

**Modular energy supply for longer cable life on robots**

**3-D E-Chain<sup>®</sup> for robot applications**

This long-life, modular energy supply for scara robots can help to secure uninterrupted production flow. With Triflex<sup>®</sup> R, igus<sup>®</sup> now offers robot manufacturers and users a whole new product family .

- Enclosed version now available in 4 sizes (size 70 and new sizes 46, 60 and 100)
- New "E-Z" version, for fast assembly of cables and hoses - available in 4 sizes
- Complete range of strain relief components and mounting brackets available

**More facts on igus<sup>®</sup> Triflex<sup>®</sup> R**

- Triflex<sup>®</sup> R is built of one-piece links that require no additional items for support
- Triflex<sup>®</sup> R can take high tensile forces, due to its "trailer hitch" design principle - Pull forces average 1000N
- High degree of flexibility, even on the 6th axis
- Takes lengthwise torsion of up to  $\pm 380$  degrees over 1 meter
- Smooth, rounded exterior makes it glide well over edgy contours
- Smooth interior increases cable life
- Easy attachment onto the robot / machine reduces setup time
- Lengthening and shortening is possible through modular design
- Outstanding test results in the igus<sup>®</sup> lab: Version TRC-70-110 has surpassed 1 million cycles without a problem. (Cycle time is 50 sec.)



iF-Design  
2004



Closed design



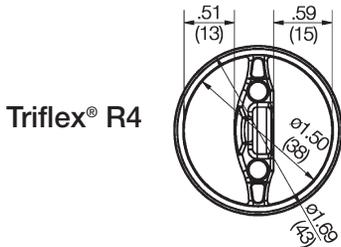
"E-Z" design

igus<sup>®</sup> Energy Chain  
System<sup>®</sup>

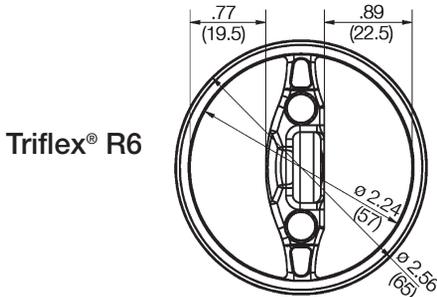
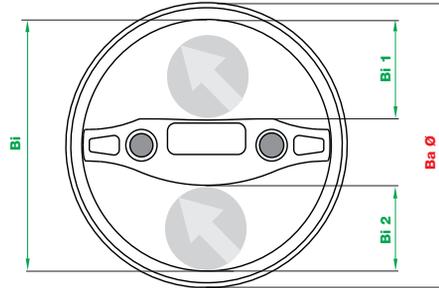
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QuickSpec: <http://www.igus.com/qs/echain.asp>

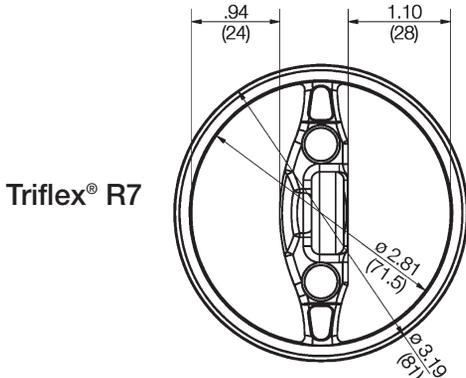
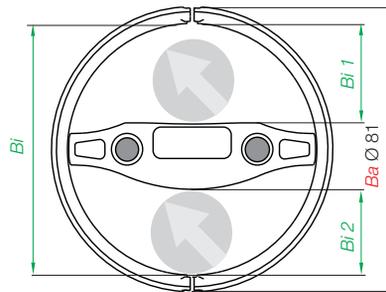
Product range and installation dimensions



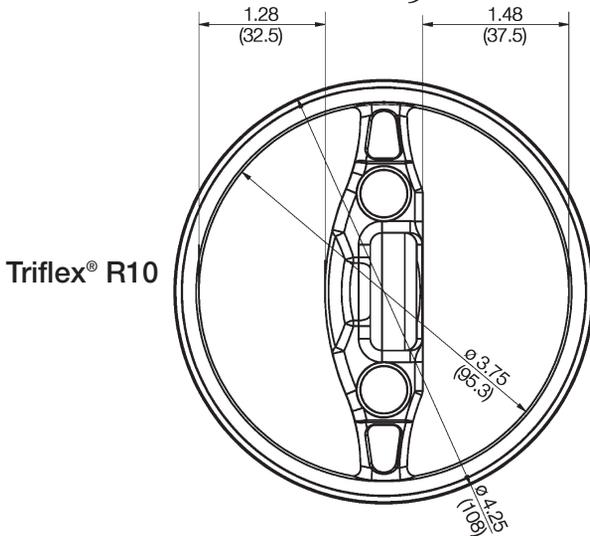
**TRC**  
Closed Design



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**TRE**  
E-Z Design



PDF: [www.igus.com/echainpdf.asp](http://www.igus.com/echainpdf.asp)  
Specs/CAD/Samples/Size Selector/RFQ:  
[www.igus.com/echain.asp](http://www.igus.com/echain.asp)



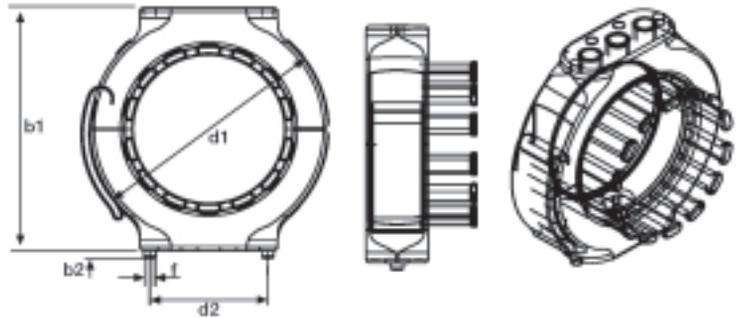
| Series       | Inner width<br>Bi 1 in. (mm) | Inner width<br>Bi 2 in. (mm) | Inner width<br>Bi in. (mm) | Outer width<br>Ba in. (mm) | Bending radii<br>R in. (mm) |
|--------------|------------------------------|------------------------------|----------------------------|----------------------------|-----------------------------|
| TRE-/TRC-40  | .59 (15.0)                   | .51 (13.0)                   | 1.50 (38.0)                | 1.69 (43.0)                | 2.28 (58.0)                 |
| TRE-/TRC-60  | .89 (22.5)                   | .77 (19.5)                   | 2.24 (57.0)                | 2.55 (65.0)                | 3.43 (87.0)                 |
| TRE-/TRC-70  | 1.10 (28.0)                  | .94 (24.0)                   | 2.81 (71.5)                | 3.19 (81.0)                | 4.33 (110.0)                |
| TRE-/TRC-100 | 1.48 (37.5)                  | 1.28 (32.5)                  | 3.75 (95.3)                | 4.25 (108.0)               | 5.71 (145.0)                |



Mounting bracket with strain relief elements for safe strain relief or attachment of Triflex® R to your machine or robot.

Special mounting brackets with snap-lock mechanism for superfast removal allow for very quick maintenance when installing or replacing Triflex® R

- Quick assembly with snap-lock mechanism
- Adapter bores for standard robot styles
- Strain relief elements available
- Can be attached at the ends or anywhere in between



| With Tiewraps | Without Tiewraps | d1         | d2        | b1         | b2        | f        |
|---------------|------------------|------------|-----------|------------|-----------|----------|
|               |                  | in. (mm)   | in. (mm)  | in. (mm)   | in. (mm)  | in. (mm) |
| TR-40-01      | TR-40-02         | 3.22 (82)  | 1.57 (40) | 3.35 (85)  | .10 (2.5) | .19 (3)  |
| TR-60-01      | TR-60-02         | 4.80 (122) | 2.36 (60) | 4.96 (126) | .16 (4)   | .24 (6)  |
| TR-70-01      | TR-70-02         | 4.80 (122) | 2.36 (60) | 4.96 (126) | .16 (4)   | .24 (6)  |
| TR-100-01     | TR-100-02        | 5.98 (152) | 2.36 (60) | 6.02 (153) | .16 (4)   | .24 (6)  |

## Triflex® R Series - Selection and Filling

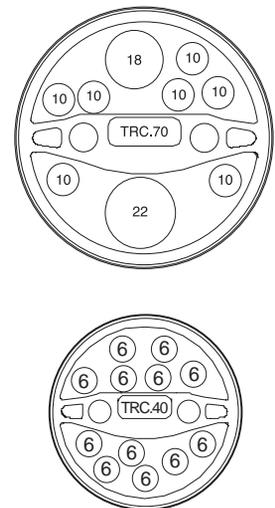
Note: When filling Triflex® R, sufficient clearance needs to be provided for all electric cables, pneumatic and media hoses, in order to compensate for forces from relative motion between the cables and hoses.

As a rule of thumb, the following values apply: The total of cable/hose diameters must not exceed 60% of the available cross section of their Triflex® R component. A clearance of at least 10% (min. 1 mm) needs to be maintained between any two cables/hoses or the Triflex® R. Upon assembly, all cables/hoses need to be able to move freely inside the straightened Triflex® R. Please refer to the chart on this page for an overview of available cross sections for Triflex® R.

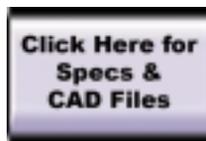
### Example: Cross Section Calculation

|   |  |
|---|--|
| $A_{conduit} = \frac{d^2 \times \Pi}{4}$                        |  |
| <b>Examples:</b>  |  |
| $A_1 = 10 \text{ mm} \times 10 \text{ mm} \times \frac{\pi}{4}$ |  |
| $= 78.5 \text{ mm}^2 \times 7 \text{ (number of conduits)}$     |  |
| $= 549.50 \text{ mm}^2$   |  |
| $A_2 = 18 \text{ mm} \times 18 \text{ mm} \times \frac{\pi}{4}$ |  |
| $= 254.34 \text{ mm}^2$   |  |
| $A_3 = 22 \text{ mm} \times 22 \text{ mm} \times \frac{\pi}{4}$ |  |
| $= 379.94 \text{ mm}^2$   |  |
| $A_{conduit} = A_1 + A_2 + A_3 = 1183.7 \text{ mm}^2$           |  |

### Example: Filling



| Series | Usable Cross Section   |
|--------|------------------------|
| TRC40  | 508.0 mm <sup>2</sup>  |
| TRC60  | 1144.6 mm <sup>2</sup> |
| TRC70  | 1788.0 mm <sup>2</sup> |
| TRC100 | 3177.0 mm <sup>2</sup> |



The smaller the relation between usable cross section and the total of cable/hose diameters, the less the stress of the cables

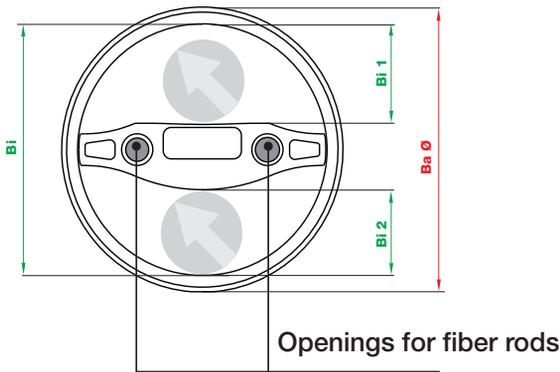


**Fiber rods**

In some applications a high degree of flexibility is not required. In this case fiber rods can be used to mount Triflex® R in a fixed position. This can reduce torsion or it can create pre-tension in specific target areas to keep Triflex® R out of work areas.

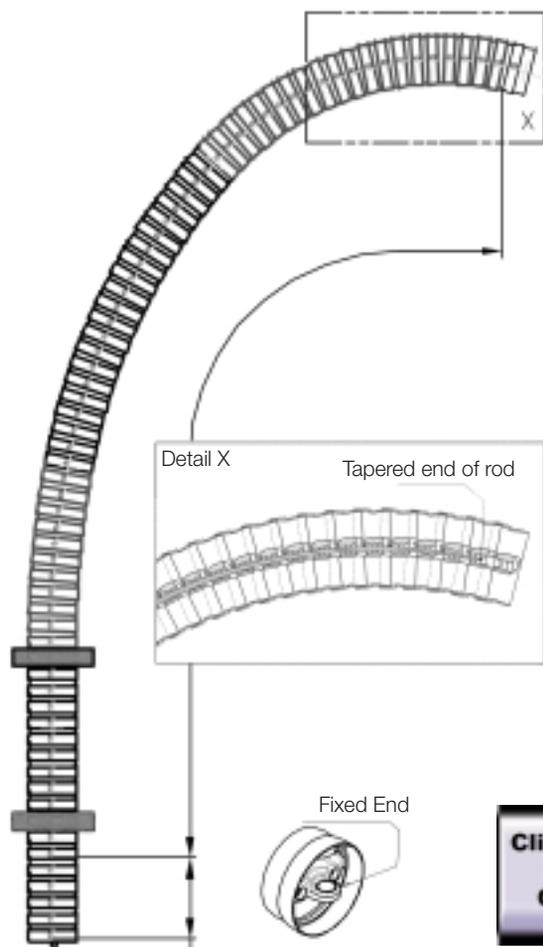
Delivery comes as a preassembled unit, consisting of Triflex® R, installed fiber rods and assembled mounting brackets.

- Full or partial mounting
- Specific pre-tension possible
- Will not catch on the exterior of the robot and provides smooth movement of the Triflex® R in extreme applications.
- Automatic repositioning of Triflex® R to the initial position.



Application with premounted fiber rod element TRC-F-1800-1-0 from the red line with Triflex® R TRC-70-110-0 (without fiber rod).

**NOTE:** Fiber rod segments will flex ONLY, not bend. Fiber rod will break if bent too much. Always use additional links after a fiber rod segment.



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 Specs/CAD/Samples/Size Selector/RFQ:  
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## Assembling Triflex® R



1. Press outer contours opposed to socket against each other



2. Push socket on top of ball and click together

## Disassembling Triflex® R



3. Push screwdriver through perforated window, moving chain links to the maximum bending position on the opposite side



4. Remove socket from ball using the screwdriver as a lever.

## Triflex® R - Chainflex® Robot cable package

Robot cables and other conduits are delivered as harnessed kits.

### Triflex® R - ReadyChain - Chainflex® cable/hose Packages

Turnkey harnessed ReadyChain cable and hose packages, equipped with Chainflex® cables for use on robots. Delivered complete with cables, hoses, connectors and accessories.

ReadyChain minimizes setup time and reduces down time.

Cable and hose packages for robotic applications can be customized with Chainflex® products or other special items.

Robot cables and other conduits are delivered as complete harnessed systems.

Under the igus® CF Robot range, control, data, servo- and motor cables are available.



[Click Here for Specs & CAD Files](#)

## Triflex® R - Testing



Test 1: Triflex® with CF Robot; more than 900,000 torsional movements so far.



Test 2: CF Robot; more than 2,454,600 movements tested okay in long term test.