IOL Con – Interface to Optical Biometer (version 2.2)

To whom it may concern,

The following document contains the information required for manufacturers of biometry devices and medical software developers to create the necessary interfaces to download intraocular lens data and upload surgical results as Extensible Markup Language or Comma Separated Values file.

Contact: admin@iolcon.org

Specification of the Extensible Markup Language: http://www.w3.org/XML

You can provide a version number, e.g. **version=1.7,** to get XML elements specified in a particular version of this interface. Currently versions 1.4 to 1.7 and 2.0 to 2.2 are supported. Updates since version 2.0 are marked green for new, yellow for changed, red for removed.

1. Login

User login at iolcon.org is performed by a HTTP-POST method at

https://iolcon.org/login.php

You have to provide attributes “username” and “password”. IOLCon will then try to set a session cookie, named “sid”, which is used to identify the user and gets revoked after about 12 hours.

2. Surgical Results Upload

Results uploads may be performed by a HTTP-POST method after login and with the session cookie provided at

https://iolcon.org/parseResultsFile.php

Description of all tags in the surgical results file to upload:

Element / *Attribute*	**Description**	**Type / Unit**
<?xml … ?>	XML declaration of the data format	
IOLCon	Root tag contains all uploaded results	
fileVersion	Version of this file format *(optional)*	text
Result	Root tag of a surgical result	
Institution	Name/identifier of the clinic	text
Surgeon	Name/identifier of the surgeon	text
Biometer	Type of the biometer	text
Keratometer	Type of keratometer *(optional)*	text
Patient	Root tag of patient data	
CaseID	Case unique identifier *(optional)*	text
Ethnicity	Specific ethnicity *(optional)*, needed to filter constants, e.g. “caucasian”, “hispanic”	text
Sex	Sex (male/female/other) of the patient *(optional)*	text
Age	Age in years of the patient *(optional)*	number
Eye	Right / OD / left / OS *(optional)*	text
Lens	Root tag of lens data	
Manufacturer	Manufacturer name/identifier	text
Name	Lens name/identifier	text
Position	Intended implant position *(optional)*: capsular bag *(default)* / sulcus ciliaris / retro iridal / pre iridal / anterior chamber	text
PowerEquivalent	Give either spherical equivalent or sphere and cylinder. If both are given, then PowerEquivalent will be preferred	dioptre
PowerSphere		dioptre
PowerCylinder		dioptre
CylinderAxis	Angle of cylinder axis *(optional)*	degree
Biometry	Root tag of biometry related data	
KeratometryIndex	Based on the biometer to convert dioptre to millimetre, e.g. 1.3375	decimal
AxialLength	Axial length	millimetre
AnteriorChamberDepth	Anterior chamber depth	millimetre

Element / *Attribute*	**Description**	**Type / Unit**
LensThickness	Central thickness of the crystalline lens *(optional)*	millimetre
WhiteToWhite	White-to-white corneal diameter *(optional)*	millimetre
KeratometryFlat	Corneal front surface radius (flat meridian of keratometry)	millimetre/dioptre
KeratometrySteep	Corneal front surface radius (steep meridian of keratometry)	millimetre/dioptre
FlatAxis	Angle of flat axis *(optional)*	degree
BackSurface	Mean corneal back surface radius *(optional)*	millimetre
CornealThickness	Central corneal thickness *(optional)*	micrometre
PostOp	Root tag of post-surgical data	
MeasureDistance	Distance of refraction, give unit if in foot *(optional)*	metre/foot
RefractionSphere	Manifest spherical equivalent refraction sphere	dioptre
RefractionCylinder	Manifest spherical equivalent refraction cylinder, if negative it is interpreted as minus cylinder notation, otherwise as plus cylinder notation	dioptre
RefractionAxis	Angle of cylinder axis, former **CylinderAxis** *(optional)*	degree
VisualAcuity	Best corrected visual acuity, former part of **Patient** *(optional)*	decimal

Example results file:

```
<?xml version="1.0" encoding="UTF-8" ?>
<IOLCon fileVersion="2.2">
     <Result>
          <Institution>Saarland University</Institution>
          <Surgeon>Dr. Smith</Surgeon>
          <Biometer>OA-2000</Biometer>
          <Patient>
               <CaseID>abc</CaseID>
               <Ethnicity>caucasian</Ethnicity>
               <Eye>left</Eye>
          </Patient>
          <Lens>
               <Manufacturer>XO test</Manufacturer>
               <Name>iLens 1000</Name>
               <Position>capsular bag</Position>
               <PowerSphere>19.25</PowerSphere>
               <PowerCylinder>0</PowerCylinder>
          </Lens>
          <Biometry KeratometryIndex="1.332">
               <AxialLength>23.77</AxialLength>
               <AnteriorChamberDepth>3.64</AnteriorChamberDepth>
               <LensThickness>3.88</LensThickness>
               <WhiteToWhite>12.0</WhiteToWhite>
               <KeratometryFlat>41.3</KeratometryFlat>
               <KeratometrySteep>43.4</KeratometrySteep>
               <CornealThickness>540</CornealThickness>
          </Biometry>
          <PostOp MeasureDistance="6m">
               <RefractionSphere>0.25</RefractionSphere>
               <RefractionCylinder>-0.75</RefractionCylinder>
               <VisualAcuity>0.9</VisualAcuity>
          </PostOp>
     </Result>
</IOLCon>
```

3. Lens Upload / Download

Lens downloads may be retrieved by a HTTP-GET method via

https://iolcon.org/downloadLenses.php or e.g.

https://iolcon.org/downloadLenses.php?action=download&constants=optimized&ethnicity=all&biometer=all&institution=all&surgeon=all&lenses=170,171,172

Parameter	Allowed values
action	download
lenses	ID number of selected lens
constants	nominal, optimized
ethnicity	all, caucasian, asian, hispanic, …
biometer	all, IOLMaster, Lenstar, OA-2000, Pentacam, …
institution	all, unique institution name
surgeon	all, display name or user name of the surgeon

The selected lenses may be provided as one comma separated list (***lenses***) or multiple times as array elements (***lenses[]***) with the unique lens identifier as value. If the lens identifier is unknown, you have to skip this parameter to get all lenses with their ID and name.

Fields can be empty, if they were not provided by the manufacturer or could not be calculated by us (mostly because of no matching clinical results).

Description of all tags in the downloaded lens file:

Element / *Attribute*	**Description**	**Type / Unit**
<?xml … ?>	XML declaration of the data format	
IOLCon	Root tag contains all downloaded lenses	
fileVersion	Version of this file format	text
downloaded	Download date (YYYY-MM-DD) of this file	date
Lens	Root tag of an intraocular lens	
id	Unique lens identifier in the IOLCon database	number
updated	Date (YYYY-MM-DD) of last constants update	date
Manufacturer	Name of the intraocular lens manufacturer/reseller	text
Name	Lens name given by the manufacturer/reseller	text
Comment	Comment or trade name for this lens	text
Specifications	Root tag of technical parameters	
SinglePiece	yes for monobloc/single piece IOL, otherwise no	boolean
OpticMaterial	PMMA, acrylic, silicone	text
HapticMaterial	PMMA, acrylic, silicone, PVDF	text
Preloaded	yes for preloaded IOL, otherwise no	boolean
Foldable	yes for foldable IOL, otherwise no	boolean
IncisionWidth	Minimum required incision width	millimetre
InjectorSize	Minimum required tip size of the injector	millimetre
Hydro	“hydrophilic” or “hydrophobic”	text
Filter	Filter information, e.g. “clear”, “yellow”, “UV”	text
RefractiveIndex	Refractive index of the lens material at 589 nm	decimal
AbbeNumber	Abbe number	decimal
Achromatic	yes for IOL with chromatic aberration, otherwise no	boolean
OpticDiameter	Optic diameter	millimetre
HapticDiameter	Haptic (full) diameter	millimetre
OpticConcept	Optical concept, e.g. “monofocal”, “bifocal”, “EDoF”	text
HapticDesign	Design of the haptic, e.g. “modified C-loop”	text
IntendedLocation	Intended location of the IOL, e.g. “posterior chamber”	text
OpticDesign	Design of the optical surfaces, e.g. “sphere” or “asphere”	text
Aberration	Spherical Aberration type of the IOL, e.g. “none”, “correcting” or “neutral”	text
saCorrection	Amount of correction of spherical aberration Z(4,0)	micrometre
Toric	yes for IOL with toric design, otherwise no	boolean

Element / *Attribute*	**Description**	**Type / Unit**
Availability	Root tag of available powers, interpreted as plus cylinder notation	
refractivePower	For toric lenses, either “sphere” or “spherical equivalent”	text
tNotation	For toric lenses, yes for cylinder power in t-notation, otherwise no	boolean
Sphere	Root tag of spherical power	
range	Number of range set	number
From	Minimum available power for this set	dioptre
To	Maximum available power for this set	dioptre
Increment	Power increment for this set	dioptre
Cylinder	Root tag of cylindrical power	
range	Number of range set (not t-notation)	number
From	Minimum available power for this set (not t-notation)	dioptre
To	Maximum available power for this set (not t-notation)	dioptre
Increment	Power increment for this set (not t-notation)	dioptre
Power	Single cylindrical power, given multiple times (for t-notation)	dioptre
label	Identifier for this power, e.g. “T2” (for t-notation)	text
Addition	Addition power	dioptre
distance	Distance information for this addition value, either “near” or “intermediate”	text

Element / *Attribute*	**Description**	**Type / Unit**
Constants	Root tag of lens constants, given two times: for manufacturer and for IOLCon provided constants	
type	Type of constant set, either “nominal” or “ULIB” (manufacturer provided) / “optimized” or “personalized” (IOLCon provided)	text
results	Number of results provided by the manufacturer or found with the given filters	number
ethnicity	Ethnicity of the patients where the optimized constants are based on or “all”	text
biometer	Name of the optical biometer which the constants are based on or “all”	text
institution	Name of the Institution/clinic of the ophthalmologist which contributed the data for the optimization or “all”	text
surgeon	(User) Name of this ophthalmologist or “all”	text
Nominal	Nominal A-constant, former **Ultrasound** (only from manufacturer)	number
type	Either “ultrasound” or “optical”	text
SRKt	A-constant for SRK/T formula	number
predictionError	Mean absolute prediction error (for every IOLCon provided constant)	dioptre
Haigis	Root tag for Haigis formula triplet	
a0	a0 constant	number
a1	a1 constant or default value 0.4	number
a2	a2 constant or default value 0.1	number
HofferQ	pACD for Hoffer-Q formula	number
Holladay1	Surgeon factor for Holladay 1 formula	number
Barrett	Root tag for Barrett formula (only from manufacturer)	
LF	Lens Factor	number
DF	Design Factor	number
Olsen	C constant for Olsen formula (only from manufacturer)	number
Castrop	Root tag for Castrop formula (only from IOLCon)	
C	C constant	number
H	H constant	number
R	R constant	number
Cooke	A-constant for Cooke K6 formula (only from IOLCon)	number

Example lens file:

```
<?xml version="1.0" encoding="UTF-8" ?>
<IOLCon fileVersion="2.2" downloaded="2023-11-01">
     <Lens id="123" updated="2023-05-17">
          <Manufacturer>XO test</Manufacturer>
          <LensName>First Lens</LensName>
          <Specifications> <!-- extract -->
               <OpticMaterial>PMMA</OpticMaterial>
               <Preloaded>no</Preloaded>
               <IncisionWidth>7.5</IncisionWidth>
               <Filter>clear</Filter>
               <OpticDiameter>6</OpticDiameter>
               <HapticDiameter>12</HapticDiameter>
               <OpticConcept>monofocal</OpticConcept>
               <OpticDesign>asphere</OpticDesign>
               <Aberration>neutral</Aberration>
               <Toric>no</Toric>
          </Specifications>
          <Availability>
               <Sphere range="1">
                    <From>0</From>
                    <To>20</To>
                    <Increment>0.25</Increment>
               </Sphere>
               <Sphere range="2">
                    <From>20</From>
                    <To>30</To>
                    <Increment>0.5</Increment>
               </Sphere>
          </Availability>
          <Constants type="nominal">
               <Nominal type="ultrasound">118.9</Nominal>
               <SRKt>118.7</SRKt>
               <Haigis>
                    <a0>2.8</a0>
                    <a1>0.4</a1>
                    <a2>0.1</a2>
               </Haigis>
               <HofferQ>5.43</HofferQ>
               <Holladay1>1.23</Holladay1>
               <Barrett>
                    <LF>1.8</LF>
                    <DF></DF>
               </Barrett>
               <Olsen></Olsen>
          </Constants>
          <Constants type="personalized" results="159" ethnicity="all"
                    biometer="all" institution="UKS" surgeon="Dr. Schmidt">
               <SRKt>118.7</SRKt>
               <Haigis>
                    <a0>1.67</a0>
                    <a1>0.4</a1>
                    <a2>0.1</a2>
               </Haigis>
               <HofferQ>5.43</HofferQ>
               <Holladay1>1.23</Holladay1>
               <Castrop></Castrop>
          </Constants>
     </Lens>
```

```
    <Lens id="456" updated="2023-05-28">
        <Manufacturer>XO test</Manufacturer>
        <LensName>Second Lens</LensName>
        <Specifications> <!-- extract -->
            <OpticMaterial>Acryl</OpticMaterial>
            <Preloaded>yes</Preloaded>
            <IncisionWidth>2.5</IncisionWidth>
            <Filter>clear</Filter>
            <OpticDiameter>5</OpticDiameter>
            <HapticDiameter>11</HapticDiameter>
            <OpticConcep>monofocal</OpticConcept>
            <OpticDesign>sphere</OpticDesign>
            <Toric>yes</Toric>
        </Specifications>
        <Availability refractivePower="sphere" tNotation="yes">
            <Sphere range="1">
                <From>0</From>
                <To>20</To>
                <Increment>0.5</Increment>
            </Sphere>
            <Cylinder>
                <Power label="T2">1.0</Power>
                <Power label="T3">1.5</Power>
                <Power label="T4">2.25</Power>
                <Power label="T5">3.0</Power>
            </Cylinder>
        </Availability>
        <Constants type="ULIB" results="357">
            <Nominal type="">118.9</Nominal>
            <SRKt>118.7</SRKt>
            <Haigis>
                <a0>2.8</a0>
                <a1>0.4</a1>
                <a2>0.1</a2>
            </Haigis>
            <HofferQ>5.43</HofferQ>
            <Holladay1>1.23</Holladay1>
            <Barrett>
                <LF>1.8</LF>
                <DF></DF>
            </Barrett>
            <Olsen></Olsen>
        </Constants>
        <Constants type="optimized" results="753">
            <SRKt>118.7</SRKt>
            <Haigis>
                <a0>1.67</a0>
                <a1>0.4</a1>
                <a2>0.1</a2>
            </Haigis>
            <HofferQ>5.43</HofferQ>
            <Holladay1>1.23</Holladay1>
            <Castrop>
                <a0>0.42</a0>
                <a1>0.17</a1>
                <a2>0.03</a2>
            </Castrop>
        </Constants>
    </Lens>
</IOLCon>
```