Nilsson:

The Timken Company ("Timken") is very interested in providing comments regarding the export control system reform described by Secretary of Defense Robert Gates on April 20, 2010. Specifically, we wish to comment regarding export controls on antifriction bearings.

Timken is an international business, with an expertise in friction management and power transmission. Our business is over 100 years old. Timken's world-wide headquarters is in Canton, Ohio. We are best known for our antifriction bearings. Attached is our company profile.

We agree with Secretary Gates' comments that the current export control regime erodes our defense industrial base and impedes the effectiveness of our closest military allies.

In the past several years, we have received extensive negative commentary from our non-U.S. customers in NATO countries, particularly in the aerospace industry, that the U.S. "over controls" many of our products. The most common cause of these complaints is where an existing commercial bearing (EAR99) has slight additional common processes done to it, for use in both civilian and military aircraft. Such common antifriction bearings are used for both civilian and military helicopter gearboxes, or in fixed wing aircraft landing wheels for both civilian and military aircraft. We have effectively used the ITAR Rule interpreting Section 17(c) of the Export Administration Act of 1979 to clarify that some bearings, which are common to both civilian and military aircraft are now typically subject to the current EAR. However, we believe that even more can be done along these lines, particularly if the focus of the new export controls takes into account capabilities, and is not based solely on design intent.

Timken's bearing business uses a "base part number", which defines the geometry of the bearing. Timken also has a number of manufacturing, inspection, packaging and similar options, which can be applied to that part number. We refer to these options as performance codes. These performance codes have been created over decades, based on industry or customer needs, and then expanded to apply to other situations, beyond the initial industry or customer. Under the current ITAR, if a particular performance code is first applied to a base part number, the intended use is for a

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mark.bump@timken.com

military application, and the performance code is actually a minor modification to the base part number (and not just something like "100% inspection"), the end result is a defense article. This is true, even if the base part number had a civil origin, the performance code had a civil origin, and we have applied the performance code to thousands of other base part numbers, just not this particular base part number, until now.

Under the current ITAR, in our situation, the capabilities provided to that base part number by the performance code are irrelevant - it is almost the "luck of the draw" that determines its export jurisdiction. If it just so happens that the first time a particular performance code is applied to that base part number, happens to be for a military application, it is a defense article. The "modified" part can often be readily used in other civil applications, where that base part number is used, since the geometry is the same, and the minor modifications of that particular performance code have no affect on the civil application. For example, a base part number first designed for a printing press roll is modified by a performance code, to be used in a helicopter landing wheel. That helicopter landing wheel bearing can be used without any changes, in the printing press roll, because the size is exactly the same, and the "landing wheel" performance code does not affect the bearing being used in the printing press. This is why non-U.S. customers have told us they prefer to use non-U.S. bearing providers. This makes it very difficult for Timken to compete globally in these markets.

We believe the new export control regime needs to make a clear distinction between the bearings described above, versus the situation at the opposite end of the "export sensitivity" spectrum, where we design bearings with specialized capabilities that are for strategic military environments, such as ultra quiet bearings for submarines, or bearings able to operate in the cold vacuum of space, which are also defense articles. Even though both the landing wheel bearing and the ultra-quiet submarine bearing are considered defense articles under the existing ITAR, we believe there is a vast difference between the two, in terms of both national security and capabilities. We believe Secretary Gates' concept of focusing on the "crown jewels", together with a "tiered approach" for export control can readily be applied to bearings, as outlined below.

We suggest the approach for export control on bearings described below, which is readily applicable to the single export control list that Secretary Gates described. We have set forth a more detailed description of that tiered approach for bearings and related software and technology, on Exhibit A, attached. Timken's suggested approach is summarized as follows:

> First, all U.S. export controls on antifriction bearings should be consistent with, and not more stringent than, multinational export controls on antifriction bearings. We have included a "cascading down" aspect to the proposed regulations, which stimulates a review of unilateral export controls by periodically moving unilateral controls down one Tier. Either the unilateral controls become multilateral, or the controls continue to lessen.
>
> Second, adopt a four tier system of controls on a single list, for antifriction bearings and related software and technology. Tier 1 would control the "most sensitive" bearings (the "crown jewels"), Tier 2 "less sensitive", Tier 3

"somewhat sensitive" and the final tier (Tier 4) would be "EAR99" as currently defined under the Export Administration Regulations. .

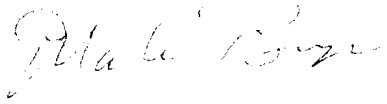
Third, export controls on each Tier, should be consistent with the "export sensitivity" of that Tier, defined in major part by capabilities. We recognize that the U.S. government may be reluctant to move some items that are currently defense articles, to low export level controls, despite the "low level" capabilities and age of the bearings involved, so our proposal includes a "phase out" approach for export controls those types of bearings. An example of such a bearing might be a landing wheel bearing on a 40 year old aircraft.

Fourth, re-export controls for bearings should be a function of the "export sensitivity" of that Tier, as well as take into account that our bearings are usually incorporated into a larger assembly, such as a gearbox, landing gear, transmission or similar item, then re-exported.

We appreciate this opportunity to present comments, and your willingness to consider them.

Please do not hesitate to contact us with any questions,

Sincerely,



cc: Philip D. Fracassa - Sr. V.P. Tax & Treasury
Robert J. Lapp - V.P. - Gov't Affairs & Comm. Rel.
Larry E. Christensen, Esq. - Miller & Chevalier

Enclosures: Timken Company Profile

EXHIBIT A
TIMKEN Suggested Export Control Reform for Bearings
June 30, 2010

I. What is in each export control Tier:

Tier 1* - would include:

- Multilaterally Controlled Tier 1 Bearings as follows:
  - bearings described by the MTCR's Equipment, Software and Technology Annex;
  - bearings described by the NSG's Guidelines Related to Transfers of Nuclear-related Equipment, Materials, Software and Techology and Dual-Use Nuclear-related Equipment, Materials, Software and Techology;
  - bearings on Wassenaar Sensitive List and Very Sensitive List;
  - bearings on the Australia Group Common Control Lists;

- Unilaterally Controlled Tier 1 Bearings, are bearings which are not described under Multilaterally Controlled Tier 1 Bearings, as follows:
  - Remaining bearings on the U.S. DoD's Military Critical Technology List
  - Remaining bearings in the following Categories/Subcategories of the US Muntions List, which are not covered by any of the above (the "Tier 1 Unilateral Controlled Bearings"):
    - Category IV - Naval Propulsion System (usually IV(h))
    - Category VIII(e) - parts for inertial navigation systems
    - Category VIII (g) - parts for Ground Effect Machines
    - Category XI - Fire Control (parts)
    - Category XV - Spacecraft (parts)
    - Category XVI - Nuclear weapons (parts)
  - Remaining bearings in any Category not mentioned above, where bearings would be considered Significant Military Equipment;
  - Remaining bearings subject to a classified or higher level restriction under NISPOM.

- One year after the enactment of these regulations, and on each anniversary thereafter, all bearings on that date which are still Unilaterally Controlled Tier 1 Bearings shall be "downgraded" to Tier 2, absent a Commodity Jurisdiction or directive from the National Security Advisor.

Tier 2 - would include bearings that are not in Tier 1, as follows:

- Multilaterally Controlled Tier 2 Bearings, which are bearings on the Wassenaar Munitions List, which are not covered in Tier 1;

- Unilaterally Controlled Tier 2 Bearings, which are bearings formerly on the USML, which are not in Tier 1, but are identified by the National Security Advisor to have significant capabilities directed toward military applications.

- One year after the enactment of these regulations, and on each anniversary thereafter, all bearings on that date which are still Unilaterally Controlled Tier 2 Bearings shall be "downgraded" to Tier 3, absent a Commodity Jurisdiction or directive from the National Security Advisor

Tier 3 - would include bearings not in Tier 1 and Tier 2, which are:

- Multilaterally Controlled Tier 3 Bearings, which are bearings on the Wassenaar Dual-Use List;

- Unilaterally Controlled Tier 3 Bearings, which are bearings formerly on the USML, which are not in Tier 1 and not in Tier 2, e.g., bearings with little or no capabilities directed toward military applications.

- One year after the enactment of these regulations, and on each anniversary thereafter, all bearings on that date which are still Unilaterally Controlled Tier 3 Bearings shall be "downgraded" to Tier 4, absent a Commodity Jurisdiction or directive from the National Security Advisor.

Tier 4 - would be to retain the EAR99 "catchall" under the Export Administration Regulations, and would include all other bearings not in Tier 1, Tier 2 or Tier 3.

Interpretation. To allow for an easier transition, and to provide clear guidance, we suggest that certain "Interpretations" be incorporated into the regulations for bearings. The Interpretations could be overridden by a Commodity Jurisdiction ruling, or could be overridden by an order of the National Security Advisor, when it affects the national security of the U.S.

Interpretation #1 - a bearing which was previously classified as "EAR99", under the EAR is presumed to be Tier 4;

Interpretation #2 - a bearing not in Tier 1, which was formerly on the USML, and which is used interchangeably without modification between civil and military applications shall be presumed to be in Tier 3, absent a specific directive to the contrary from the National Security Advisor.

Interpretation #3 - a bearing which previously had an ECCN, other than 2A001, is presumed to be Tier 4 (EAR99).

* Timken currently does not make or sell bearings which are described by the NSG Guidelines, the Wassenaar Sensitive or Very Sensitive List and the Australia Group Common Control Lists; however, Timken believes that if and when such bearings exist, they should be controlled as Tier 1.

II. What export controls are on each Tier:

Tier 1 - export license to all destinations except Canada (for end-use in Canada - government or Crown Corporation).

Tier 2 - no license required for export to NATO and Major U.S. Allies' countries; license required for export to other countries. Refer to III, below for re-export controls.

Tier 3 - license required to current Country Group E and PRC. NLR to other countries.

Tier 4 - same as EAR99 today, with no item controls (but subject to existing embargo/sanction rules)

III. Re-export controls for each Tier would generally be as follows:

Tier 1 - no U.S. "re-export" controls within and among NATO countries and Major U.S. allies, where end-use is by government; allow for U.S. re-export controls outside of NATO/major U.S. allies governments.

Tier 2 - no U.S. "re-export" controls if bearings are substantially transformed in the NATO/Major U.S. Ally country, e.g., installed in helicopter transmission or landing gear, or bearings are replacement parts for previously legitimately exported assemblies or aircraft. Re-exports for substantially transformed items will be handled by that (NATO/Major US Ally) country's export controls on the assembly into which bearing was installed, and not on the bearing inside the assembly. For "export destination" countries other than NATO/Major U.S. Ally country, the re-export controls would be dictated by the export license from U.S.

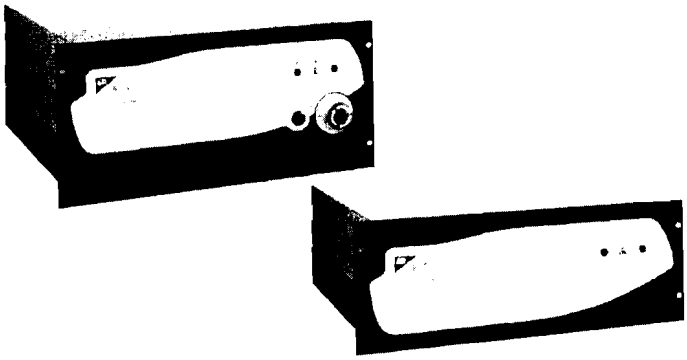
Tier 3 - no re-export as a bearing or in assembly to Country Group E and PRC, without U.S. license.

Tier 4 - same as EAR99 today.

****

JK Fiber Lasers

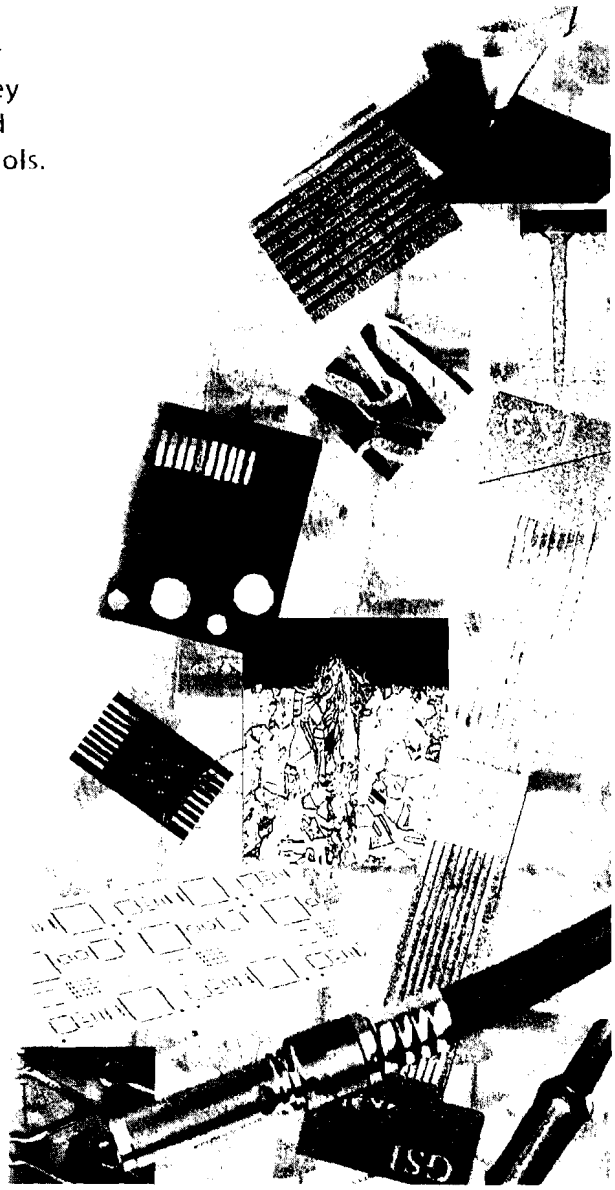
A range of ytterbium industrial fiber lasers for rack mounting



The JK Fiber Laser Range provides the ultimate laser solution for industrial applications. Offering absolute power and control, they combine ease of integration, a powerful user interface, patented processing technology and an integrated range of processing tools.

- 50W - 400W CW output powers
- TEM_{00} M^2<1.1, single mode fiber beam delivery
- Range of Cutting and Welding Heads
- FiberView™ software Graphical User Interface
- Patented Back reflection protection
- Easy integration and interfacing
- High reliability, zero maintenance system
- FiberPierce™ peak power enhancement option
- Fast modulation and Pulse Shaping
- Applications and sample support

GSI™ JK™ Fiber Lasers

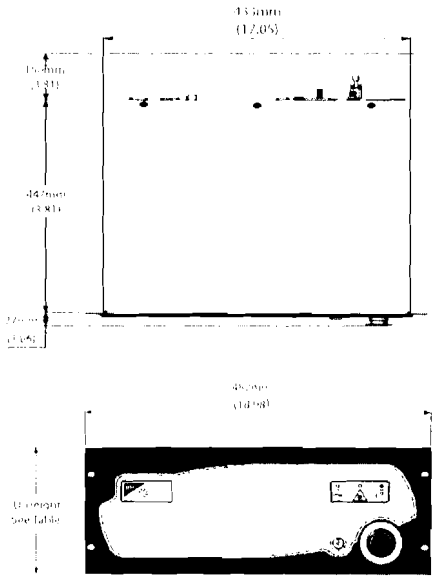


Fiber Lasers for Industrial Applications

In the JK range of Fiber Lasers, GSI Group offers the advantages of fiber lasers including single-mode beam quality, high efficiency, compactness and simplicity. Furthermore, drawing on the experience of our lamp-pumped JK laser range we can deliver these as a truly industrial package, with applications support, sample processing and a range of beam delivery options.

Performance Data					
Model	JK50FL	JK100FL	JK200FL	JK300FL	JK400FL
Average Output Power (W)	50	100	200	300	400
Operatiing Modes	CW, Modulated and Peak power enhancement		CW and Modulated		
Output power range	20 - 100%	10 - 100%			
Long term Output power stability	+/- 1.5% typical (+/- 3% specified)				
Wavelength (nm)	1080 +/- 10				
Linewidth (nm)	<2				
Polarisation	Un-Polarised				
Modulation Capability	Unlimited Pulse Shapes, Ramping, Process Cycle				
Min. Rise / Fall Time (µs)	5				
Max. Modulation Frequency (kHz)	50				
Max. Peak Power (W)	100	200	200	300	400
Fiber Optic Beam Delivery					
Ouput Fiber Type	Single Mode				
Beam Quality	TEM $_{00}$ M^2< 1.1				
General					
Electrical					
Electrical Supply (Hz)	100 - 264 VAC / 47 - 63				
Power consumption* (W)	250	400	800	1200	1600
Physical					
Height - Air cooled	6U	6U	6U	7U	-
Height - Water Cooled	4U	4U	4U	5U	5U
Environment / Cooling					
Ambient Temperature - Air Cooled (°C)	5 - 35		5 - 25		-
Max. Water Temperature / Pressure (°C/Bar)	25 / 6				
Max. Humidity	85% RH @ 20°C, 50% RH @ 40°C, non-condensing				
Interface					
Standard Interfaces	Serial - RS232, Parallel - Machine Interface				

*Water cooled. Add 30W for air cooled version



Dimensions in mm (inches)
1U = 44.5mm (1.75")

Product Code Selection Guide

Model		Fiber		Cooling
JK200FL	-	EVW		SRWE

1a) Package:
- O Basic (indicators only)
- B Extended (E-stop and Keyswitch)
- L Local Manual Control

b) Options:
- P Fiber Pierce™ (only available for JK50FL and JK100FL)
- V **Visible Pointing Diode**
- T **Flat-Top Beam Profile**

c) Cooling:
- A Air
- W Water

2a) Fiber length:
- 2 2 meters
- 5 5 meters (Standard)
- 10 10 meters

b) Conduit type:
- R Rugged
- F Flexible
- W Window or Collimation lens focal length

c) O/P Optic:
- 25 25mm for 3.5mm 1/e² beam diameter
- 35 35mm for 5mm diameter

Specifications are subject to change.

Please consult Product Centre for complete details

www.gsiglasers.com

GSI JK™ Fiber Lasers

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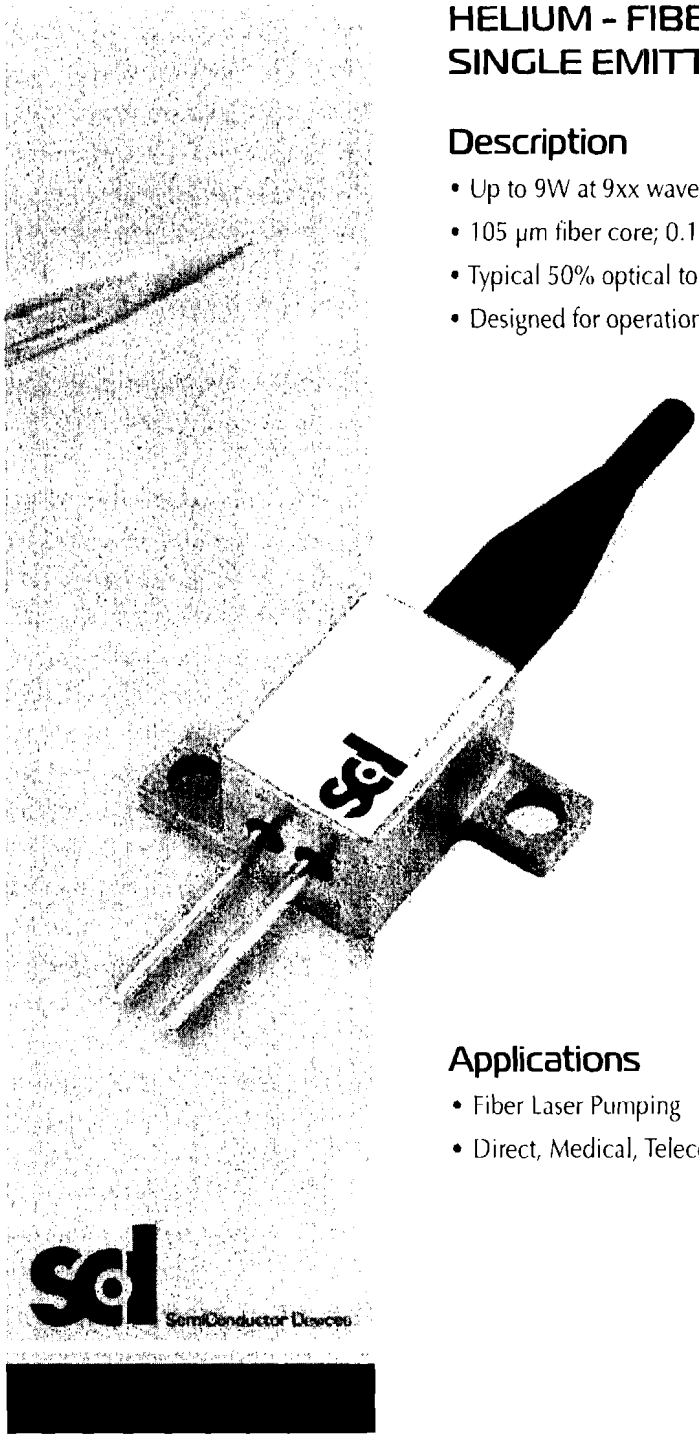
HELIUM



HELIUM - FIBER COUPLED SINGLE EMITTER

Description

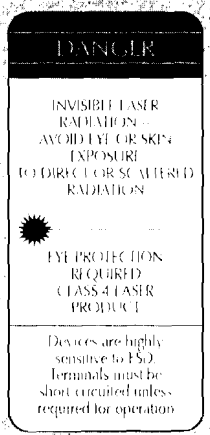
- Up to 9W at 9xx wavelengths
- 105 μm fiber core; 0.15=NA
- Typical 50% optical to electrical efficiency
- Designed for operation in rugged environment

Applications

- Fiber Laser Pumping
- Direct, Medical, Telecom, Space and Defense

Helium - Fiber Coupled Single Emitter: Generic Specifications

Parameter	Typical	Typical	Typical
Laser Characteristics			
Central wavelength	915 +/-5 nm	940 +/-5 nm	975 +/-5 nm
CW output power	Up to 8 W	Up to 8 W	Up to 9 W
Spectral width (FWHM)	4 +/-1 nm	4 +/-1 nm	4 +/-1 nm
Conversion efficiency	>=45%	>=45%	>=45%
Operating Current	< 11 A	< 11 A	< 12 A
Forward Voltage	1.7 V	1.7 V	1.65 V
Characterization temperature	25C	25C	25C
Wavelength tuning vs. temperature	<0.35 nm/°C	<0.35 nm/°C	<0.35 nm/°C
Fiber Characteristics			
Fiber core dimension	105 µm	105 µm	105 µm
Fiber Numerical aperture	0.15	0.15	0.15
Fiber Cladding	125 µm	125 µm	125 µm



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No responsibility is assumed for the use of these products, nor for any infringement on the right of others, resulting from the use of these products.
Laser diode product components are intended for use in a user devised end system.
However, these products are capable of emitting Class IV radiation.
Extreme care must be exercised during their operation.
Only persons familiar with the appropriate safety precaution should operate a laser product.
Direct viewing of the laser beam exposure to specular reflections, must be avoided.
Serious injury may result, if any part of the body is exposed to the beam.
The eye is extremely sensitive to the infrared radiation and therefore, proper eyewear must be worn at all times.
Use of optical instruments with these products, may increase eye hazard.
Always wear proper eye protection when operating.

www.studio3.co.il

SCD/UNC-33168-1210

scd SemiConductor Devices

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LD pumped Nd: YAG LASER
SL188 series

To Customers

SL188 series has a very wide range of line-up. Adding standard model (SL188A/ SL188A2/ SL188AS/ SL188AS2) optimized for high average power, we can optimize them to variety of laser applications, like high beam quality model for and high pulse energy model etc..

Specification

LD pumped Nd: YAG laser
SL188A / SL188A2

Equipment type	SL188A	SL188A2
Laser crystal	Nd:YAG	
Laser wavelength	1.064μm	
Oscillator type	Continuous wave pumping and Q switching laser	
Output energy	>20mJ@10kHz	>20mJ@20kHz
Maximum average power	>200W@10kHz	>400W@20kHz
Cooling type	Water-cooled	Water-cooled
Utility	3phase200V 50 / 60Hz 30A	3phase200V 50 / 60Hz 60A

LD pumped Nd: YAG SHG laser
SL188AS / SL188AS2

Equipment type	SL188AS	SL188AS2
Laser crystal	Nd:YAG	
Laser wavelength	0.532μm	
Oscillator type	Continuous wave pumping and Q switching laser	
Output energy	>10mJ@10kHz	>20mJ@10kHz

Maximum average power	>100W@10kHz	>200W@10kHz
Cooling type	Water-cooled	Water-cooled
Utility	3phase200V 50 / 60Hz 30A	3phase200V 50 / 60Hz 60A

New Series !!
LD pumped Nd: YAG THG laser
SL188AT

Equipment type	**SL188AT**	**SL188AT2 ***
Laser crystal	Nd:YAG	
Laser wavelength	0.355μm	
Oscillator type	Continuous wave pumping and Q switching laser	
Output energy	>6mJ@8kHz	>10mJ@10kHz
Maximum average power	>50W@8kHz	>100W@10kHz
Cooling type	Water-cooled	Water-cooled
Utility	3phase200V 50 / 60Hz 30A	3phase200V 50 / 60Hz 60A

* : In development.

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Product information

- Laser Processing Systems
- Lineup by Application

Pulse IR YAG Laser

Continuous Wave IR YAG Laser
Q Switched IR YAG Laser

Q Switched Green YAG Laser
Q Switched UV YAG Laser

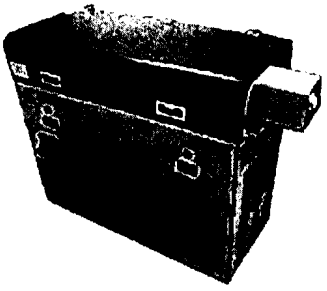
Q Switched IR YVO4 Laser
Q Switched Green YVO4 Laser
Q Switched UV YVO4 Laser

Fiber Laser

- LCD Manufacturing Equipment
- Rechargeable Battery Inspection Equipment

Product Information

Continuous Wave IR YAG Laser / Q Switched IR YAG Laser



KLY-C300a

Continuous output type "KLY-C300a" achieves 15% or more electricity-optical conversion efficiency under the condition of beam quality where transmission to optical fiber with core diameter 300μmf is possible by the optimization of YAG crystal configuration corresponding to LD pumping and development of high steady high-luminance and highly stable oscillator.

KLY-Q200a

Q-switched pulse type "KLY-Q200a" succeeds in obtaining 30nsec Q-switched pulse at the shortest by enhancing the efficiency as well as development of the super-highspeed gain switch control system of AO-Q switch elements that generate Q-switched pulse. The average output class of "KLY-Q200a" makes it possible to gain 200kW Q-switched pulse at the maximum.

KLY-SQ350a

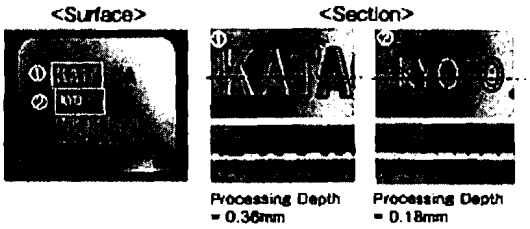
"LD pumping technology" and "Q-switched control technology" that we cultivated thorough the development of KLY-series were gathered for the development of KLY-SQ350a laser osccillator boasting of domestic top level average output and peak output in LD pumping high output Q-switched type IR lasers. In addition, new technology was adopted, as a result, we succeeded in the development of KLY-SQ350a. Both quality of beam and high output are achieved. High performance was achieved in all aspects such as "average output: 300W" and "Maximum peak output:250kW", "M2<15". In addition, due to LD pumping, high output as well as small size are also realized. The design is system consturciton friendly, therefore, for laser osccilator and power source, either separated type or integrated type can be selected in order to correpond to all applications.

Applications

Deep Engraving Marking、High-Speed Cutting、Large Area Removal Processing

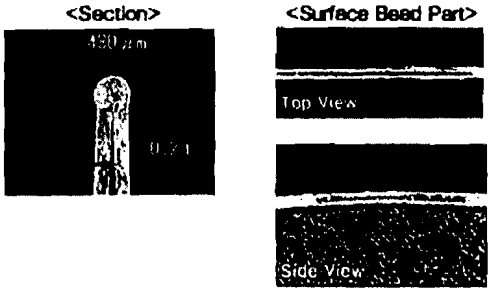
Processed Example

Aluminum Deep Engraving Processing



Oscillator Model : KLY-Q200 α
Processing Details : Deep Engraving
Material : A5000 Series
Processing Optics : Galvano Scanner

SUS Doughnut-Shape Peripheral Welding



Oscillator Model : KL Y-C300 α
Processing Details : Overlapping Outer Welding
Material : SUS304
Sheet Thickness : 0.2t
Processing Nozzle : KLP-HF80/C-T

Basic Specifications

Item	Details		
Model	KLY-C300α	KLY-Q200α	KLY-SQ350α
Wavelength	1064nm		
Pumping Source	808nm Semiconductor Laser (LD)		
Active Medium	Nd:YAG Crystal		
Configuration	Integrated Oscillator and Power Operating Voltage Part Type (Chiller Unit separate) :SI Type/GI Type Type Fiber	Integrated Oscillator and Power Operating Voltage Part Type (Chiller Unit separate) Direct Ray Optics	Separate Oscillator and Power Operating Voltage Part Type Or Integrated Type (Chiller Unit separate)
Maximum Average Output Power	300W	200W@20kHz	300W10kHz
Maximum Peak Output Power	-	200kW@5kHz	250kW@10kHz
Maximum Frequency	CW,1Hz~500Hz	100Hz~50kHz	5kHz~15kHz
Pulse Width	-	<300nsec@10kHz	<150nsec@10kHz
Output Power Stability	Less than 2%rms (Cooling water stability: ±1℃.)		
Operating Voltage	AC220V±0%、50／60H z ±1Hz		

Input power Consumption	3.5kVA	6kVA
Weight	170kg	175kg
External Dimensions W×H×Dmm3	398×940×1060mm3 (Not including protrusions)	456×940×1064mm3 (Not including protrusions)

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Single Mode Fiber Lasers

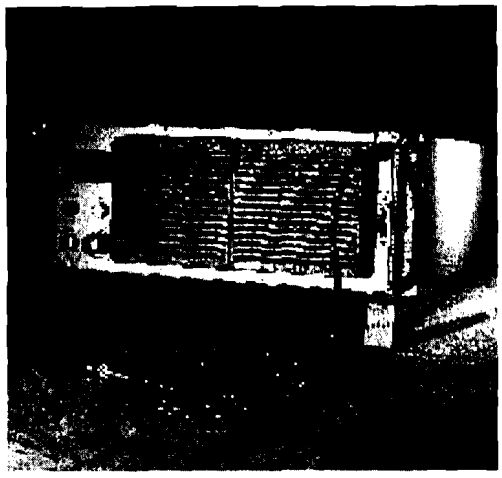
for Industrial and Scientific Applications

IPG PHOTONICS

The Power to Transform™

IPG's Single Mode Fiber Lasers Advantages

IPG's YLR-SM Series represents a break-through generation of diode pumped single mode CW Ytterbium fiber lasers of near infrared spectral range (~1070nm) with a unique combination of high power, ideal beam quality, fiber delivery, high wall-plug efficiency, compactness and reliability.



YLR-200-SM 200W CW Fiber Laser

These lasers possess a reliability that is unmatched by conventional solid state or gas laser. Selectivity of operating wavelengths, ultra-low amplitude noise, high stability and ultra-long pump diode lifetime completes an impressive list of advantages of this modern fiber laser system. The YLR-SM Series was developed to meet fast growing demand of industrial, R&D and medical markets for a compact, robust, turnkey and maintenance-free solution that can be easily integrated into an industrial manufacturing system, scientific experiment, OEM machine or an automated production line.

Main Features:

- ✓ **10W to 2kW Output Optical Power**
- ✓ **TEM_{00} (M^2<1.1) Beam Quality**
- ✓ **Over 25% Wall-Plug Efficiency**
- ✓ **Maintenance Free Operation**
- ✓ **Compact 'Plug & Play' Design**
- ✓ **Air or Water Cooled Versions**
- ✓ **Estimated Diode Lifetime > 100,000 hrs**
- ✓ **Single Mode Fiber Delivery**
- ✓ **CW or Modulated Operation**
- ✓ **Extended Warranty Program**

Practical and convenient front panel interface and RS232 or parallel and analog interfaces easily allow you to integrate this fiber laser to your setup. Each laser is provided with an integrated single-mode fiber delivery cable, of customer selected length, terminated by state-of-the-art output collimator or by industrial QBH-connector.

Users can customize the YLR-SM Series to meet their requirements by selecting output power, wavelength, polarization, delivery fiber length, cooling method and computer interface. All YLR Series laser systems are factory sealed so there is no need for alignment or maintenance. The laser system plugs into a standard power line, and can operate immediately. An another attractive features are no warm up time (laser could operate from "cold" start immediately) and ability to directly modulate laser up to 50kHz.

Typical Specifications

Optical Parameters

	Unit	YLR-50	YLR-100	YLR-200	YLR-500-SM	YLR-1000-SM
Nominal Output Power	W	50	100	200	500	1000*
Mode of Operation		CW or directly modulated				
Beam Quality	M^2	<1.05	<1.05	<1.1	<1.1	<1.15
Linewidth	nm	<2	<3	<3	<4	<5
Polarization		random**	random**	random**	random**	random
Output Power Stability	%	+/-2	+/-2	+/-2	+/-2	+/-2

Electrical Parameters

	Unit	YLR-50	YLR-100	YLR-200	YLR-500-SM	YLR-1000-SM
Electrical Requirements	V AC	110-230	110-230	110-230	190-250	360-520
Typical Power Consumption	W	200	400	800	2000	4000
Standard Interfaces		Digital I/O, Analog				
Direct Modulation	kHz	0-50	0-50	0-50	0-5	0-5

General Parameters

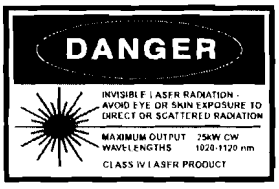
	Unit	YLR-50	YLR-100	YLR-200	YLR-500-SM	YLR-1000-SM
Cooling Method ***	V AC	air or water	air or water	air or water	water	water
Cooling Water Temperature Range	°C	20-30	20-30	20-30	20-30	20-30
Dimensions (W x H x D)	cm	3RU 19"	3RU 19"	4RU 19"	6RU 19"	60x80x80
Weight	kg	25	30	40	50	150

* Output power up to 2kW available on request with single mode (TEM_{00}) output. Please contact IPG Photonics with your requirements.

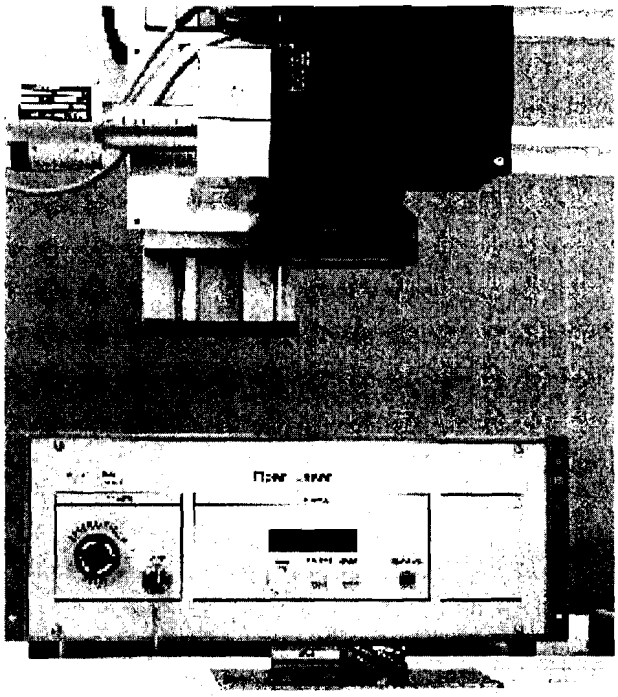
** Linear polarization is available on request for up to 500W output power.

*** Customer can select cooling method.

Legal notices: All product information is believed to be accurate and is subject to change without notice. Information contained herein shall legally bind IPG only if it is specifically incorporated into the terms and conditions of a sales agreement. Some specific combinations of options may not be available. The user assumes all risks and liability whatsoever in connection with use of a product or its application. IPG, IPG Photonics and IPG Photonics logo are trademarks of IPG Photonics Corporation. Other trademarks are property of their respective holders. © IPG Photonics Corporation. All rights reserved.



IPG YLR Lasers Offer Versatility and Ease of Integration



YLR-200-SM laser integrated with a scanner in an engraving machine

Compact in size, user-friendly, highly reliable, and broadly versatile, IPG's diode-pumped fiber lasers bring revolutionary solutions to multiple applications. Depending on output optics used, spot sizes of less than 10 µm can be achieved by keeping focal lengths of more than 200 mm. This leads to large working areas for galvo scanning systems and user-friendly long working distances. Already 50-100 W output powers at 10-20 µm spot size is enough for fine cutting applications such as cutting of coronal stents or hole drilling.

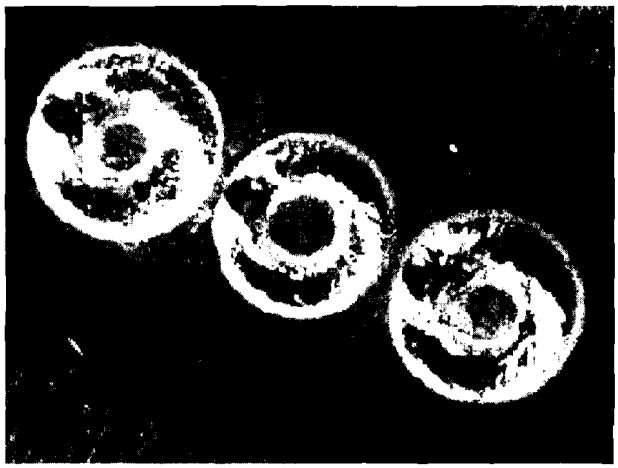
IPG single mode fiber lasers can be quickly integrated into a variety of different work stations including robots, cartesian co-ordinate systems and high speed scanners. These units can be provide with integrated collimators or plug and play connectors that plug into available standard beam delivery systems. In many cases the lasers can replace conventional YAG and gas lasers on existing work stations to allow the user to take advantage of the tremendous reliability and cost savings that this technology offers. For new systems, IPG can recommend an integrator from a long list of qualified system integrators familiar with our technology.

Due to small spot sizes of down to 10 µm, the heat affected zone stays small and fine contours are able to be cut. Precision spot and seam welding applications for all metals are done with either direct optics or galvo scanning heads.

Depending on needed spot diameters, working distances and material properties, IPG's single mode YLR-SM lasers cover all applications of precision spot and seam welding applications in fine mechanics, electronics and medical device industries.

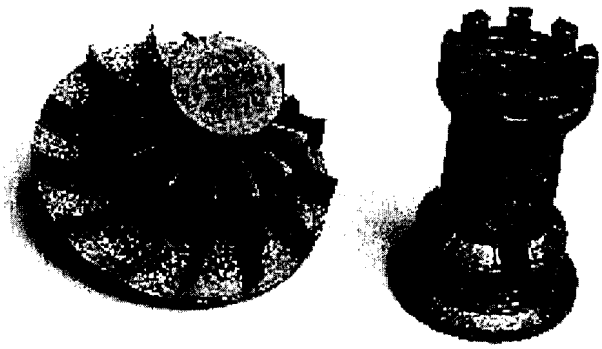
YLR-1000-SM 1kW fiber laser integrated in a cutting cell

Flexibility for a Variety of Applications



Copper contacts welding sample

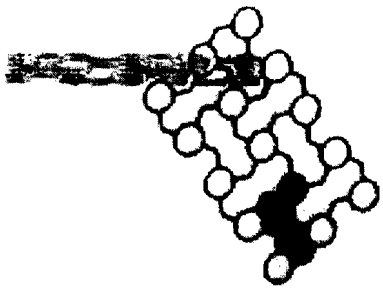
On cutting applications, single mode fiber lasers are utilized for precise cutting of very delicate structures such as stents, silicon wafers, surgical knifes as well as thicker materials at the higher power levels. Because of the high fluence, only possible with single mode fiber lasers, combined with long standoff distance fiber lasers are achieving speeds and heat profiles never before achieved with laser processing. When operating in the modulated mode, these lasers are ideal for producing small holes at a rapid rate. For example, 50 micron holes in .012" Titanium at a rate of 300 holes per second with a 600 Watt single mode fiber laser. In drilling holes required by the printing and engraving industries, single mode fiber lasers have become the dominant technology achieving precise holes at rates above 100 kHertz.

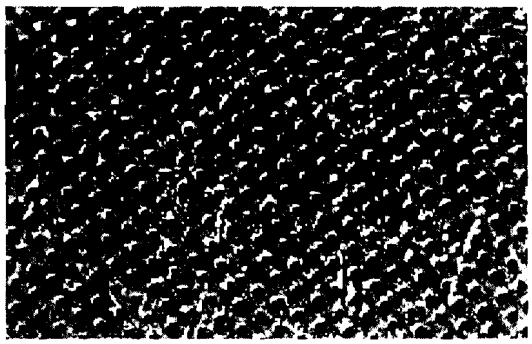


3D stereo-lithography samples

Single mode fiber lasers have gained rapid acceptance on a large variety of welding applications including batteries, medical assemblies, fuel cells, wire welding, flexures for hard disc drives, and thicker assemblies such as transmission components where deep narrow welds are required. The optimization is very rapid as these lasers can operate in a continuous mode or a modulated mode, with no spot size change over the 10%-105% dynamic operating range. The low divergence allows for long working distances that makes focus control very forgiving and repeatable. On single spot welds, the pulse duration can be set from a few microseconds to continuous operation and operate up to 50 kHertz. The control of both spot size and heat control cannot be matched by any other industrial material processing laser.

Precise stent cutting by YLR-200-SM





50um holes drilled at speed of 300 holes per second

Fiber lasers are also used extensively by OEMs offering sintering machines to produce three-dimensional parts from metal powders. On this application the consistent CW power that can be focused to a very precise spot size (in case of single mode laser down to ~10 micron) is ideal for manufacturing very precise parts while minimizing the powder consumption. IPG's YLR series has been widely deployed for this unique application over last few years.

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The Power to Transform™

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USA Germany Russia Italy Japan India UK China Korea

Distributors worldwide

IPGP

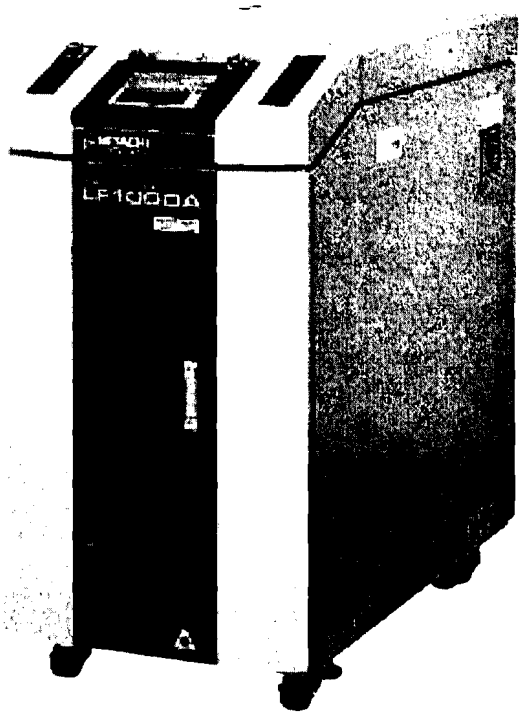
NASDAQ

LISTED

Fiber Laser Welder

LF1000A

- 1kW laser power
- Real time power feedback
- Energy and time share options
- Touch screen interface
- Optical feedback protection
- Flexible beam delivery options



Features

1kW laser power – enables both high speed and penetration welding of steels and aluminum.

Real time power feedback – laser power output is verified and maintained to ensure high weld repeatability and quality

Energy and time share options – increase efficiency by supporting more than one workstation or multiple weld heads with energy and time beam sharing options

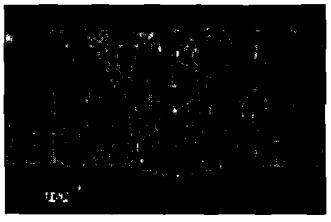
Laser tuned for weld performance – laser beam characteristics are specifically designed for both excellent weld quality and performance. Pulse shaping and modulation provide ultimate weld control

Touchscreen interface – enables quick and easy parameter programming

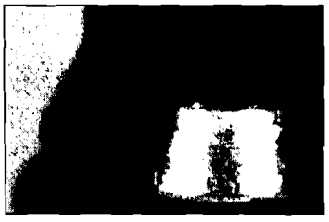
Optical feedback protection – the unique internal design of the laser provides *guaranteed protection* from optical reflection from the workpiece

Flexible Beam Delivery Options – a range of delivery fibers and focus heads are available to provide an optimized solution for process spot size and equipment integration

TYPICAL APPLICATIONS

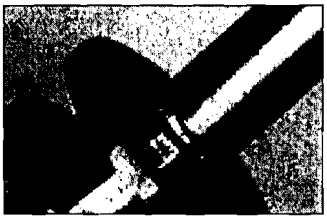


Welding 0.06" thick aluminum



High speed welding of tube components

Welding battery tabs



Seam welding automotive sub assemblies

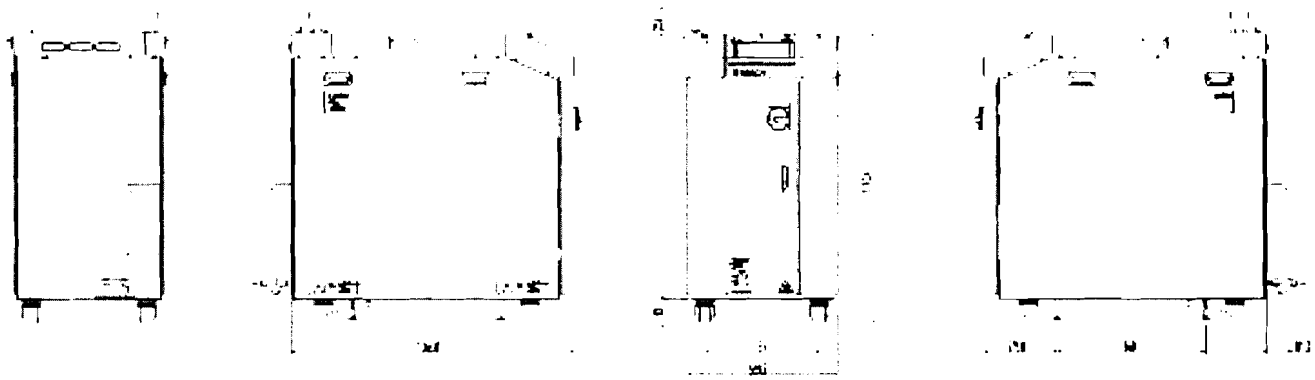
Spirit of Innovation

MIYACHI UNITEK™

SPECIFICATIONS

MODEL NUMBER LF1000A			
Oscillator:	*Maximum rated power*		1000W
	Maximum peak power		1000W
	Waveform	*REPEAT mode*	0.1~500.0ms (0.1ms step) / 0.05~50.00ms (0.05ms step)
	Control	*CW Mode*	0.1~100.0ms (0.1ms step) / 0.01~10.00ms (0.01ms step)
	Repetition speed		1~5000pps
	Modulation		1~5000Hz (Single, triangle, and square wave)
	Wavelength		1070~1100nm
	Safety shutter		Open-close sensor
	Guide laser		Red-colored visible laser
	Output power stability		±2% or below @ over 10W
	Optics		Optical fiber , three energy share at max.
Controller:	*Schedule set*		256
	Measuring and monitoring		Laser energy (J) and average power (W)
	Counter:		Total outputs (9 digits), good results (9 digits) LD-on time (7 digits), processing time (7 digits)
	Cable length		0.5m
Power Supply:	*AC power requirements*		Three phase, 200~400VAC +10%/-15%, 50/60Hz
	Power consumption		10.3kW max. (1.0kW @ hold time)
	External datacom		RS-485, LAN (100BASE-TX/10BASE-T)
	Cooling method		Water cooling (Temp. 5~26°C)
	Ambient operation temperature:		41-122°F (5-50°C)
	Weight lbs (kg)		838 (380)
	Dimensions H x W x D in (mm)		43.7 x 22.4 x 42.0 (1110.4 x 569.5 x 1068.8)

Specifications subject to change without notice



Your Local Representative

Spirit of Innovation

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991-099 4/10

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redPOWER®

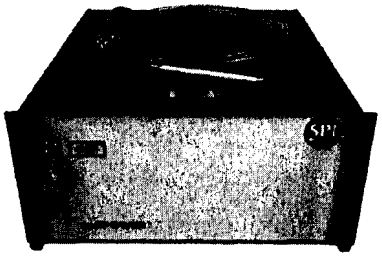
High Power Fiber Lasers R4 200-400W CW/M –"LM"

With GTWave® Technology

PRELIMINARY DATASHEET

Features

- CW or Modulated to 100 kHz (modulated pulses <10μs to CW)
- Efficiency up to 10x equivalent Nd YAG lasers
- High output power stability
- Full comms / analog I-O control options
- Application optimized beam profile
- Improved process control for welding
- 2-year standard warranty (additional warranty options available)



Applications

Made For..... Materials processing

Precision welding
Cutting
Bending
Bonding
Plastics Cutting/welding
Sintering
Annealing
Surface texturing

Application Optimised Beam Profile

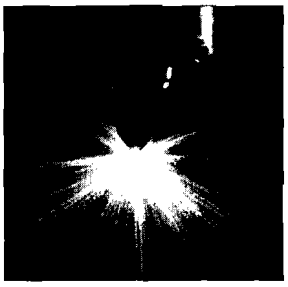
redPOWER®

The redPOWER® series of fiber lasers from SPI has been designed to meet the highest standards of reliability, repeatability and user safety.

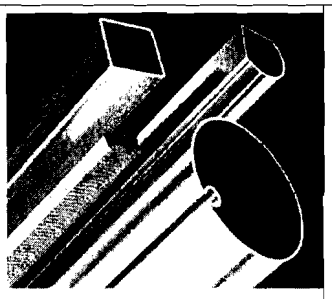
The commercial advantages of fiber lasers over alternative technologies are far reaching: improved line speeds, finer machining capabilities, reduced downtime and lower cost of ownership, giving users a leading edge advantage. With the Low Moded (LM) M^2~4 beam parameters, the laser has been optimised as a highly flexible process tool for a wide range of cutting and welding applications. SPI's R4 LM lasers are designed for applications in markets such as medical, electronics, plastics and printing.

Significant design features of the SPI unit include thermal management, low noise, output stability and system-to-system repeatability. Every care has been taken at the design stage to ensure our products offer a long and maintenance-free life.

Designed in accordance with: IEC/EN 60825 Laser safety, IEC/EN 61010 Electrical safety, IEC/EN 61000 EMC, RoHS Directive.



Fiber Laser Cutting



Tube Cutting

Remote Welding- Fraunhofer IWS

Seam Welding

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SM-S00167 Issue C
PRELIMINARY

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SPI Lasers LLC, 4000 Burton Drive, Suite 1, Santa Clara, CA 95054

US office: +1 408 454 1169

nqa. ISO 9001 Registered

	200W "LM"	400W "LM"
Optical		
Rated output power		
Central emission wavelength	1070 ± 10nm	
Mode of operation	CW and Modulated	
Output power variation	<± 3 % (1)	
Red pilot laser	Standard	
Pulse Characteristics		
Maximum modulation rate	100kHz	
Minimum pulse width	<10 µS	
Output Beam Characteristics		
Beam diameter	3.2 ± 0.5	
Full angle divergence	<3.0	
M^2 / Beam Parameter Product (BPP)	3-5 / 1 – 1.7 mm.mrad	
Polarization	Random	
Beam delivery cable length	6m (standard) / options available	
Control		
Control interface	Analog/RS232 (standard) / options available	
Control options	Open Loop	
Electrical		
Power supply requirements	Single Phase	
Operating Voltage(Vac 50 - 60 Hz)	240	
Safety Interlock Performance Level	PL'e' (2)	
Mechanical		
Dimensions	5U (19") rack unit 507 x 483 x 221 mm	
Weight	<45kg	
Cooling	Water	
Environmental		
Operating temperature	5-40°C	
Humidity	5-85% RH (non-condensing)	
Configuration Options		
10m Beam delivery optic cable	•	•
PSE (Pulse Shape Equalization)	•	•
XPR (Extended Processing Range)	•	•

(1) 8 hrs constant temperature (2) ISO 13849-1 - Safety of Machinery

Accessories

Visit www.spilasers.com for more information on accessories and accessory datasheets.

- Extended warranty options
- Longer beam delivery optic lengths

Terms and Conditions

Some specific combinations of product specifications and optional accessory may not be available. These lasers are designed as products for incorporation or integration into other equipment. All product information is believed to be accurate and subject to change without notice. A complete product specification will be issued on request at time of order acknowledgement. The user assumes all risks and liability whatsoever in connection with the use of the product or its application.

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redPOWER®

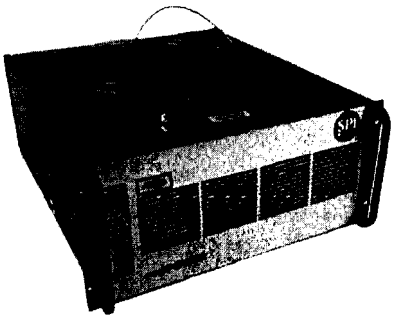
High Power Fiber Lasers R4 25-400W CW/M -"HS"
With GTWave® Technology

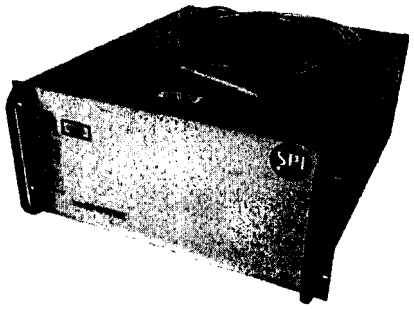
Features

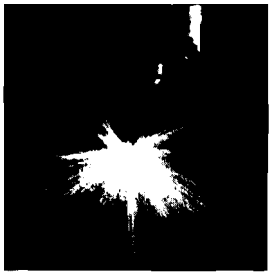
- CW or Modulated to 100 kHz (modulated pulses <10μs to CW)
- Single mode (M^2 <1.1)
- Efficiency up to 10x equivalent Nd YAG lasers
- High stability laser (typically <±0.5% output power variation)
- Spot size to sub 10μm
- Open Loop/ Closed Loop Control Options
- XPR, PSE Extended performance control options
- Full comms/analog I-O control options
- High reliability optics, diode MTTF > 400,000 hours
- 2-year standard warranty (additional warranty options available)

Applications

- Materials processing
  - Precision welding
  - Cutting
  - Bending
  - Bonding
  - Drilling
  - Rapid prototyping
  - Sintering
  - Annealing
  - Surface texturing
- Marking and engraving
  - Graphic image processing
  - Flexo
  - Anilox
  - Gravure







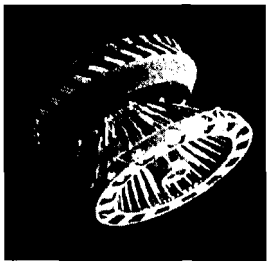


Image Courtesy of Inno-Shape and Bessy

redPOWER®

The redPOWER® series of fiber lasers from SPI has been designed to meet the highest standards of reliability, repeatability and user safety.

The commercial advantages of fiber lasers over alternative technologies are far reaching: improved line speeds, finer machining capabilities, reduced downtime and lower cost of ownership, giving users a leading edge advantage. SPI's R4 "HS" series lasers can be employed in a wide range of process requirements and have been optimized for maximum performance and operating flexibility. Extended Performance Range (XPR) and Pulse Shape Equalization (PSE) control features are available options for the most demanding applications.

Significant design features of the SPI unit include thermal management, low noise, output stability and system-to-system repeatability. Every care has been taken at the design stage to ensure our products offer a long and maintenance-free life.

Designed in accordance with: IEC/EN 60825 Laser safety, IEC/EN 61010 Electrical safety, IEC/EN 61000 EMC, RoHS Directive.

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SM-S00087 Issue F

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SPI Lasers LLC, 4000 Burton Drive, Suite 1, Santa Clara, CA 95054
US office: +1 408 454 1169

nqa. ISO 9001 Registered

Optical							
Rated output power	**25W "HS"**	**50W "HS"**	**75W "HS"**	**100W "HS"**	**200W "HS"**	**300W "HS"**	**400W "HS"**
Central emission wavelength	1070 ± 10nm						
Mode of operation	CW and Modulated						
Output power variation	<± 0.5% (typical) [1]						
Red pilot laser	Standard						
Pulse Characteristics							
Maximum modulation rate	100kHz						
Minimum pulse width	<10 µS						
Output Beam Characteristics							
Beam diameter	5.0 ± 0.5mm					5.0 ± 0.7mm	
Full angle divergence	<0.4mrad					<0.45mrad	
M^2 / Beam parameter product (BPP)	<1.1 (nominal) <0.37 mm.mrad						
Polarization	Random						
Beam delivery cable length	6m (standard) / options available						
Control							
Control Interface	Analog/RS232 (standard) / options available						
Control Options	Closed Loop / Open Loop						
Operating Voltage(Vac 50 - 60 Hz)	100-240					240	
Electrical							
Power supply requirements	Single Phase						
Operating Voltage(Vac 50 - 60 Hz)	100-240					240	
Safety Interlock Performance Level	PL'e' [2]						
Mechanical							
Dimensions	5U (19") rack unit 507 x 483 x 221 mm						
Weight	<45kg						
Cooling	Air	Air	Air	Air	Air Water	Water	Water
Environmental							
Operating temperature	5-40°C						
Humidity	5-85% RH (non-condensing)						
Configuration Options							
10m Beam delivery optic cable	•	•	•	•	•	•	• [2]
PSE (Pulse Shape Equalization)	•	•	•	•	•	•	•
XPR (Extended Processing Range)					• [3]	•	•

[1] Measured under closed loop control **[2] ISO 13849-1 Safety of Machines** **[3] Water cooled variant only**

Accessories

Visit www.spilasers.com for more information on accessories and accessory datasheets.

- Extended warranty options
- Longer beam delivery optic lengths

Terms and Conditions

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redPOWER®

High Power Fiber Lasers R4 100-400W CW/M –"RS"
With GTWave® Technology

Features

- CW or Modulated to 10 kHz (modulated pulses <10μs to CW)
- Single mode (M^2 <1.1)
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- High stability laser
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- High reliability optics, diode MTTF > 400,000 hours
- 2-year standard warranty (additional warranty options available)

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- Materials processing
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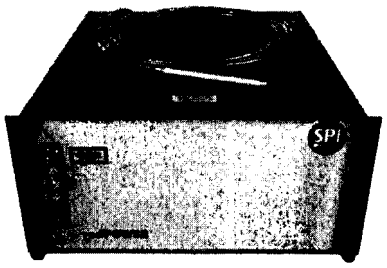
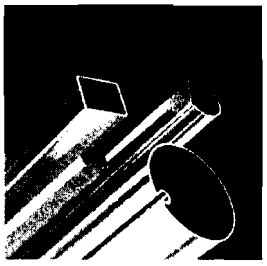
  - Bonding
  - Drilling
  - Sintering
  - Annealing





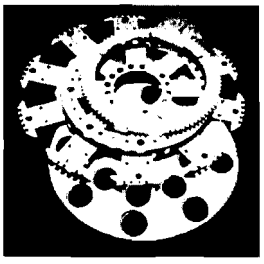


Image courtesy of Micrometric

redPOWER®

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The commercial advantages of fiber lasers over alternative technologies are far reaching: improved line speeds, finer machining capabilities, reduced downtime and lower cost of ownership, giving users a leading edge advantage. SPI's R4 "RS" product variants can be employed in a wide range of material processing applications and have been optimized to enable maximum performance to be achieved at competitive cost.

Significant design features of the SPI unit include thermal management, low noise, output stability and system-to-system repeatability. Every care has been taken at the design stage to ensure our products offer a long and maintenance-free life.

Designed in accordance with: IEC/EN 60825 Laser safety, IEC/EN 61010 Electrical safety, IEC/EN 61000 EMC, RoHS Directive.

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US office: +1 408 454 1169

nqa. ISO 9001 Registered

Rated output power	50W "RS"	100W "RS"	200W "RS"	300W "RS"	400W "RS"
Central emission wavelength			1070 ± 10nm		
Mode of operation			CW and Modulated		
Output power variation			<± 3% [1]		
Red pilot laser			Standard		
Pulse Characteristics					
Maximum modulation rate			10 kHz		
Minimum pulse width			<10 µS		
Output Beam Characteristics					
Beam diameter	5.0 ± 0.5mm			5.0 ± 0.7mm	
Full angle divergence	<0.4mrad			<0.45mrad	
M^2 / Beam Parameter Product (BPP)			<1.1 (nominal) / <0.37 mm.mrad		
Polarization			Random		
Beam delivery cable length			6m (standard) / options available		
Control					
Control interface			Analog / RS232 (standard) / options available		
Control options			Open Loop		
Electrical					
Power supply requirements			Single Phase		
Operating Voltage(Vac 50 - 60 Hz)	100-240			240	
Safety Interlock Performance Level			PL'd'[2]		
Mechanical					
Dimensions			5U (19") rack unit 507 x 483 x 221 mm		
Weight			<45kg		
Cooling		Air		Water	
Environmental					
Operating temperature			5-40°C		
Humidity			5-85% RH (non-condensing)		
Configuration Options					
10m Beam delivery optic cable	•	•	•	•	•
PSE (Pulse Shape Equalization)	N/A	N/A	N/A	N/A	N/A
XPR (Extended Processing Range)	N/A	N/A	N/A	N/A	N/A

[1] 8 hours at constant temperature **[2] ISO 13849-1 Safety of Machinery**

Accessories

Visit www.spilasers.com for more information on accessories and accessory datasheets.

- Extended warranty options
- Longer beam delivery optic lengths

Terms and Conditions

Some specific combinations of product specifications and optional accessory may not be available. These lasers are designed as products for incorporation or integration into other equipment. All product information is believed to be accurate and subject to change without notice. A complete product specification will be issued on request at time of order acknowledgement. The user assumes all risks and liability whatsoever in connection with the use of the product or its application.

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TRUMPF

Laser Technology/Electronics

State-of-

laser technology.

The TRUMPF Group ranks among the world's leading manufacturers of laser and production technology. Our innovations set the standard in the development of laser technology, machine tools and power tools for sheet metal fabrication, and medical technology. Our customers have relied on the superior quality of our technical solutions since 1923. Today's TRUMPF Laser GmbH + Co. KG began in 1971 in Schramberg, Germany, with the development of a solid-state laser. This was followed in 1985 by TRUMPF's first CO_2 laser with a power of 1 kW. Today, we are the technology and world market leader in industrial lasers and laser systems. We continually develop new processes and increasingly powerful laser sources and systems, and consistently apply these developments to innovations targeting our cus-

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tomers' requirements. You can count on us for all of your projects. Our comprehensive services include feasibility studies performed in our application laboratories, laser processing and design consultation, and formulating a start-to-finish concept for your plant. Even if you just want information about a new focusing optics – we speak your language.

The

rounder.

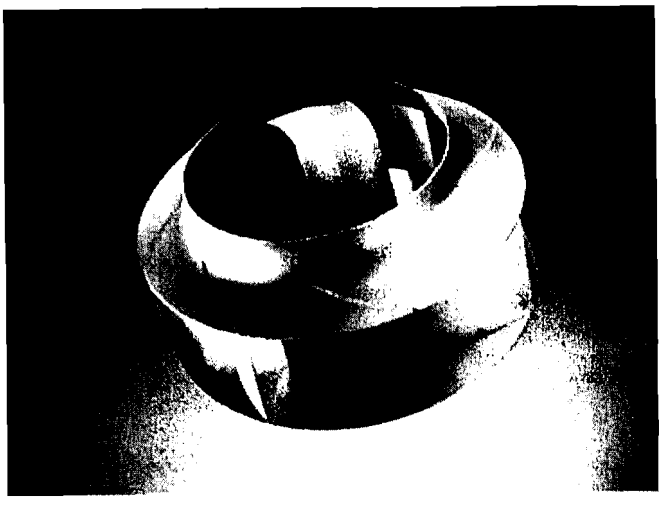
The laser is the most universal tool available for cutting, welding, marking, drilling, coating, hardening, and performing structural processing work on surfaces. A laser operates without contact, and with no wear and tear. Therefore, the heat-affected zone and component distortion produced by lasers is extraordinarily small. Refinishing work is usually unnecessary.

TRUMPF lasers have the flexibility to be used in a variety of applications, allowing for short processing times with optimum processing quality. Precision and a high level of automation go hand in hand when using amplified light.

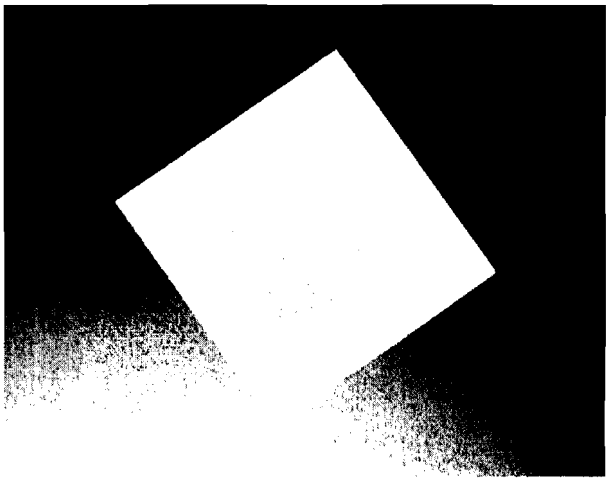
TRUMPF lasers have proven themselves ten thousand times under today's toughest manufacturing conditions and in a wide range of industries, including automotive manufacturing, automotive supply, aerospace, electronic entertainment media, precision mechanics, and medical technology. Lasers are used for processing a wide variety of products, including car bodies, transmission, exhaust and control system components, sensors, tubes and profiles, electronic components, and solar cells. Our lasers repair and coat tools and molds, and can mark anything from pacemakers to apples.

Laser cutting, from thin to thick

Narrow, high-strength laser weld seams



Filigree spot welds.



Creating the smallest of holes with the highest precision.

Everything from a single source.

When you use TRUMPF lasers, you benefit from our decades of practical experience in all laser-related fields. With TRUMPF, after all, you get it all from a single source – everything from laser units, beam guidance components, and focusing optics, to software and complete systems. Our components can also be adapted to every job and easily integrated into your plant setup.

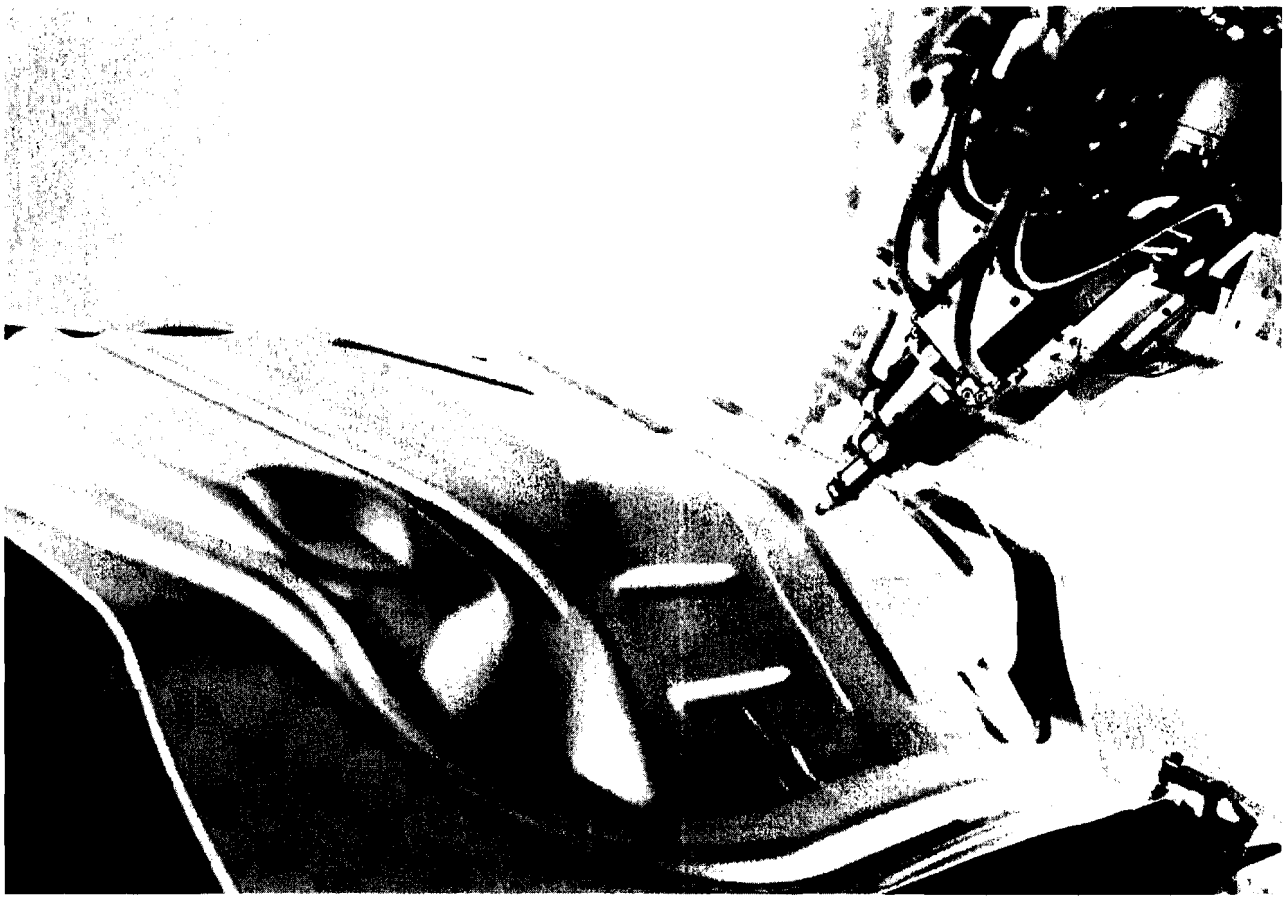
Service right from the start.

Our service begins even before you decide to buy a laser or laser system. We maintain application laboratories worldwide, where we can determine the feasibility of your desired application and show you what laser technology can do for your production processes. It goes without saying that – even after you purchase a TRUMPF laser – our application specialists will continue to assist you with application technology, incorporating lasers into component design and optimizing your production sequences.

Efficient

economical.

CO_2 lasers have been used for decades as the standard tool for processing an enormous variety of materials efficiently and economically. Worldwide, over 16,000 of our beam sources are used day in and day out, providing reliable service for cutting, welding, or surface treatment of two and three-dimensional workpieces.



Easy integration.

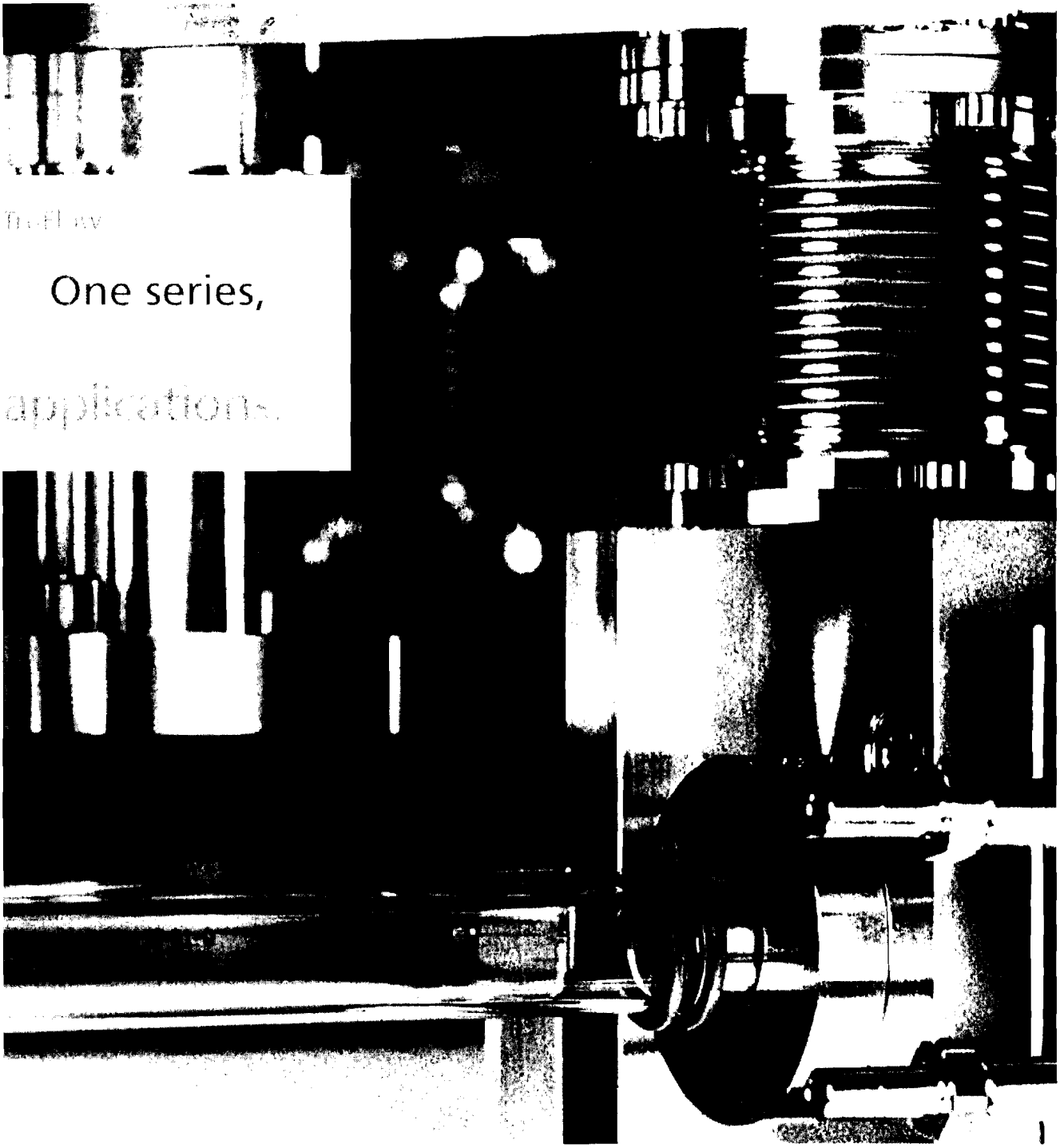
Their compact, sturdy design and open interface architecture make it easy to integrate TRUMPF CO_2 lasers into production systems. They can even be used on moving machine assemblies. Our lasers deliver top-notch quality and a high level of productivity.

Versatility.

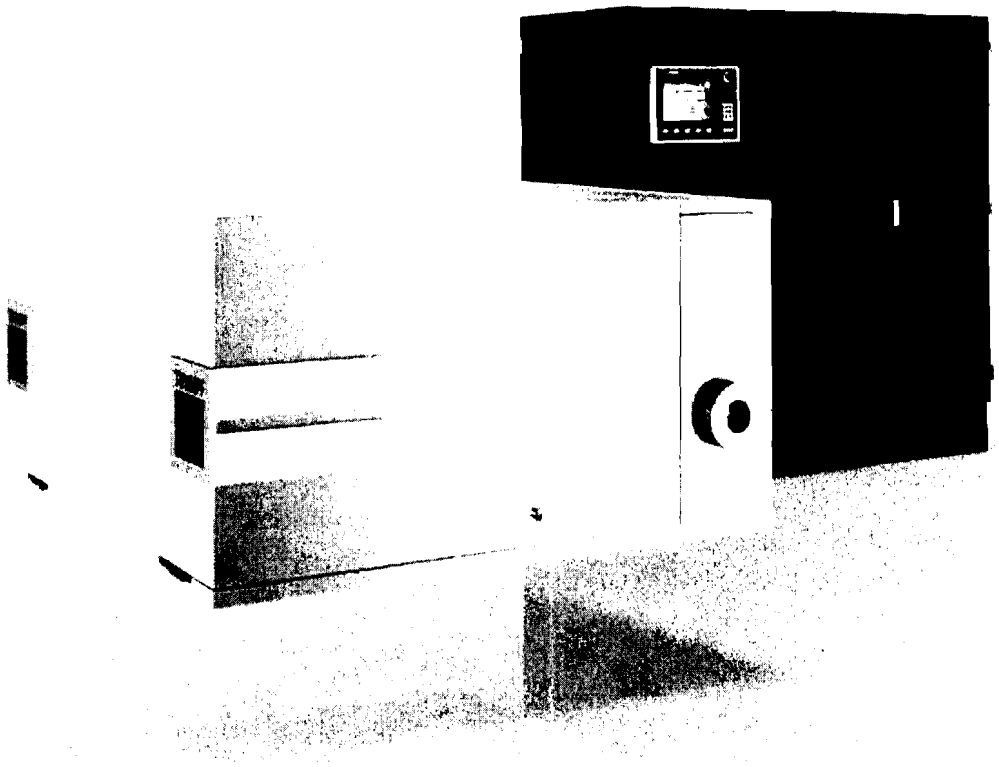
The TRUMPF portfolio consists of TruFlow fast axial-flow lasers and TruCoax diffusion-cooled lasers. Their broad range of output options and outstanding beam characteristics make it easier to optimize the beam source with respect to your production process.

Lasers in the lower output range provide an economical means of cutting thin sheet metal and non-metal materials such as wood, paper, or plastics, and are also suitable for melting glass or perforating ceramic substrates. CO_2 lasers with output greater than 2 kW may be used to cut 2-D or 3-D sheet metal components and for welding tubes, profiles, and components of transmissions or exhaust systems. Lasers in this performance class are also the preferred choice for applying or melting down anti-abrasion layers.

TruFlow lasers in the highest output range, from 12 to 20 kW, may be used for reliable welding of thick sheet metal in applications such as shipbuilding, construction machinery, or the production of transmission components for commercial vehicles.



One series, applications.



	TruFlow 700	TruFlow 1200	TruFlow 1500	TruFlow 2000	TruFlow 2700	TruFlow 3200	TruFlow 3600	TruFlow 4000
Laser power	700 W	1,200 W	1,500 W	2,000 W	2,700 W	3,200 W	3,600 W	4,000 W
Beam quality K (M^2)	0.6 (1.67)[1]	0.6 (1.67)[1]	0.6 (1.67)[1]	0.6 (1.67)[1]	0.6 (1.67)[1]	0.6 (1.67)[1]	0.6 (1.67)[1]	0.5 (2.0)[1]
Nominal power consumption[2]	23 kW	23 kW	23 kW	27 kW	34 kW	36 kW	42 kW	44 kW
Dimensions beam source								
Length	1,185 mm	1,185 mm	1,185 mm	1,185 mm	1,185 mm	1,185 mm	1,185 mm	1,185 mm
Width	1,150 mm	1,150 mm	1,150 mm	1,150 mm	1,150 mm	1,150 mm	1,150 mm	1,150 mm
Height	650 mm	650 mm	650 mm	650 mm	650 mm	650 mm	650 mm	650 mm

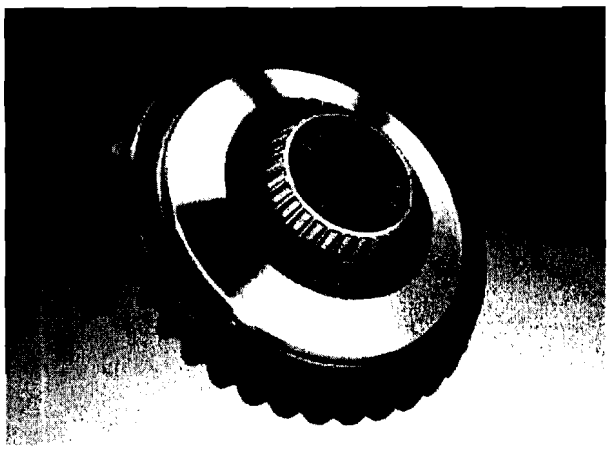
	TruFlow 5000	TruFlow 6000	TruFlow 7000	TruFlow 8000	TruFlow 12000	TruFlow 15000	TruFlow 20000
Laser power	5,000 W	6,000 W	7,000 W	8,000 W	12,000 W	15,000 W	20,000 W
Beam quality K (M^2)	0.55 (1.82)[1]	0.55 (1.82)	0.55 (1.82)[1]	0.52 (1.9)	0.26 (3.8)	0.24 (4.2)	0.22 (4.5)
Nominal power consumption[2]	56 kW	68 kW	80 kW	105 kW	120 kW	155 kW	200 kW
Dimensions beam source							
Length	1,185 mm	1,185 mm	1,185 mm	1,185 mm	1,665 mm	1,665 mm	1,665 mm
Width	1,150 mm	1,150 mm	1,150 mm	1,150 mm	1,524 mm	1,524 mm	1,524 mm
Height	650 mm	650 mm	650 mm	650 mm	1,100 mm	1,100 mm	1,100 mm

Valid for all laser types above:

Wavelength	10.6 µm (further more on demand)
Output stability, according to the nominal power	± 2 %

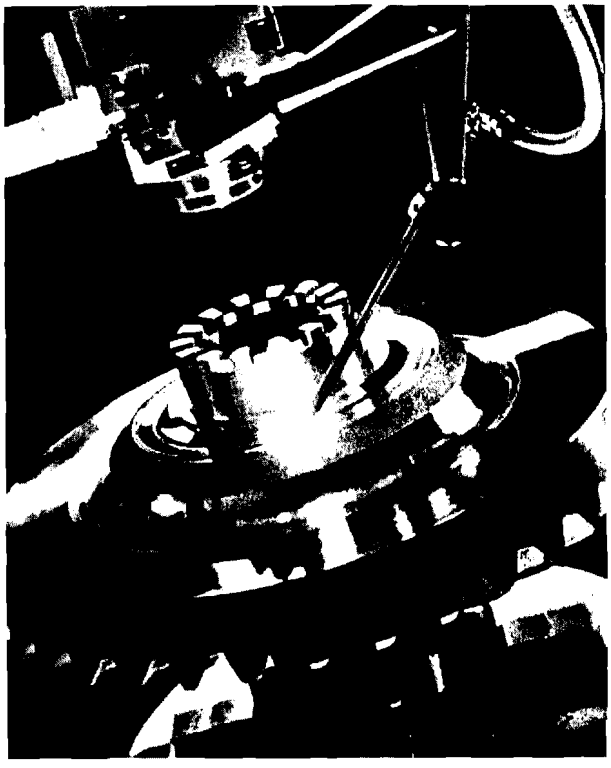
[1] The HQ lasers have a beam quality of K ≈ 0.9 resp. M^2 ≈ 1.1. Their laser power is approx. 10 % lower than the stated values.

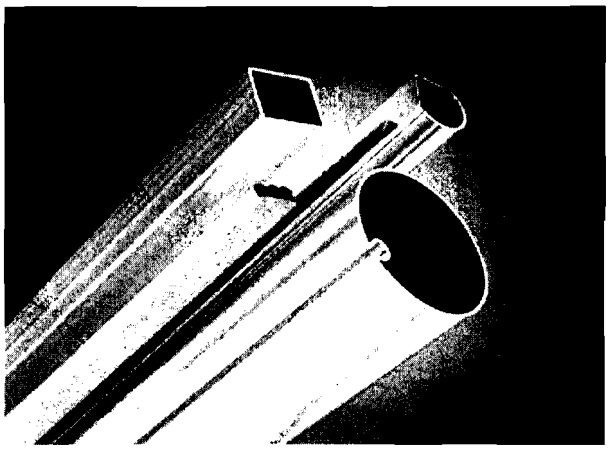
[2] Laser without cooling system



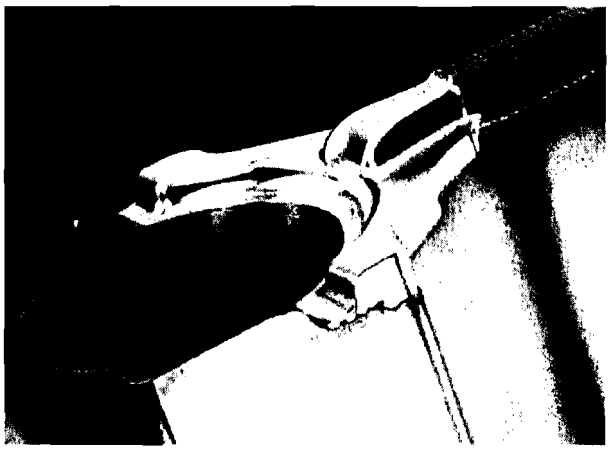
Laser welded transmission component.

TruFlow Series lasers offer you the highest level of availability and productivity – qualities that remain reliable even under the toughest production conditions. Output is available between 700 and 20,000 W, a range covering an immense array of applications. TruFlow lasers generate smooth cutting edges at high advance speeds and narrow cutting kerfs. They can also be used to create narrow welded seams with a small heat-affected zone, thereby maintaining a very low thermal load on the component.





Welding and cutting of tubes and profiles.



Powder coating of a die-forging tool.

Universal and specialized.

The modular construction of the entire series lets you tailor your TruFlow laser specifically to your application. Its wide range of output options allows you to select the beam parameters required for a given application. In addition to its standard lasers for cutting and welding, TRUMPF also offers solutions tailored to specific tasks within an application, such as lasers with especially high focusability, or beam sources that can be optimized for specific surface applications.

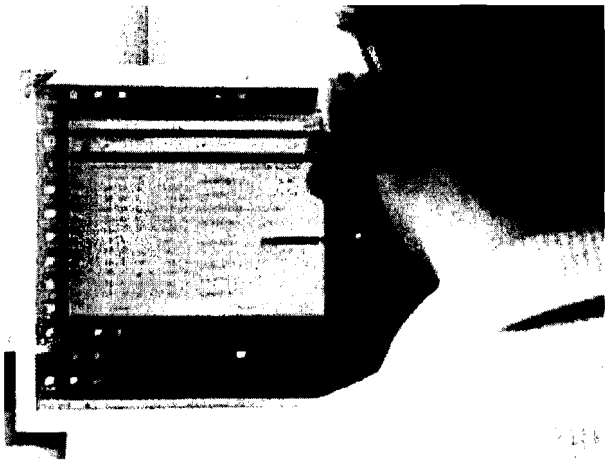
Compact, reliable, robust.

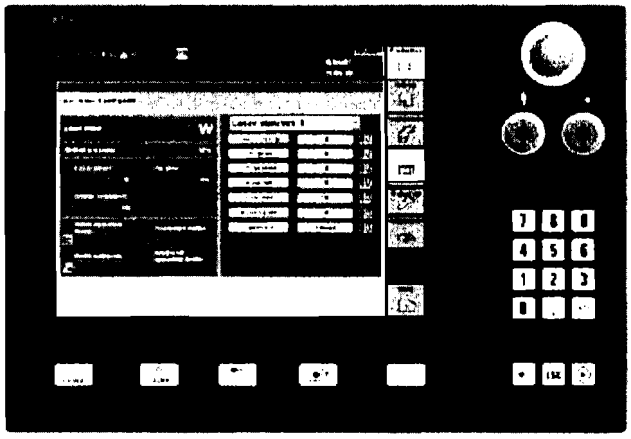
The compact, square design of the TruFlow laser resonator maximizes resonator length, allowing you to optimize beam characteristics, while minimizing overall dimensions. All major resonator components are water-cooled and offer a high level of thermo-dynamic stability, ensuring that TruFlow lasers are up to the challenge of the tough conditions of day-to-day industrial operations. TruFlow lasers are extraordinarily reliable, even on moving machine assemblies.

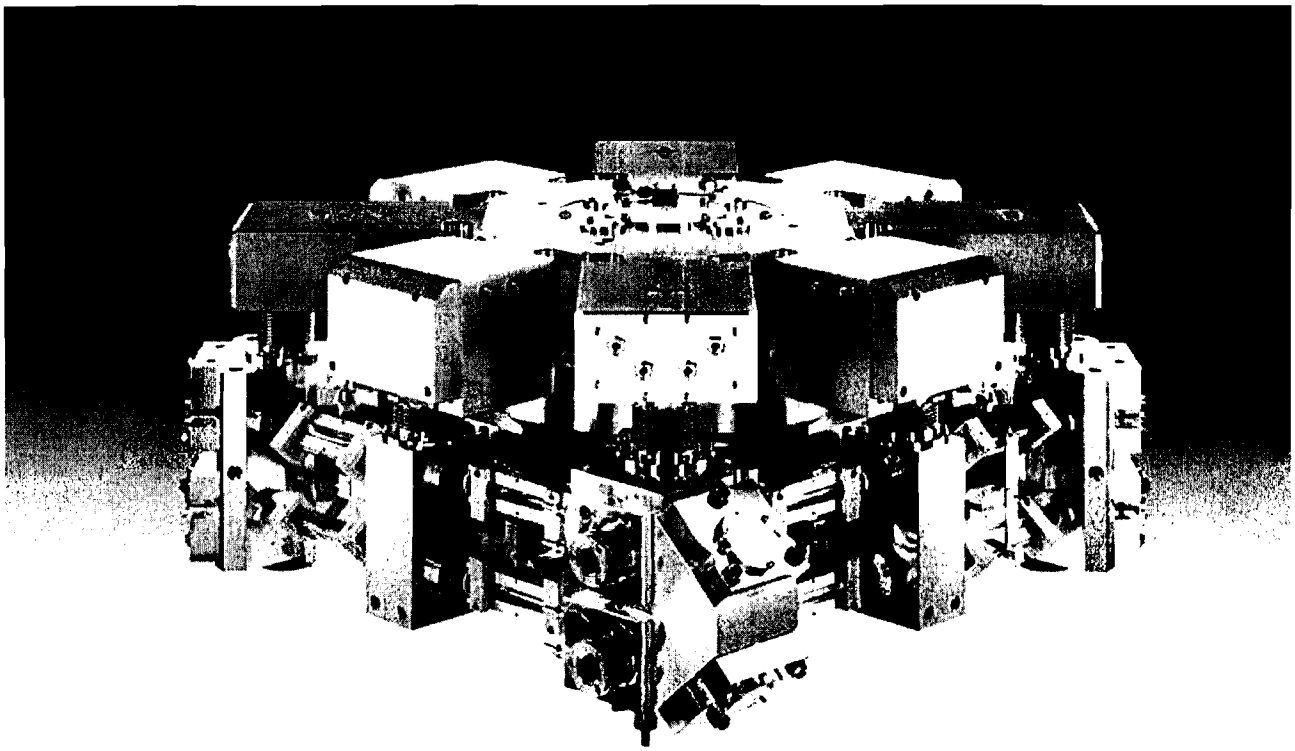
Efficient.

TruFlow lasers utilize only capacitive high-frequency excitation. It is the cleanest and most reliable form of laser excitation, providing high efficiency, constant beam parameters, and excellent laser output control.

Since it is magnetically suspended, the turbo radial blower is not subject to wear and tear, and is virtually maintenance-free. By continuously recirculating the laser gas, the blower provides high efficiency cooling and a high level of overall laser value.







Readily mixed.

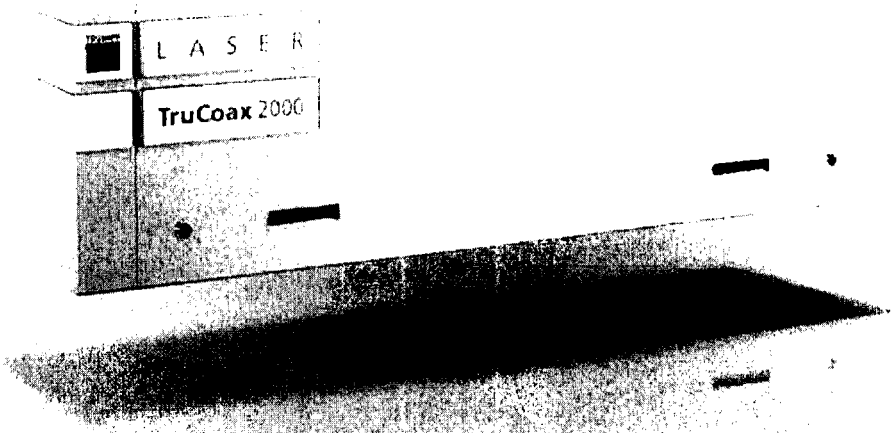
Instead of using individual gas bottles, you can also use a premix gas bottle.

Easy operation.

All TruFlow lasers are run from the same control unit, and can be operated using an intuitive user interface. For integration into a higher-level production system control, the laser control unit is available with Profibus interface, or with analog interfaces for laser power and pulse frequency. For the ease of operation, the control reminds you of any maintenance interval that might come up.

High performance

little package



	TruCoax 1000	TruCoax 2000
Laser power	1,000 W	2,000 W
Beam quality K (M^2)	0.9 (1.1)	0.9 (1.1)
Nominal power consumption[1]	20 kW	33 kW
Dimensions beam source		
Length	1,300 mm	1,840 mm
Width	430 mm	500 mm
Height	320 mm	540 mm

Valid for all laser types above:

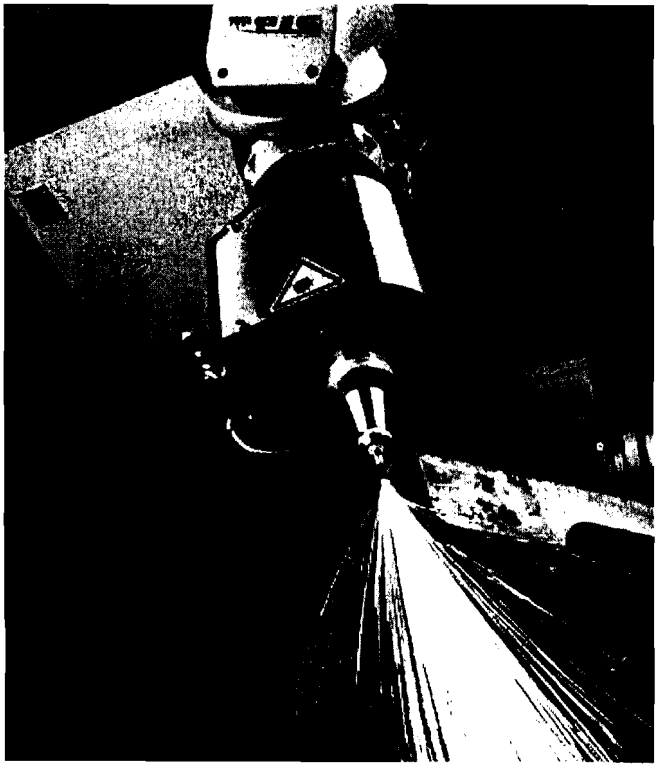
Wavelength	10.6 µm
Output stability according to the nominal power	± 2 %

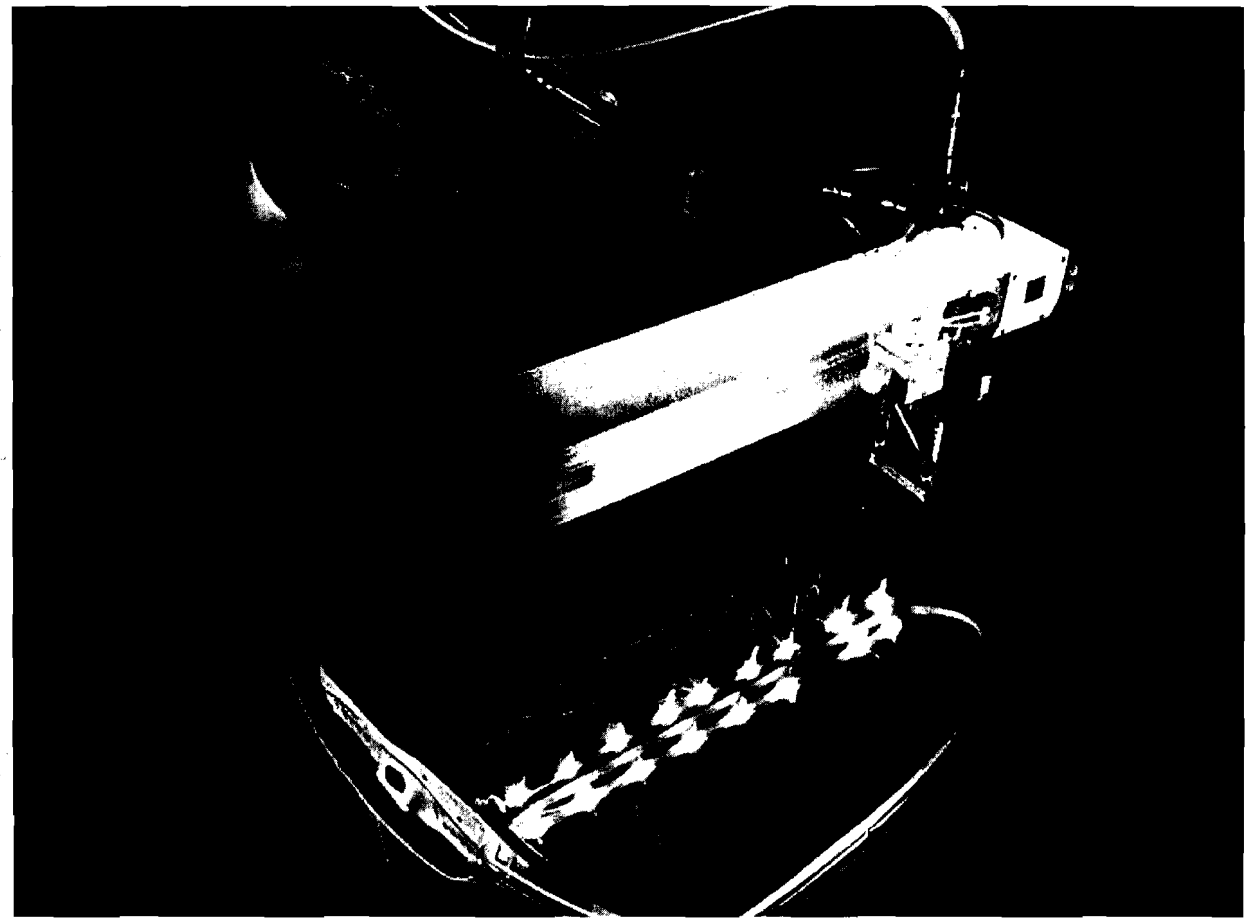
[1] Laser without cooling system

Our TruCoax CO_2 laser is diffusion-cooled and provides a high level of beam quality at a laser power of up to 2,000 W.

TruCoax lasers are so compact that they can easily fit on the frame of a machine, and can even be combined with robotic systems. Part of what makes this possible is the design of the resonator. Its walls release the heat that is generated, and two coaxial, nested metal tubes act as high-frequency electrodes and as cooling elements.

Yet another advantage of the TruCoax laser is that the gas which is premixed in a small bottle is stored in the resonator. Plus, the TruCoax uses so little gas that you only need to replace the bottle every 1.5 to 2 years. It's hard to imagine how laser processing could be more user-friendly, or involve less maintenance.





Flexible.

The major advantage of solid-state laser technology is that the laser beam can be coupled with fiber-optic cables. Flexible laser light cables conduct the beam from its source to the processing site. Integrating lasers into production facilities or robotic equipment also showcases the advantages of laser light cable technology.

Intelligent design.

Our solid-state lasers give you fast, dynamic control, allowing laser power to be digitally controlled in real time, to achieve reproducible results from the very first second. All of the interfaces typically needed for communicating with external control units are at your disposal.

Intuitive.

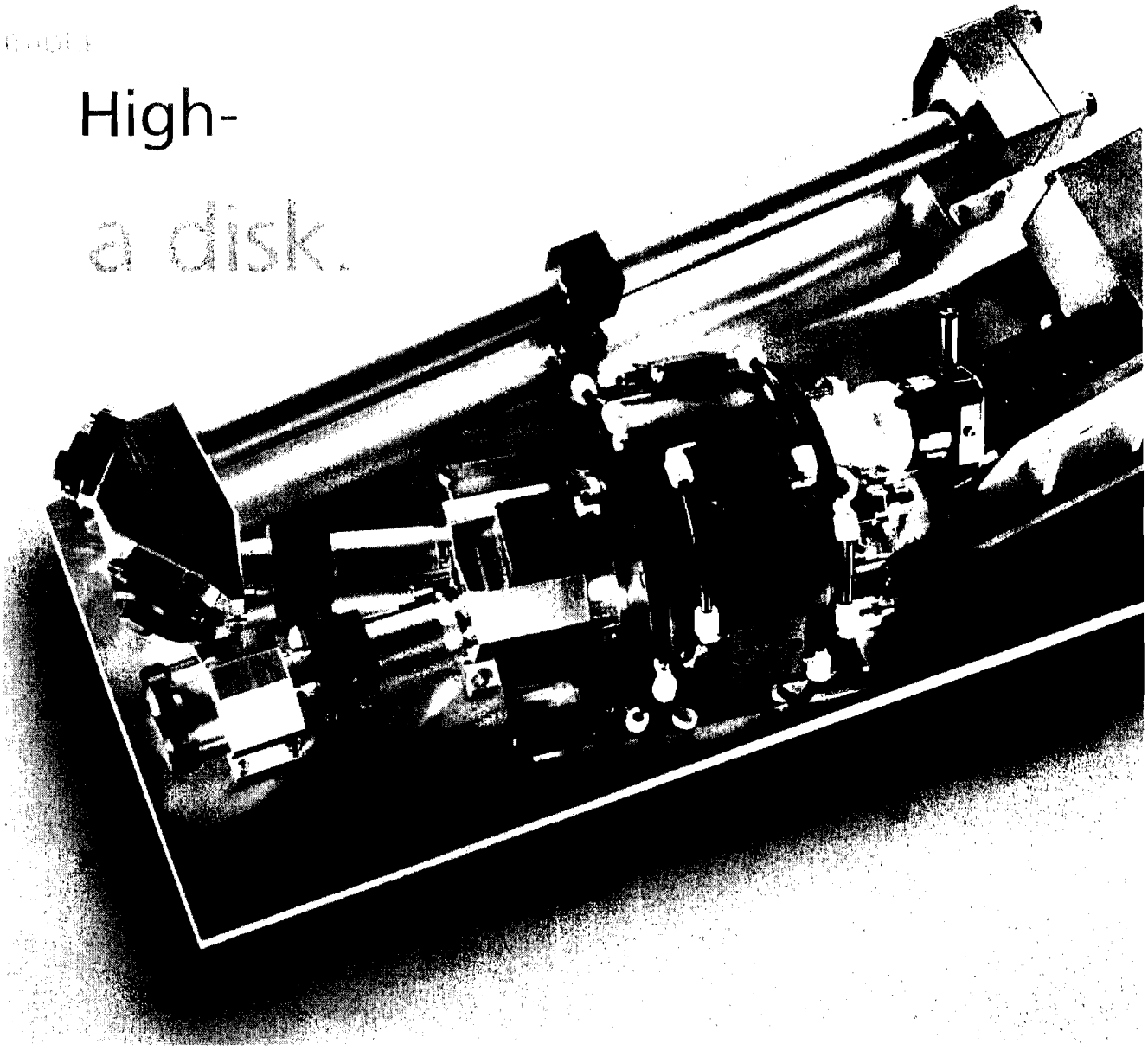
A touch screen and turn-push button are used to operate lasers through a user interface that is clearly structured and self-explanatory. The convenient operating panel can be separated from the laser, so that you can take it directly to the processing site and control all laser functions from there. Operating software allows you to store up to 200 programs, edit and scale pulse shapes, and use a single command to initiate ramping.

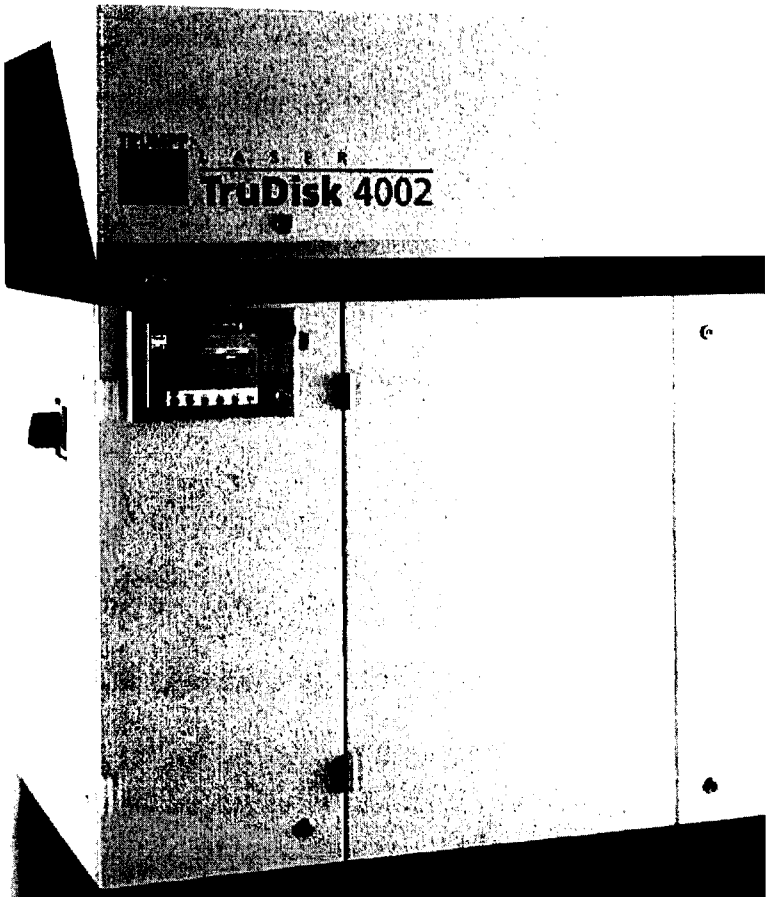
Secure data transmission.

Thanks to its Telepresence Portal, TRUMPF offers you unique solid-state laser services throughout the world, with over hundreds of continuously measured values available through secure remote access. As a result, our service experts can quickly troubleshoot and assess any error, often eliminating the problem immediately.

High-

a disk.

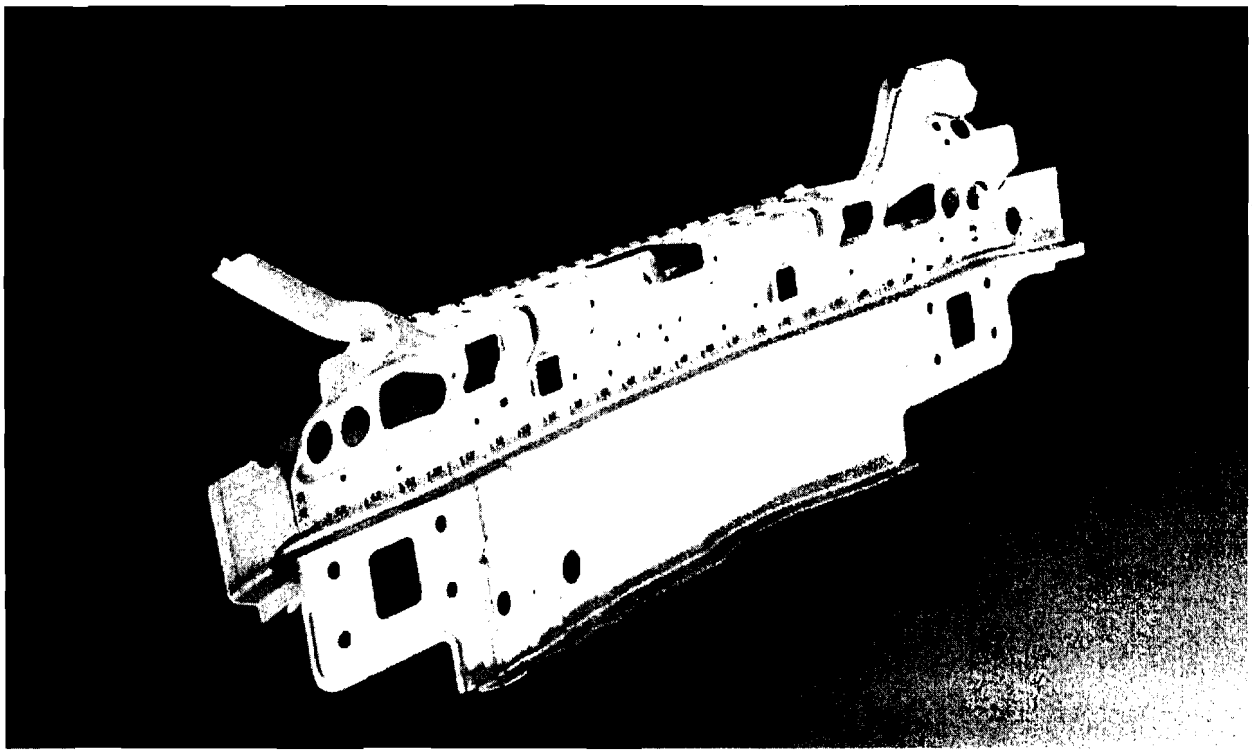




	TruDisk 1000	TruDisk 2002	TruDisk 3002	TruDisk 3002	TruDisk 4002	TruDisk 4002
Laser device						
Laser power	1,000 W	2,000 W[1]	2,600 W[1]	3,300 W[1]	4,000 W	5,300 W[2]
Beam quality[4]	2 mm · mrad	8 mm · mrad	8 mm · mrad	8 mm · mrad	8 mm · mrad	8 mm · mrad
Min.ø laser light cable	50 µm	200 µm	200 µm	200 µm	200 µm	200 µm
Consumption						
Nominal power consumption	5 kW	10 kW	13 kW	16 kW	19 kW	26 kW
Cooling water temperature range	5 – 20 °C	5 – 20 °C	5 – 20 °C	5 – 20 °C	5 – 20 °C	5 – 20 °C
Dimensions						
Width	1,460 mm	1,600 mm	1,600 mm	1,600 mm	1,600 mm	1,990 mm
Height	1,350 mm	1,550 mm	1,550 mm	1,550 mm	1,550 mm	1,550 mm
Depth	730 mm	950 mm	950 mm	950 mm	950 mm	1,200 mm

[1] optionally upgradable on up to 4,000 W
[2] optionally upgradable on up to 8,000 W
[3] optionally upgradable on 12,000 W
[4] optional beam quality of 4 mm · mrad at laser powers from 2,000 W to 6,000 W, from 12,000 W optional beam quality of 8 mm · mrad possible

	TruDisk 6602	TruDisk 8002	TruDisk 10002	TruDisk 12003	TruDisk 16003
Laser device					
Laser power	6,600 W[2]	8,000 W	10,000 W[3]	12,000 W	16,000 W
Beam quality[4]	8 mm · mrad	8 mm · mrad	8 mm · mrad	12 mm · mrad	12 mm · mrad
Min.ø laser light cable	200 µm	200 µm	200 µm	300 µm	300 µm
Consumption					
Nominal power consumption	33 kW	39 kW	49 kW	60 kW	80 kW
Cooling water temperature range	5 – 20 °C	5 – 20 °C	5 – 20 °C	5 – 20 °C	5 – 20 °C
Dimensions					
Width	1,990 mm	1,990 mm	2,800 mm	2,800 mm	2,800 mm
Height	1,550 mm	1,550 mm	1,600 mm	1,600 mm	1,600 mm
Depth	1,200 mm	1,200 mm	1,400 mm	1,400 mm	1,400 mm



Scanner welded car body part.

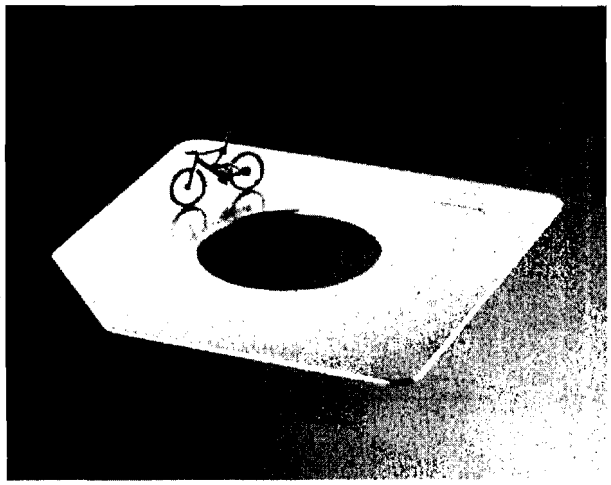
Powerful and efficient.

The new TruDisk generation of disk lasers is even more powerful, cost-effective and compact than before, and offers you numerous advantages for the efficient part production. Laser powers range from one to 16 kW and, because of their disk geometry, TruDisk lasers have best beam quality in the high multi-kilowatt range. With most of the units you can choose between two beam qualities, so you always have the laser best suited to your individual production task. The excitation of the new TruDisk lasers is provided by extremely long-lasting laser diodes made by TRUMPF. This enables a high degree of laser efficiency and minimizes operating costs.

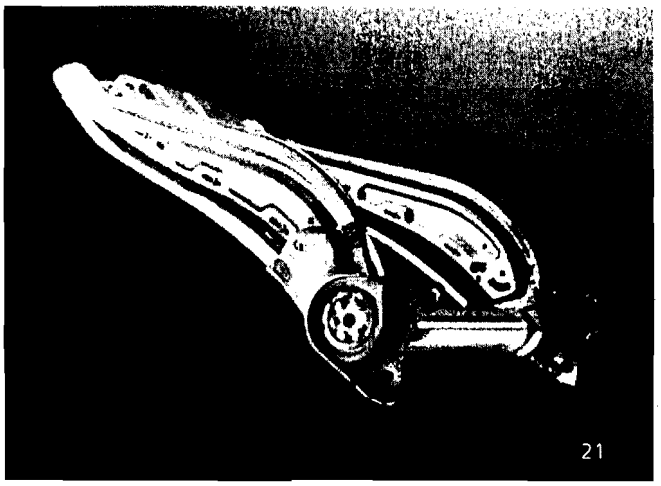
Modular and compact.

Beam generation, beam guidance, power supply, cooling and control of the TruDisk lasers are all modular in design and are located inside a compact housing. Everything is thought through and coordinated down to the smallest detail – for maximum availability and easy maintenance.

Precision cutting with TruDisk.



Laser welded seat structure

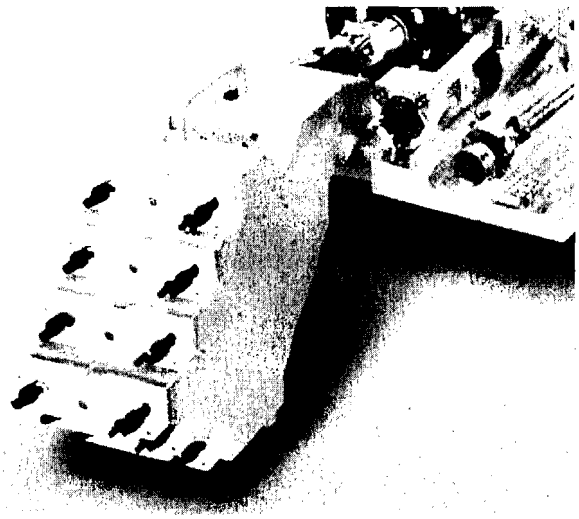


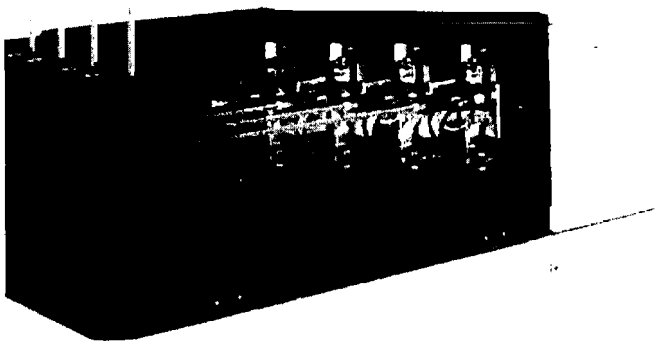
Reliable processing.

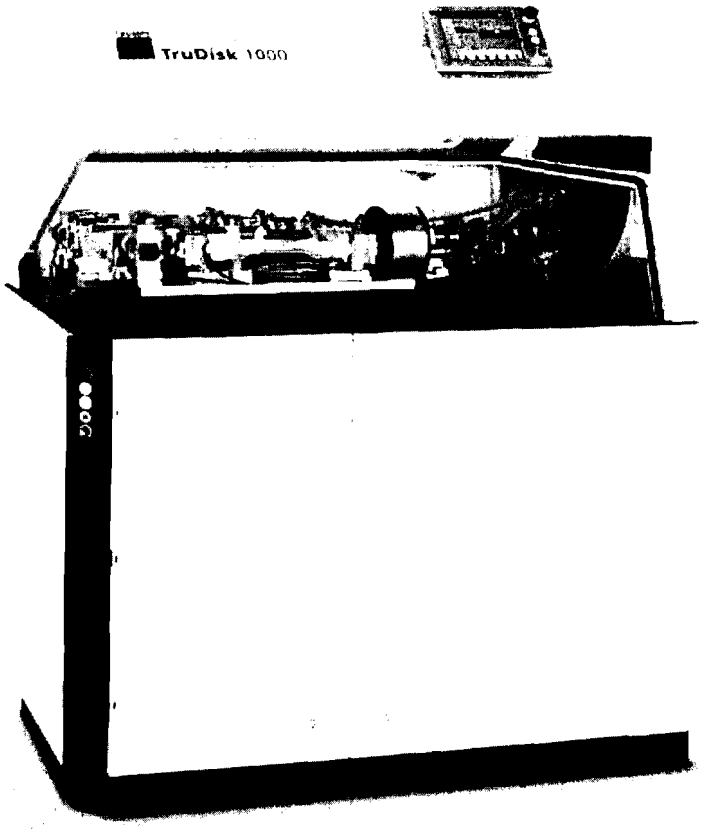
When scaling the laser power, the internal laser power density of the TruDisk lasers always lies within a secure range.
Its patented resonator design makes the TruDisk laser resistant to back reflections on all optic components, so they remain extremely stable during the production process. Thanks to the absolute laser power control, you get reproducible production results at all times.

Customizable and upgradable.

The integrated beam guidance design can be customized, both in regards to the number of outputs as well as to „energy and time sharing" options. Up to six laser light cables can be connected to a TruDisk – and they can also be easily reconnected even if you are working at the other outputs. The laser power of the disk lasers can also be individually configured – and the modular design means they can easily be upgraded later, on-site – in only a few hours.







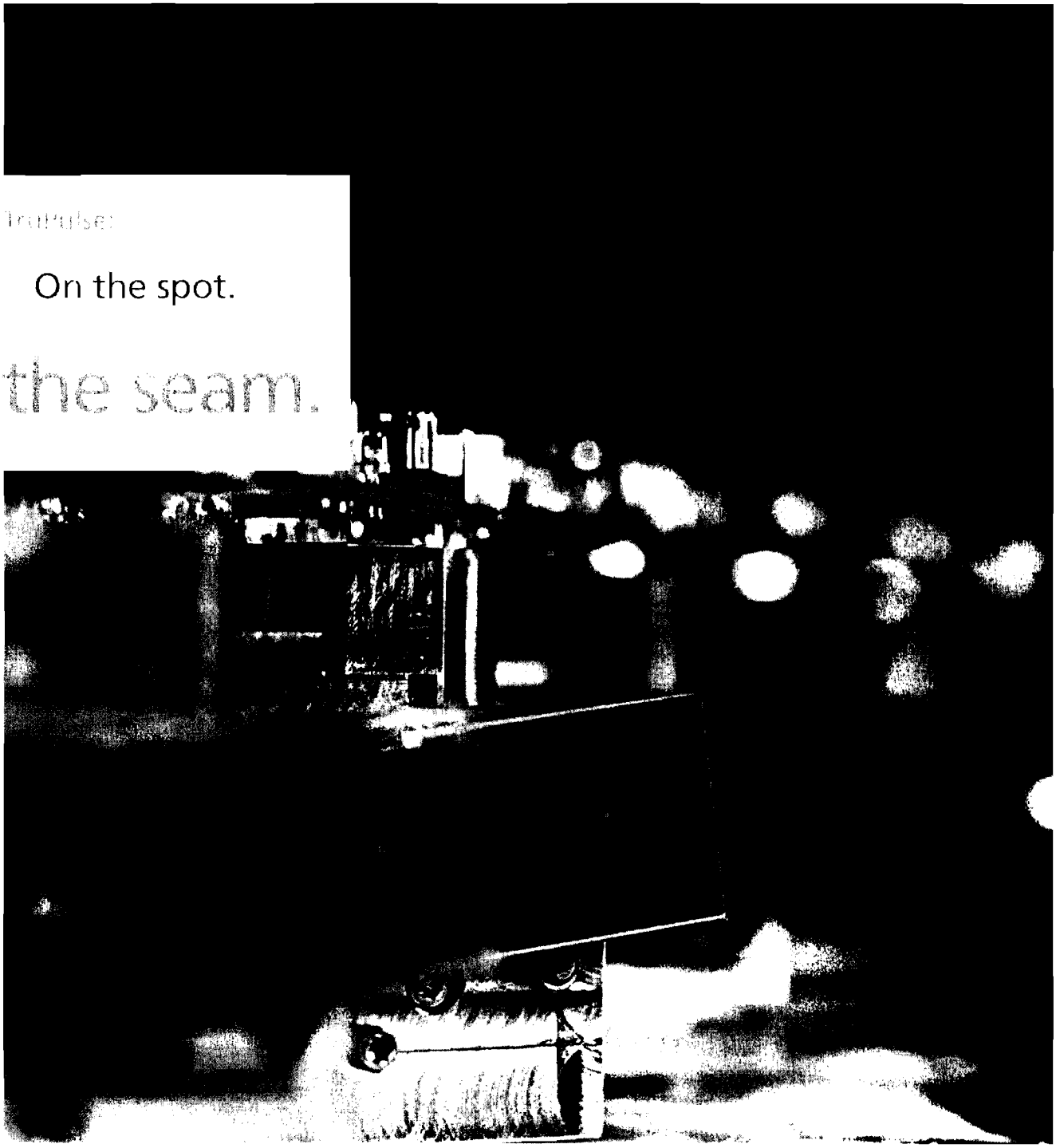
Always ready.

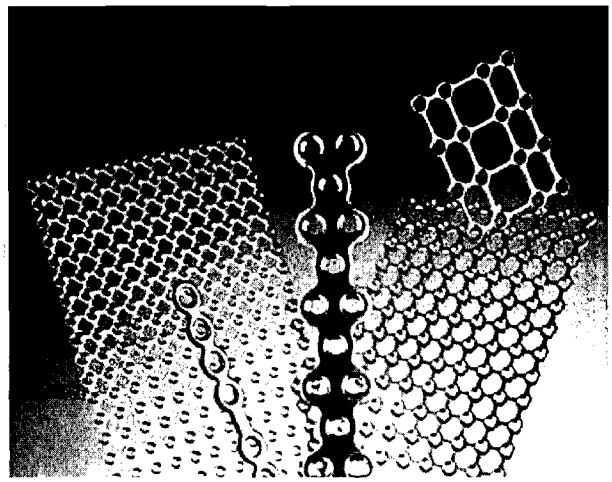
The new passively cooled pump modules of the TruDisk laser are ultra-long-lasting. This means they are no longer considered consumables, and operating costs can therefore be kept to a minimum. In the unlikely event that a module fails, the pump diodes instantly cover for each other: the power of the remaining modules is automatically increased so that there is no loss of power at the workpiece. You can then replace the failed pump module in an orderly manner without interrupting production – in a matter of minutes, and in just a few steps.

Impulse:

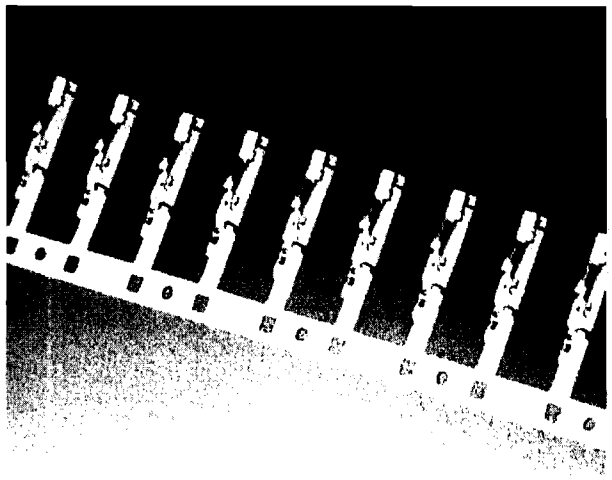
On the spot.

the seam.





Cutting of the finest contours on titanium implants



Laser welded connectors

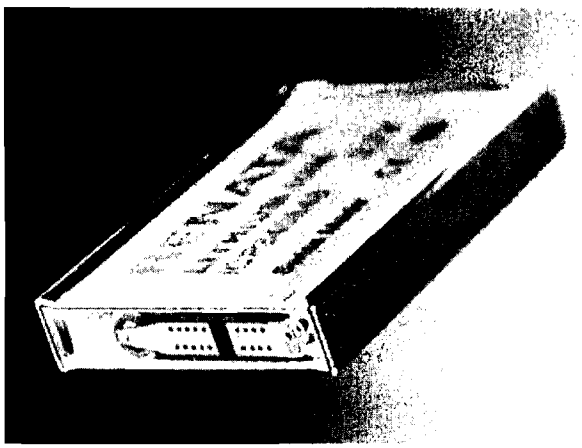
Finely tuned.

Several kilowatts of pulse power for a few milliseconds let you weld and cut in situations where other processes fail. Whether in terms of power, energy, or focusability, the TruPulse Series covers the entire parameter range for welding and cutting. With pulse powers as high as 10 kW, pulse duration between 0.2 and 50 ms, and pulse energy running up to a maximum of 120 J, these lasers are universal tools for use in both manual and automated applications.

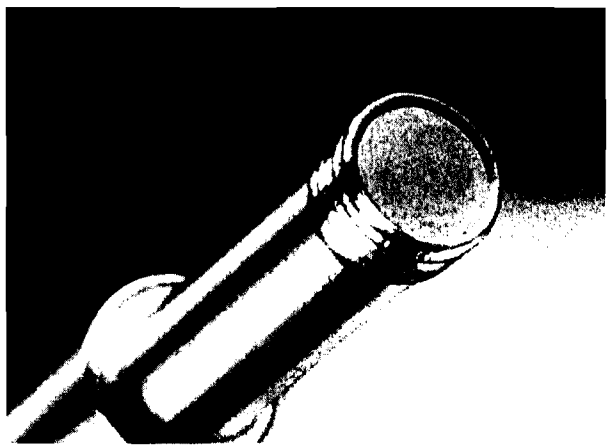
Modular.

Beam generation, beam guidance, power supply, cooling, and control units are all set up as modules in a system that has been thought out and tested in great detail. One laser can service up to six processing stations, either in parallel or in sequence. For TruPulse lasers with powers of up to 150 W, you decide whether to use air or water cooling for your laser unit.

Laser welded battery.



Laser deposition welding on beryllium-copper



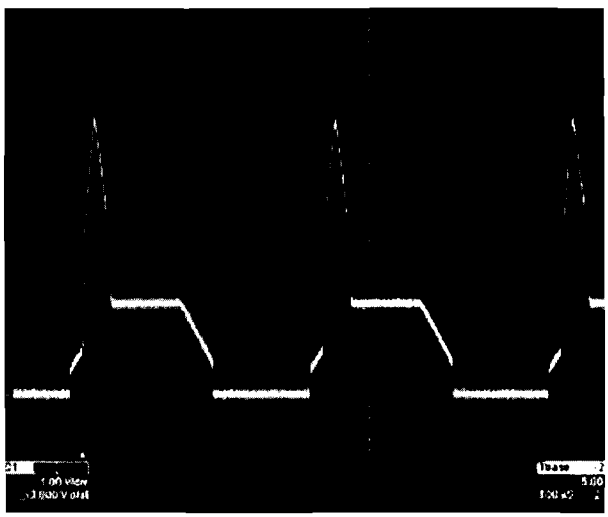
Cabinet	**A**	**B**	**C**	**D**	**D+**
Dimensions					
Width	485 mm	980 mm	980 mm	1,500 mm	1,500 mm
Height	700 mm	1,220 mm	1,220 mm	1,370 mm	1,370 mm
Depth	800 mm	505 mm	715 mm	730 mm	990 mm

Best results.

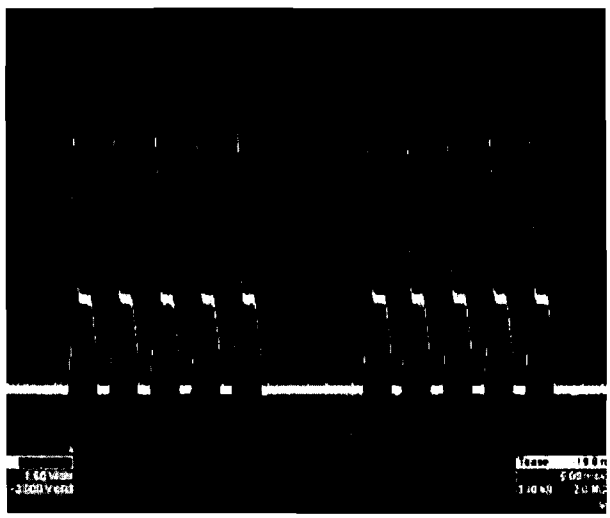
The power supply is highly dynamic, enabling ultra-short pulse rise times, and in conjunction with fast, real-time power control, provides high pulse-to-pulse stability – keeping your processing results constant at all times.

Laser pulse frequency is typically limited by pulse energy and average power. The Power Regulated Burst, however, lets you considerably exceed the average power for a short time and keep the welding time within a processing cycle to a minimum. Long Pulse Welding also opens up new possibilities, allowing you to generate a welding seam within a single laser pulse by quickly moving either the workpiece or laser beam.

Pulse shapes.



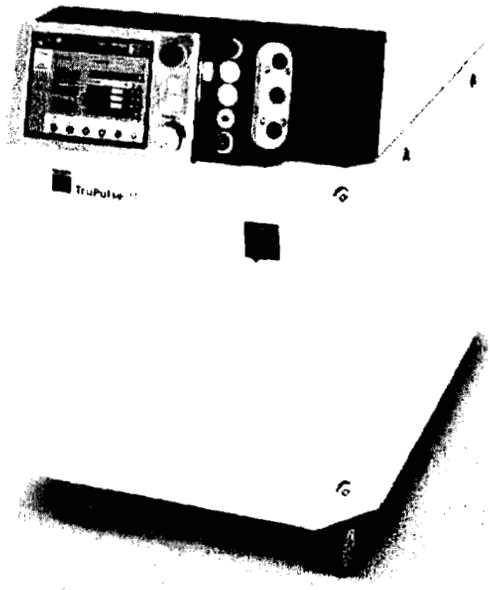
Power Regulated Burst

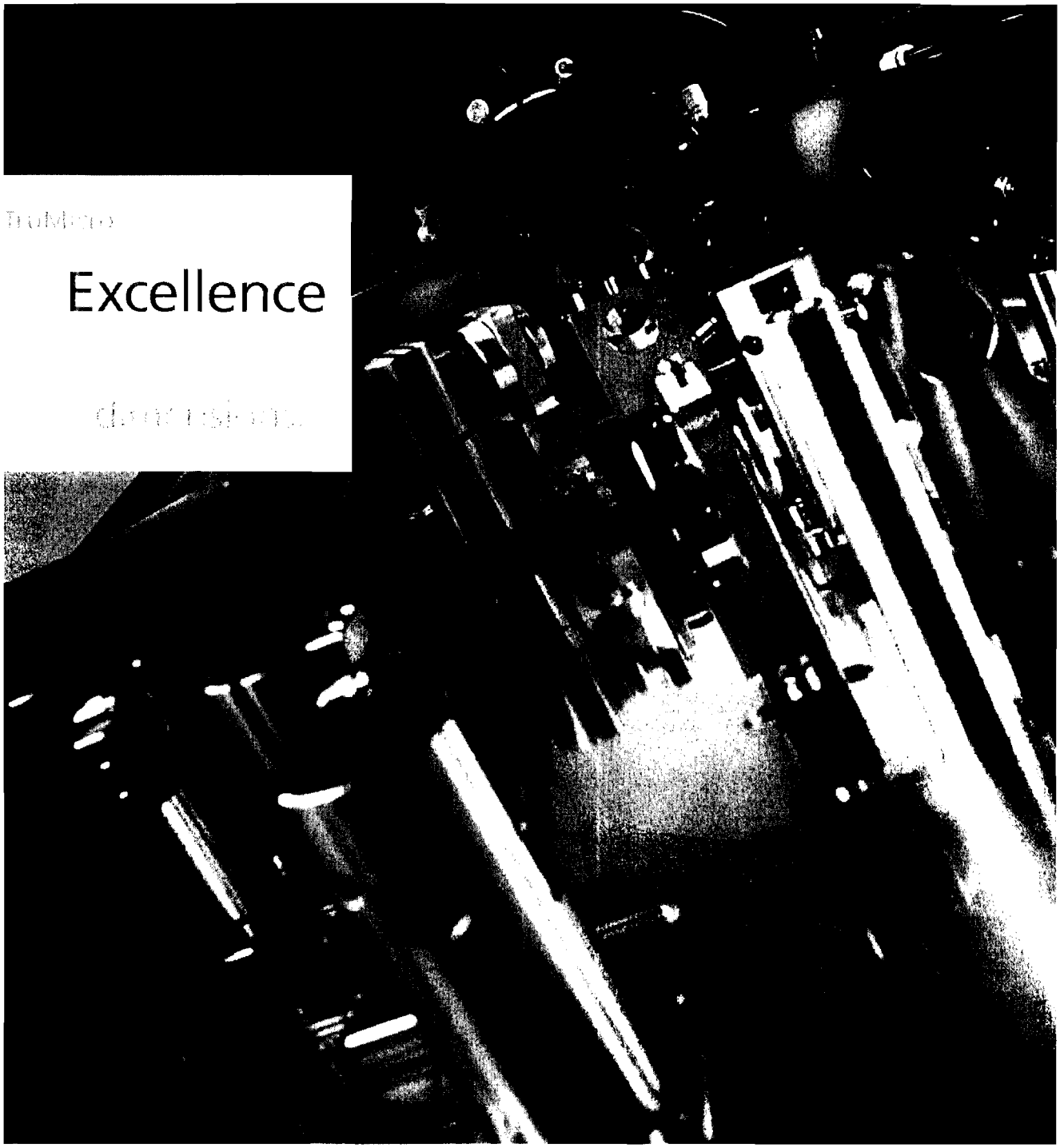


Helpful.

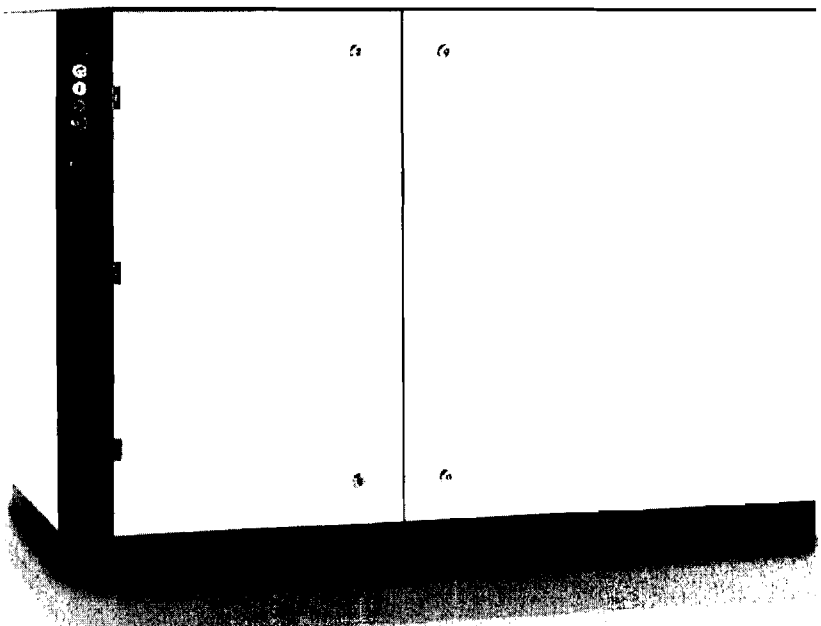
The application wizard „Weldassist" will help you optimize your welding parameters. If this is not sufficient, TRUMPF application specialists will be there for you with help and advice.

If the components you are processing with your laser must meet strict standards, our software module „Datastore" will help you record and evaluate your quality-related laser parameters.



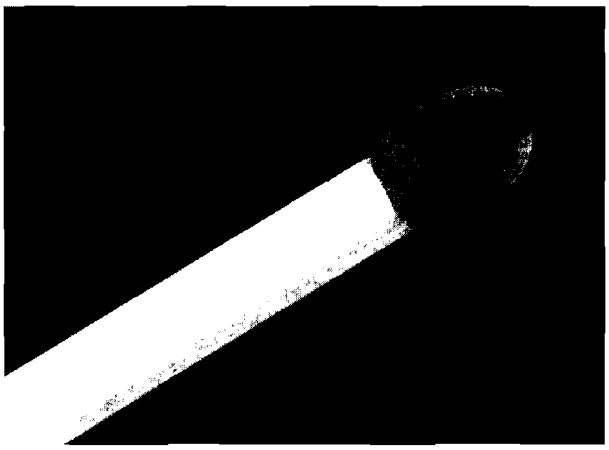

TruMicro
Excellence

TruMicro 7050



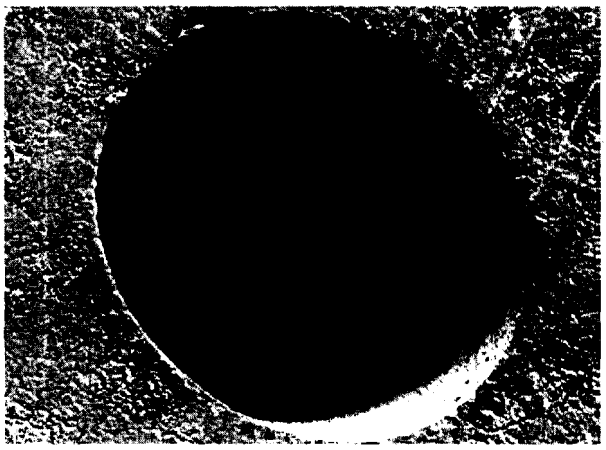
	TruMicro 5050	TruMicro 5250	TruMicro 5350	TruMicro 7050	TruMicro 7250
Laser device					
Wavelenght	1030 nm	515 nm	343 nm	1030 nm	515 nm
Max. average power	50 W	25 W	15 W	750 W	400 W
Beam quality	$M^2 < 1,3$	$M^2 < 1,3$	$M^2 < 1,3$	$M^2 < 13$ (LLK 01[1])	$M^2 < 13$ (LLK 01[1])
Polarisation ratio	Linear > 500:1	Linear > 500:1	Linear > 500:1		
Pulse duration	< 10 ps	< 10 ps	< 10 ps	30 – 700 ns[2]	300 – 1500 ns[2]
Max. pulse energy	250 µJ	125 µJ	75 µJ	50 mJ	10 mJ
Repetition rate	max. 400 kHz	max. 400 kHz	max. 400 kHz	5 – 50 kHz	5 – 100 kHz
Consumption					
Nominal power consumption	2.3 kW	2.3 kW	2.3 kW	5 kW	5 kW
Max. cooling water consumption at 18 °C	0.3 m³/h	0.3 m³/h	0.3 m³/h	0.9 m³/h	0.9 m³/h
Cooling water temperature range	6 – 18 °C	6 – 18 °C	6 – 18 °C	5 – 20 °C	5 – 20 °C
Dimensions					
Laser head	upon request	upon request	upon request		
Supply unit					
Width	650 mm	650 mm	650 mm	1,460 mm	1,460 mm
Height	1,150 mm	1,150 mm	1,150 mm	1,350 mm	1,350 mm
Depth	1,210 mm	1,210 mm	1,210 mm	730 mm	730 mm

[1] The minimum fiber diameter depends on the pulse duration.
[2] Definite pulse duration on delivery.



Cold processing with picosecond pulses on a match-head

Scale: ——— 30 µm



Drill-hole in stainless steel using TruMicro 5050

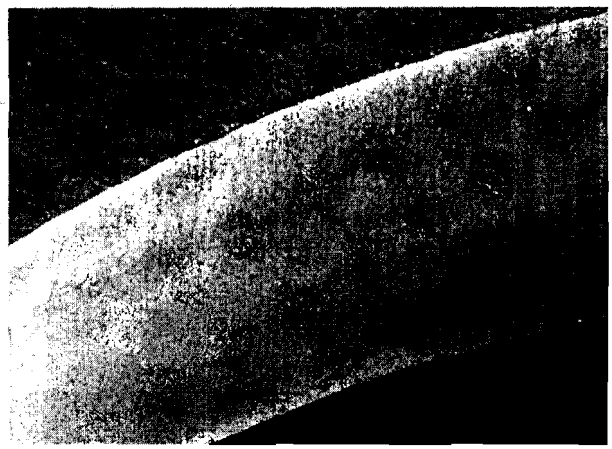
TruMicro Series 5000: Shorter than short.

The TruMicro Series 5000 is used for material ablation wherever mechanical or thermal influences, such as micro-cracks, burrs or deposits, are unacceptable or refinishing work must be avoided. These lasers enable micro processing with an ideal combination of quality, productivity and profitability.

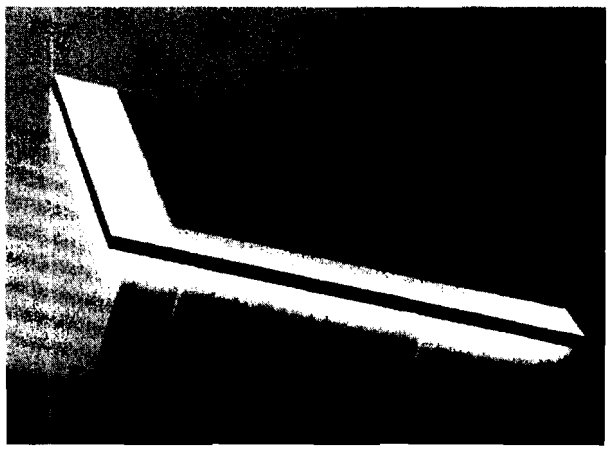
The decisive benefits of the TruMicro Series 5000 are short pulse durations which are smaller than 10 ps and their easy average power scaling, at pulse energies of up to 250 µJ. It is the unique combination of fiber and disk laser technology that enables penetration into these performance classes. Intensification of the picosecond pulses of a fiber laser with a disk laser is superior to other technologies in terms of laser power and pulse energy, while simultaneously retaining excellent beam quality.

The high peak pulse power of the TruMicro 5050 of 50 W with an infrared wavelength translates to high throughput times. With the TruMicro 5250 and 5350 you have two variants at your disposal, with outputs of 25 W in the green spectral range and 15 W in the ultraviolet spectral range. As a result, semiconductor materials, die-electrics and plastics are processed with outstanding quality and high throughput. In addition, a laser can operate several workstations simultaneously. And the overall cost of disk lasers from the TruMicro Series 5000 remains incredibly low throughout their entire service life.

Scale: ——— 50 µm



Cutting edge of a silicon wafer processed with TruMicro 5250.



Border deletion on a thin-film solar cell with TruMicro 7050.

TruMicro Series 7000: Short and productive.

The lasers in the TruMicro Series 7000 combine short pulses with high peak pulse powers. With these outputs – which are especially high for short pulsed lasers – you can quickly ablate large surface layers, create micro-drilled holes or even cut with the highest throughput.

With pulse durations ranging from several tens to several hundreds of nanoseconds, the TruMicro Series 7000 achieves laser powers of up to 750 W. The disk laser technology used here features a combination of short pulses and high pulse energies together with excellent beam quality. This enables remote processing, i.e. fast positioning of the laser beam with the aid of a scanner, for precision processes such as fine cutting or drilling the tiniest of holes.

The TruMicro Series 7000 is ideal for integration into production plants. The laser and supply unit form a compact device, and beam delivery to the focussing optics takes place via our flexible laser light cable. Beam switches and splitters are integrated into the laser unit, enabling laser power to be optimized during processing as well as between workstations.

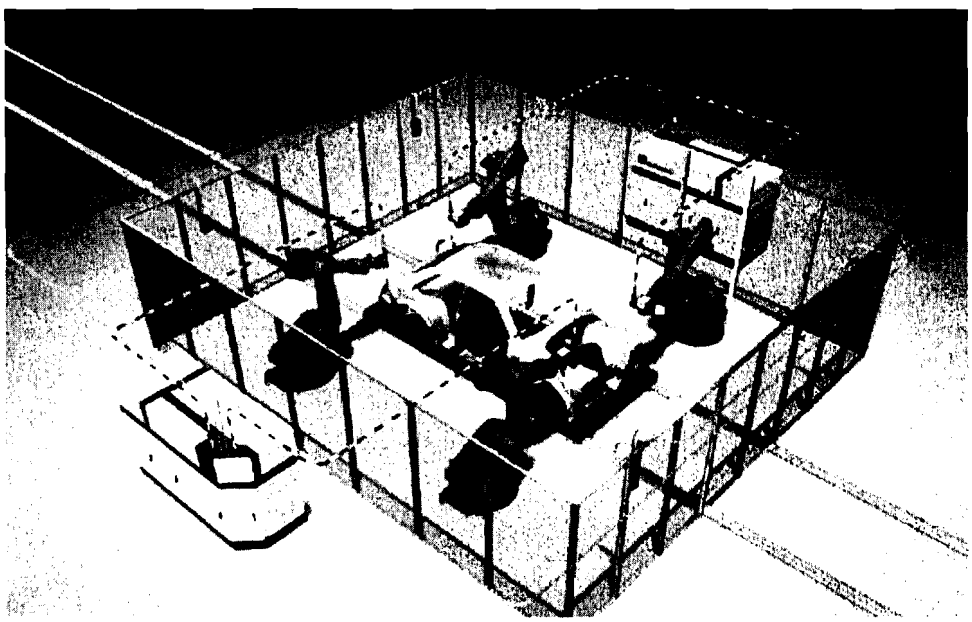
Beam guidance and solid-state lasers.

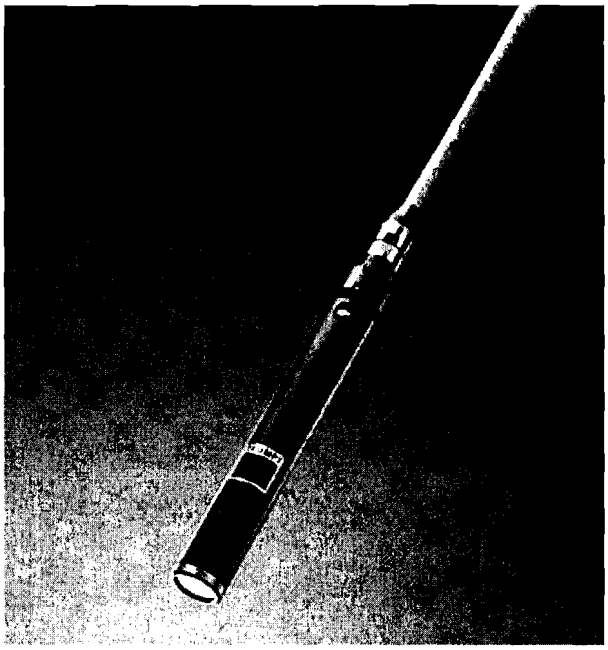
Flexible light transportation: The laser light cable.

Feeding the beam through a laser light cable makes it possible for the solid-state laser to be located away from the processing station. All that is required at the actual processing site are optics that focus the laser light on the workpiece and that can be easily integrated. The beam can be switched at the laser unit to a different output, or split into as many as six outputs, making it possible to supply up to six processing stations at once. The laser light cable can be easily connected by yourself, plug & play.

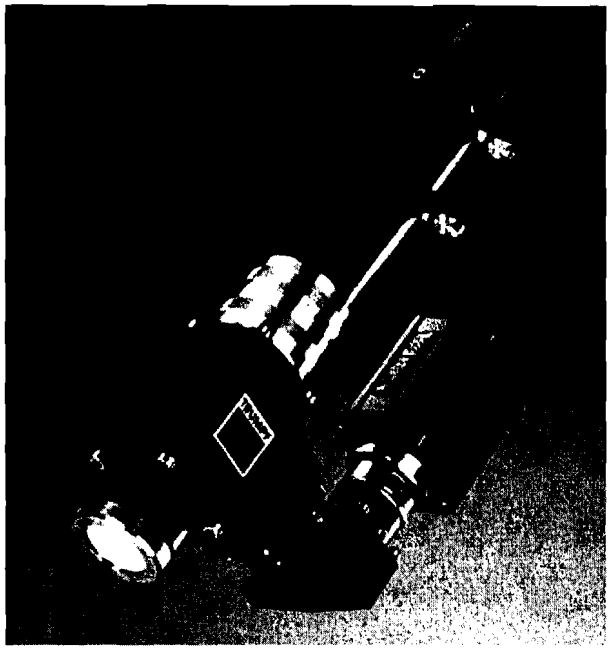
The TRUMPF LaserNetwork.

Link and distribute intelligently – the TRUMPF LaserNetwork gives you the flexibility you need to effectively use the energy available from one or more lasers at several processing stations. This allows you to make better use of individual laser capacity, increasing facility availability. The laser light cable transmits the necessary information about the laser unit and guidance system, even when you switch the cable from one outlet to another. The entire security circuit is monitored continuously, guaranteeing laser safety.





Focusing optics BEO D25.



Focusing optics BEO with D35 with camera.

The right optics for every job.

We offer an extensive line of focusing optics, for anything from welding and cutting to drilling and ablating applications. A variety of options are available for adapting all TRUMPF optics to any need.

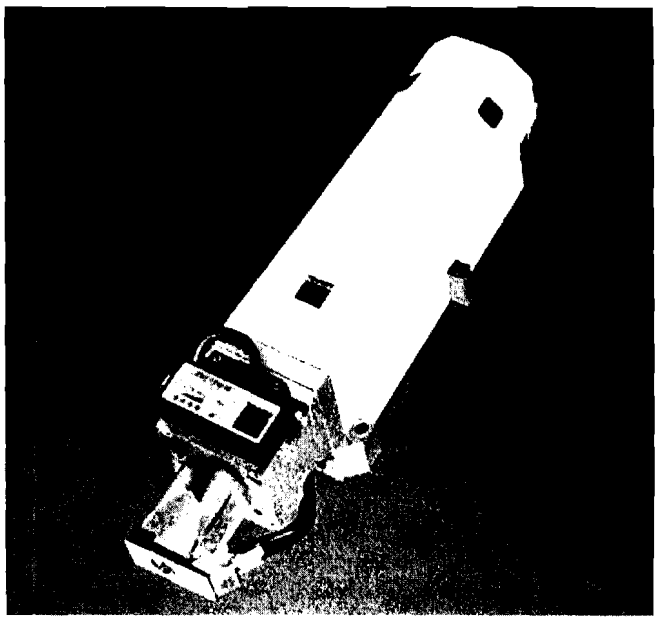
Robust and proven.

The series of BEO focusing optics consists of three basic models that differ in terms of their size and collimation focal length. Dependent on the laser you use, you will achieve a focal diameter between 10 µm and 1 mm. The BEO D25, the most compact focusing optics of the series, is used in welding applications with pulsed lasers, with outputs of up to 200 W. It is especially suited for integration into automated assembly systems. The BEO D35 can be used for welding, cutting, or drilling, in combination with pulsed or cw solid-state lasers that have powers in the kilowatt range. The BEO D70 focusing optics shows its strengths at large operating distances, when the focal diameter is small.

Monitored.

The optical construction of the controlled focusing optics of the CFO Series is similar to that of the BEO Series, but with the addition of sensors that monitor the functions of the optics. These sensors monitor the degree of contamination of the cover slide, the temperature and flow of cooling water and inert gas, as well as cross-jet pressure. TRUMPF service specialists can use our Telepresence service to call up monitoring data upon request, allowing them to troubleshoot, assess, and eliminate errors occurring anywhere along the beam path.

Controlled focusing optics CFO.



Programmable.

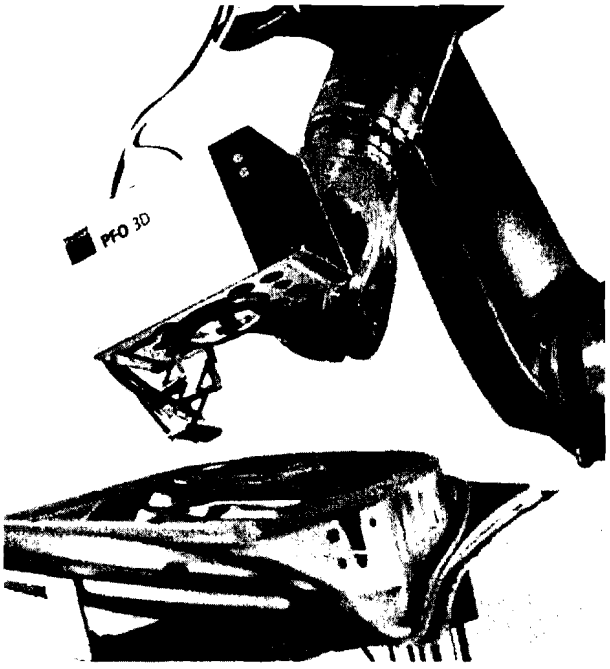
Programmable focusing optics of the PFO Series are scanner optics used for welding. Two mirrors are used to position the laser beam within the operating field. The mirror angles can be changed through a highly precise and dynamic process. In conjunction with pulsed or cw solid-state lasers, this system can be used for spot and seam welding, without having to move the workpiece or the focusing optics. The F-theta lens makes it possible to obtain constant focal conditions – and thus identical processing quality – for every point within the processing field.

TRUMPF offers three designs of these programmable focusing optics:

The PFO 20 is largely intended for seam and spot welding within small work areas, whereas the PFO 33 and PFO 3D are best used in conjunction with a laser with a high beam quality, such as the TruDisk laser, for remote welding applications, i.e., for welding at large working distances. The PFO 3D includes an integrated z-axis with a 140 mm stroke that even allows you to perform welding tasks within a three-dimensional workspace. The PFO control unit can be combined with that of a robot, which significantly enlarges the processing area, allowing welding "on-the-fly".

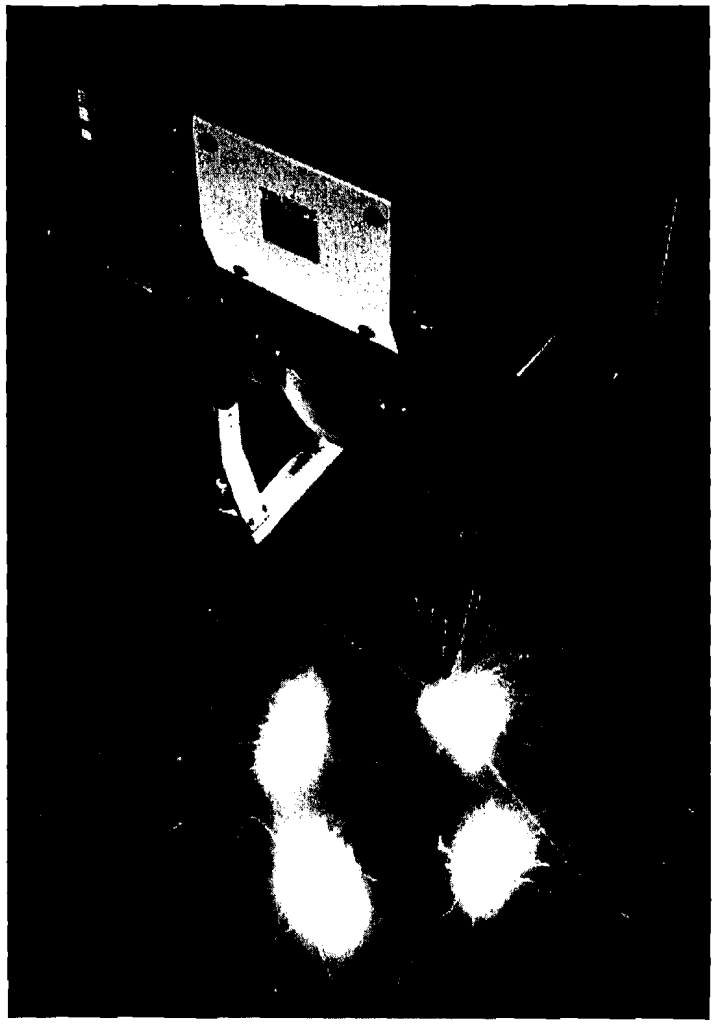
Like focusing optics of the CFO series, PFOs are also integrated in our global Telepresence network.

Programmable focusing optics PFO 3D.



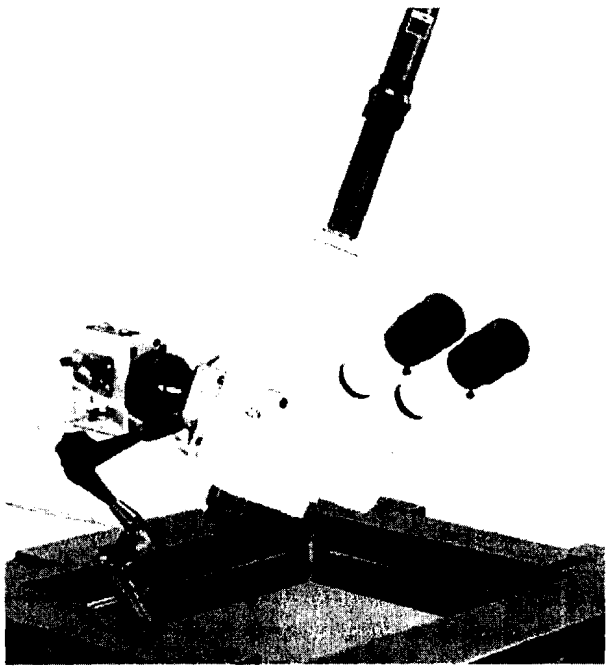
For manual applications.

We offer a focusing optics with a stereo microscope for welding by hand. Along with the integrated visor, this feature allows the operator to make first-rate process observations, and work on even the thinnest welding wires by hand. The diameter of the welding point can be adjusted to the welding task by mechanically moving the motor-driven defocusing unit.



Programmable focusing optics PFO 20

Manual focusing optics with stereo microscope.



Trusted services.

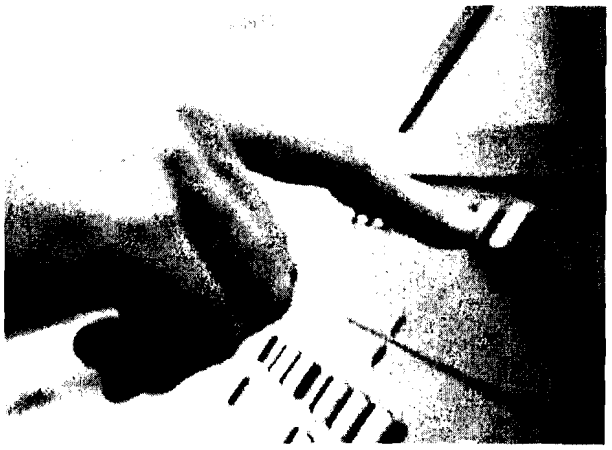
We are

for you.

Our service begins even before you decide to buy a laser. We provide comprehensive consulting services to help you figure out what you really need.

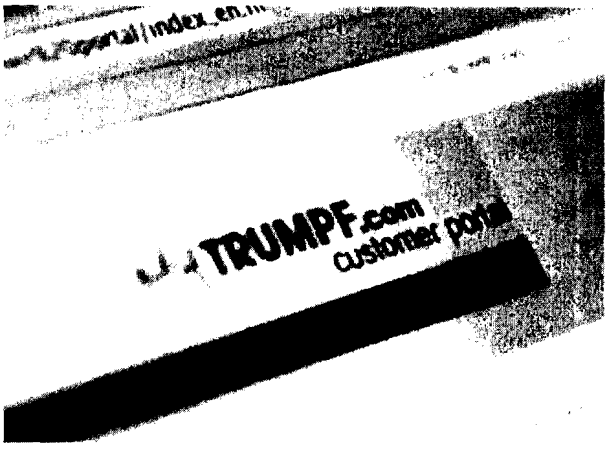
Let's go.

Your laser will be operational in the shortest time possible. The laser, beam guidance system, focusing optics, programming, control unit, and, where applicable, automation components were developed for one another at TRUMPF – eliminating all interface problems.



Comprehensive support.

We support you with made-to-order services that go above and beyond the entire life cycle of your facility, maintaining the machine and upgrading it with new functions upon request. We will train you and your employees so that you can take full advantage of your laser system's potential. Our service is so extensive that we will even visit your site to optimize your machine parameters, in order to help you lower your parts costs and increase both production speed and product quality. We keep downtime and service visits to a minimum, because, with your permission, our specialists can use our online Telepresence service to access your software directly and solve the problem at hand. And, should you need a spare part, we can be reached from anywhere in the world, 24/7, 365 days a year.



TRUMPF is certified according to DIN EN ISO 9001 and VDA 6.4

WENSAUER & PARTNER

ID no. 0376144-40-06-09-F – Subject to change

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February 7, 2011

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Department of Commerce
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Attn: Notice of Inquiry - CCL

Loos & Co., Inc. (CAGE 59157) is a manufacturer of wire rope and wire rope assemblies. The US Military is our largest customer. We are also dominant in the global commercial aviation industry.

We are one of a few manufacturers of US Military Specification wire ropes. These specifications are controlled by a Qualified Products List (QPL) which is controlled by the DLA, specifically the Defense Supply Center – Richmond.

The sale of bulk military specification wire rope is not of concern to us since this specification is the standard for the commercial aviation industry around the world. Its use in the commercial world far exceeds its U.S. Military use. It is so popular that Asian wire rope manufacturers claim to produce cables to the specification despite the fact that none of them are approved or listed in the QPL.

The area of our business that is somewhat grey is the fabrication of wire rope assemblies. There are many applications for wire rope assemblies in military use. They are used for everything from the wire rope that is on a hoist which is on the front of trucks to lanyards that secure a tag to a bomb. They are also used as flight controls in aircraft, on rescue winches on helicopters, and many, many other uses. The two primary Federal Supply Classes (FSC) that these products fall under are 1640 and 4010.

None of these uses are of a nature that would place our country at risk. Wire rope assemblies can be reverse engineered very easily since there are no proprietary secrets to their fabrication.