LB 942

Tristar 5 Multimode Microplate Reader

Operating Manual
69185BA2
Rev. Nr.: 00, 08/2023

Not for use in in-vitro diagnostic (IVD) procedures.

The information in this guide is subject to change without notice.

DISCLAIMER
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This instrument is not designed or intended for use with installations or equipment in hazardous environments. Servicing of the instrument must only be performed by Berthold Technologies Field Service Engineers or service staff authorized by Berthold Technologies.

Please contact our Service Center at service@berthold.com if you have any operational issues.

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1 Preface

1.1 Contact Information

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1.2 The Operating Manual

1.2.1 Validity of the Operation Manual

This operating manual is valid for all configurations of

LB 942 Tristar 5 (ID 69185)

from the delivery of the product to the user until its disposal. Version and release date of this operating manual can be found in the bottom of each page.

Read these instructions thoroughly and completely before working with the product. We have tried to compile all information for safe and proper operation for you. Keep the operating manual for future reference.

The manufacturer reserves the right to make changes to this operating manual at any time without stating reasons.

However, should questions arise which are not answered in this manual please contact bio@berthold.com.

Revision history of the manual

Date	Changes
08/2023	Initial document

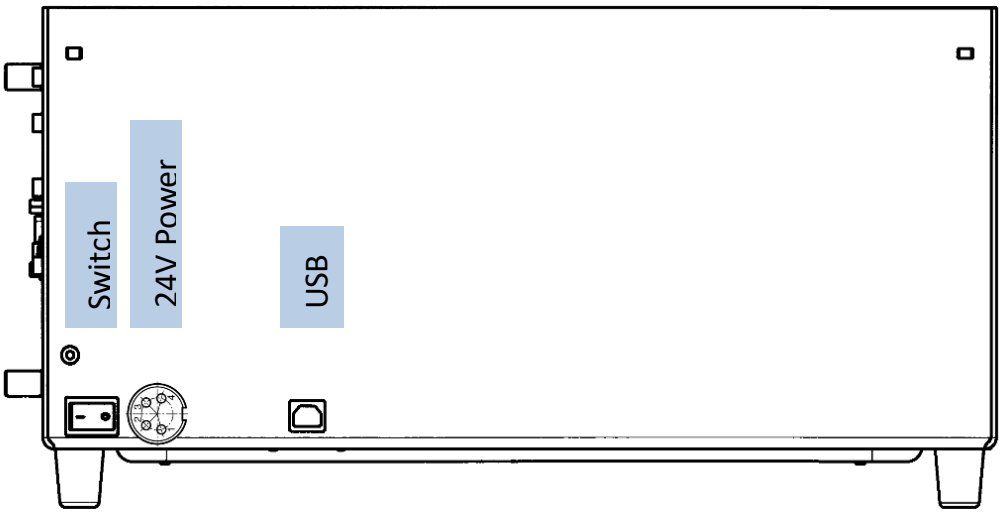
1.2.2 Copyright

This operating manual contains copyright-protected information. None of the chapters may be copied or reproduced in any other form without prior authorisation from the manufacturer.

1.3 Explanation of LEDs and Beeps

LED	Instrument status
lights up **green**	Instrument OK and connection to PC OK
lights up **yellow**	Instrument OK, no connection to PC
flashes **yellow** + 1 short beep	New CAN is installed after power on of instrument
lights up **yellow** + 1 long beep	CAN correctly installed
lights up **red**	Shortly after power on of the instrument (during initialization)
flashes **red** + 2 short beeps	Error after power on of instrument / CAN module not correctly installed

1.4 Connections and Switches



	Description
switch	Power switch
24V Power	Power supply unit (24V DC, only use original power supply)
USB	USB B connection to PC

1.5 Typographical Conventions

1.5.1 Symbols on the Instrument

Symbols	Description
	Warning – general warning, risk of danger
CE	This instrument bears the CE mark, based on conformity to current EC legislation and stated on the declaration of conformity.
	No domestic waste. The electronic product must not be disposed of in domestic waste.
	Manufacturer symbol
	Warning - Hot surface
	Warning – Biohazard material
	Warning – Laser

1.5.2 Warnings, Notes and Symbols used in this Manual

⚠ DANGER

Indicates an imminent, major hazard, which will certainly result in serious injuries or even death if the hazard is not avoided.

⚠ CAUTION

Refers to a potentially dangerous situation, which can result in medium or minor physical injuries or damages to property, if it is not avoided.

NOTICE

If this information is not observed, deterioration in the operation and/or property damage may occur.

IMPORTANT

Sections marked with this symbol point out important information on the product or on handling the product.

Symbols	Description
●	Enumerations
1.	Actions are symbolized by numbers
< >	Buttons are printed inside angular brackets in bold type
[ ]	Menu titles and items, dialog boxes and select lists are printed inside square brackets in bold type
/	Menu items and submenu item are separated by an angular line.

2 Important information

2.1 Safety Instructions

This operating manual includes information and warnings that have to be observed by the user in order to ensure safe operation of the instruments.

IMPORTANT

General notes of the manufacturer:

- The instruments have been manufactured in accordance with the safety requirements for electrical measuring systems.
- The instruments are tested by the manufacturer and supplied in a condition that allows safe and reliable operation.
- Only accessories, in particular desktop power supply, power supply cable and data connection cable if any, supplied with the instrument or by Berthold Technologies for working with this instrument may be used for operation.
- The instrument was tested by an independent accredited testing laboratory. It meets the requirements of DIN EN 61326-1: Class A and is compliant to the limits and methods of DIN EN 55011 Class A. If necessary, take measures to mitigate the radio interferences, which could possibly occur in the domestic environment.

Safety instructions:

Please do always act according to the following safety instructions, before as well as during operation of the system!

⚠ DANGER

Dangerous voltage:

- The user is responsible for connecting the instrument in accordance with the valid regulations for electrical instruments.
- The mains supply voltage range of 100 – 240 VAC ± 10%, 50/60 Hz, must not exceed.
- Disconnect the power supply before opening the instrument.
- To disconnect the unit from the power supply, the plug of the AC adaptor must be disconnected from the unit.
- The electronic unit of the detector generates high voltage. Do not touch it during operation!

- Protect yourself from electrostatic charge, as discharge could damage sensitive instrument parts, especially sensitive parts of the computer and electronics boards. This is especially true when working on device openings, e.g. filter openings.
- The mains adapter is provided with a 3-pole grounded plug. If your wall outlet does not allow connection of a 3-pole plug, have a suitable wall outlet installed by qualified personnel or use an adapter for safe grounding. Please observe the safety specifications of the grounded plug. Set the instrument up to ensure easy access to the mains switch.
- All supplied devices and additional devices must be connected to the mains with grounded connection: Use a grounded plug!

⚠ CAUTION

Damage to persons or property by improper start of operation:

- Before set up and operation of the instrument it is necessary to read the instructions below as neither safe operation of the instrument nor safety of the user are guaranteed otherwise. Failure to follow the instructions may invalidate the warranty.
- If the law lays down regulations on the installation and/or operation of sample measuring systems, then it is the operator's responsibility to adhere to them.

- The manufacturer has done everything possible to guarantee that the equipment functions safely, both electrically and mechanically. The user has to make sure that the instrument will be set up and installed properly to guarantee safe operation.
- This equipment must be installed and used in accordance with the manufacturer´s recommendations. Installation must be performed by properly trained and authorized personnel.
- Set up the device in such a way that the mains plug is easily accessible.
- The ventilation slits must not be covered. A distance of at least 10 cm to neighboring units or walls must be maintained.
- Remove the transportation lock before switching on the instrument.

⚠ CAUTION

Damage to persons or property by improper use of the instrument:

- The instrument may only be operated by personnel who have been trained on the use of the system. It is strongly recommended that all users read this manual prior to use.
- Berthold Technologies assumes no liability for any damages, including those to third parties, caused by improper use or handling of the instrument.
- The units are not for use in in-vitro diagnostic (IVD) procedures. Use the instrument only for the designated application. Please refer to the intended use statement.

- The instrument is designed for indoor use only.
- Hot surface: Care while touching the cover or the lamp, it can be hot. Never touch the heating foil inside the device.
- Never put parts of your body or other devices into the instrument while the unit is in operation.
- If you can see that the instrument has become unsafe to use, switch it off and disconnect it from power supply.
- If liquid gets inside the instruments, pull the power cord. Clean the unit or have it cleaned by an authorized service center.
- The instrument may contain a CLASS 1 LASER PRODUCT. Class 1 laser products are safe for the naked eye under reasonable foreseeable conditions of operation. However, these laser products can be harmful to the eye if the beam is viewed using magnifying optical instruments.

⚠ CAUTION

Damage to persons or property by chemical or biological substances:

- Observe all legal requirements for the handling of biological or chemical assay reagents, samples and waste.
- Prior any measurement/operation with reagent liquids an individual risk assessment has to be done by the user.
- Some assays, assay components or specimen may pose a biohazard, a risk of infection or other kinds of danger for the user. Always adhere to the safety precautions and recommendations for assay performance and temperature range, written in the assay's package insert. Wear appropriate protective equipment such as laboratory coats or chemical rubber cloves and act carefully to avoid chemical burn, contamination and potential infection.
- The operator is responsible for the use of reagents. Follow strongly safety advices of the reagent supplier and the test manufacturer.
- If there is any doubt about the compatibility of decontamination and cleaning agents with parts of the device or with substances contained therein, please contact the device manufacturer or his local representative.

- Use only reagents recommended by the kit manufacturer and in accordance with the kit manufacturer's instructions for the designated assay, for priming the injector lines or washing and cleaning.
- Explosive substances must not be used with the instrument.
- Avoid spilling liquids on the outer surface, the plate carrier or other parts of the instrument.Wipe up all spills immediately and decontaminate the surfaces in cases of biohazard spilled liquids.
- Waste (when priming/washing the tubing) always has to be disposed properly: If a waste pump is installed, a bottle has to be connected. If no waste pump is present, a suitable prime plate has to be placed below the injectors during priming/washing.
- Liquid from priming/washing may be corrosive (see chapter “Cleaning Tubing”)
- Injector solutions may be pumped back only if the appropriate reagent bottle is connected.
- Dispose chemical and biohazard waste carefully and according to local legislation. It is recommended to treat potential biohazard waste by autoclaving.

⚠ CAUTION

Damage to persons or property by improper service or repair:

- The operator may only perform the maintenance work described in this user guide.
- Use only parts described in this manual for servicing.
- The tests and service work recommended by the manufacturer has to be performed to make sure that the operator remains safe and that the instrument continues to work correctly. Any service and maintenance work not described in this user guide has to be performed by authorized service personnel.
- Reliable instrument function can be guaranteed only when original spare parts are used.

- Service and repair work may be carried out by qualified personnel only.
- Do not open any instrument doors as long as the instrument is in operation.
- Disconnect power supply before opening the instrument.
- Upon removal of the front and top parts of the housing no safety measures are in effect. Be aware of any moving parts. The interior of the instrument may reach temperatures that can cause burns. Some parts of the instrument may remain hot without visual indication for some time after the power has been turned off.
- Protect yourself from electrostatic charge, as discharge could damage sensitive instrument parts, especially sensitive parts of the computer and electronics boards.
- There are no exchangeable electrical components in the instrument. In case of malfunction call authorized service personnel.

⚠ CAUTION

Damage to property by incomplete transport package

The instrument should be shipped in its own case. For transport all transportation locks (e.g. for the plate carrier) have to be installed.

NOTICE

Cleaning:

For instrument cleaning, please refer to the respective sections in this manual.

2.2 Consignes de Sécurité

Ce mode d'emploi contient des informations et avertissements qui doivent être suivis par l'utilisateur afin de garantir un fonctionnement en toute sécurité des instruments.

IMPORTANT

Informations générales du fabricant :

- L´appareil a été fabriqué conformément aux directives de sécurité en vigueur pour les appareils de mesure électroniques.
- Les appareils sont contrôlés à l'usine et livrés dans un état assurant la sécurité de fonctionnement.
- Seuls les accessoires, en particulier le bloc d'alimentation, le câble d'alimentation et, le cas échéant, le câble de connexion de données, fournis avec l'instrument ou fournis par Berthold Technologies pour travailler avec cet instrument peuvent être utilisés pour le fonctionnement.
- L'instrument a été testé par un laboratoire d'essai indépendant et accrédité. Il répond aux exigences de la norme DIN EN 61326-1 : Classe A et est conforme aux limites et méthodes de la norme DIN EN 55011 Classe A. Si nécessaire, prenez des mesures pour atténuer les interférences radio qui pourraient éventuellement se produire dans l'environnement domestique.

Consignes de Sécurité:

Il est impératif de respecter les consignes de sécurité suivantes, non seulement avant la mise en service mais aussi pendant le fonctionnement de l'appareil!

⚠ DANGER

Tension électrique dangereuse :

- Il est de la responsabilité de l'utilisateur d'installer l'équipement conformément à la réglementation électrique.
- La plage de tension d'alimentation du secteur ne doit pas dépasser 100 - 240 VAC ± 10%, 50 / 60 Hz.
- Débrancher l'alimentation avant d'ouvrir l'appareil.
- Pour déconnecter l'appareil de l'alimentation électrique, la fiche de l'alimentation doit être retirée de l'appareil.
- L'unité électronique du détecteur génère une tension élevée. Ne pas la toucher pendant le fonctionnement!

- Protégez vous des charges électrostatiques afin d'éviter de provoquer des décharges qui pourraient endommager des parties sensibles de l'appareil telles que les cartes électroniques ou PC. Ceci concerne en particulier lors d'ouvertures de l'appareils, notamment lors de la manutention des barrettes de filtres
- L'instrument est fourni avec une fiche à 3 broches dont une prise de terre. C'est une règle de sécurité. Il est nécessaire que cette fiche puisse être branchée sur une prise reliée à la terre. Dans le cas contraire, veillez à faire appel à un électricien afin d'installer une telle prise. Il ne faut pas négliger cette consigne de sécurité.
- Tous les appareils fournis et les appareils supplémentaires doivent être raccordés au réseau avec mise à la terre : Utilisez une prise de courant avec mise à la terre !

⚠ ATTENTION

Dommages corporels ou matériels en cas de mauvaise mise en service:

- Avant l'installation et la mise en service de l'instrument, tous les utilisateurs des appareils sont tenus de lire ces instructions d'utilisation. Le cas échéant, le fonctionnement correct de l'appareil et la sécurité de l'utilisateur ne peuvent être garantis. Ne pas suivre ces instructions d'utilisation entraine une annulation de la garantie.
- Si des réglementations légales existent pour le montage et/ou l'utilisation d'instruments de mesure, il est de la responsabilité de l'installateur et de l'exploitant de les respecter.
- Le constructeur a fait le nécessaire pour assurer le fonctionnement sûr des appareils (du point de vue électrique, électronique et mécanique). L'utilisateur est tenu de veiller à ce que les appareils soient installés correctement afin de garantir leur utilisation en toute sécurité.

- Les appareils ne doivent être utilisés que par des personnes autorisées et leur utilisation est réservée au personnel compétent. Tous les utilisateurs des appareils sont tenus de lire d'abord ces instructions d'utilisation.
- Installez l'appareil de manière à ce que la fiche secteur soit facilement accessible.
- Les fentes d'aération ne doivent pas être couvertes. Une distance de 10 cm au minimum doit être maintenue entre l'appareil et d'autres appareils ou parois.
- La fixation de transport doit être démontée avant la mise sous tension de l'appareil.
- L'instrument peut contenir un PRODUCT LASER DE CLASSE 1. Les produits laser de classe 1 sont sans danger pour l'œil nu dans des conditions de fonctionnement raisonnablement prévisibles. Toutefois, ces produits laser peuvent être nocifs pour l'œil si le faisceau est observé à l'aide d'instruments optiques grossissants.

⚠ ATTENTION

Dommages corporels ou matériels dus à une mauvaise utilization:

- Les appareils ne doivent être utilisés que par des personnes autorisées et leur utilisation est réservée au personnel compétent. Tous les utilisateurs des appareils sont tenus de lire d'abord ces instructions d'utilisation.
- Berthold Technologies décline toute responsabilité de dommages résultant d'une utilisation non conforme à l'emploi prévu, y compris des dommages causés à un tiers.
- L'appareil n'est pas prevu pour l'utilisation diagnostique in vitro et ne peut être utilisé que pour son usage initiallement prévu.

- L'appareil est destiné uniquement pour une utilisation intérieur.
- Surface chaude: Attention en touchant le couvercle ou la lampe – danger de brûlures! Ne jamais toucher la feuille chauffante à l'intérieur de l'appareil.
- Ne mettez jamais une partie de votre corps ou des objets dans l'appareil lorsque celui-ci est en fonctionnement
- Si vous vous apercevez que le fonctionnement de l'appareil n'est plus sûr, il faut alors l'arrêter et le débrancher de la prise secteur.
- Si du liquide a pénétré dans l'appareil il faut immédiatement le débrancher. Il faut ensuite, le nettoyer ou bien le faire nettoyer par une agence de service après-vente autorisée.

⚠ ATTENTION

Dommages aux personnes ou matériel causés par des substances chimiques ou biologiques:

- Respecter la réglémentation en vigueur concernant la manipulation des déchets biologiques, des réactifs et des prélèvements/échantillons.
- Avant la première mesure ou manipulation avec les réactifs, l'utilisateur doit effectuer une évaluation des risques
- Certains systèmes de tests, composants de tests ou échantillons peuvent potentiellement présenter un risque biologique, un risque d'infection ou un autre type de danger. Respectez toujours les consignes de sécurité et les recommandations relatives à la performance et à la température recommandée du test, inscrites sur la notice. Porter un équipement de protection approprié, comme des blouses de laboratoire et / ou des gants de protection contre les produits chimiques, et faire preuve de prudence pour éviter les brûlures chimiques, la contamination et les infections potentielles.
- L'utilisateur assume la responsabilité exclusive de l'utilisation des réactifs. Respecter scrupuleusement les consignes de sécurité du fournisseur de réactifs et du fabricant du test.
- En cas de doute sur la compatibilité des produits de décontamination et de nettoyage avec les pièces de l'appareil ou avec les substances qu'il contient, veuillez contacter le fabricant de l'appareil ou son représentant local.
- Utilisez uniquement les réactifs recommandés par le fabricant du kit et conformément aux instructions du fabricant du kit pour le test choisi, pour l'amorçage des lignes d'injection ou le lavage et le nettoyage.
- Les substances explosives ne doivent pas être utilisées avec l'appareil.
- Évitez les éclaboussures de liquides sur la surface extérieure, le porte-plaque ou d'autres parties de l'instrument. Essuyez immédiatement toutes les éclaboussures et décontaminez les surfaces en cas de d'éclaboussures de liquides présentant un danger biologique.
- Les déchets (lors de l'amorçage / lavage de la tubulure) doivent toujours être éliminés correctement: si une pompe à déchets est installée, une bouteille doit être connectée. Si aucune pompe à déchets n'est présente, une plaque vide et appropriée doit être placée au-dessous des injecteurs pendant l'amorçage / lavage
- Le liquide provenant du tuyau d'évacuation peut être corrosif (voir chapitre "Cleaning Tubing / lavage des tubulures")
- Les solutions à injecter peuvent être pompéessi le flacon de réactif approprié est connecté
- Éliminer les déchets chimiques et biologiques avec soin et conformément à la législation en vigueur. Il est recommandé de traiter les déchets potentiellement dangereux à l'autoclave.

⚠ ATTENTION

Dommages corporels ou matériels dus à un entretien ou à une réparation inadéquats

- Seuls les travaux d'entretien décrits dans le manuel peuvent être effectués par l'utilisateur.
- Seules les pièces spécifiées peuvent être utilisées.
- Afin d'assurer la sécurité de l'utilisateur et le bon fonctionnement des appareils, effectuer les travaux d'inspection et d'entretien recommandés par le fabricant. Toutes les mesures d'entretien et de réparation allant au-delà de celles spécifiées dans ce manuel sont réservées aux techniciens autorisés.
- Le fonctionnement correcte est garanti si et seulement si les pièces de rechange utilisées soient appropriées.

- Les travaux d'entretien et de réparation devront être confiés exclusivement à des spécialistes dûment formés.
- N'ouvrez aucune porte de l'appareil tant qu'il est en fonctionnement.
- Débrancher l'alimentation avant d'ouvrir l'appareil.
- Si vous ouvrez l'appareil, votre sécurité et celle de l'appareil ne sont plus garanties (capôt et parois de l'appareil). Faites attention aux parties mobiles. L'intérieur de l'appareil et certaines pièces peuvent atteindre des températures pouvant provoquer des brûlures s'il y a contact. Même lorsque l'appareil est éteint, des parties peuvent rester chaudes alors qu'il n'y a pas d'indication visible de température élevée.
- Protégez vous des charges électrostatiques afin d'éviter de provoquer des décharges qui pourraient endommager des parties sensibles de l'appareil telles que les cartes électroniques ou PC.
- Il n'y a pas de composants électriques interchangeables dans l'appareil. En cas de dysfonctionnement, appelez un technicien agréé.

⚠ ATTENTION

Dommages corporels ou matériels dus à un emballage de transport incorrect

Transporter l'appareil uniquement dans son emballage d'origine. Lors du transport, bloquer le support de plaques à l'aide de la vis d'arrêt.

INDICATION

Nettoyage:

Pour le nettoyage de l'instrument veuillez vous référer au paragraphe correspondant dans ce mode d'emploi.

2.3 Sicherheitshinweise

Die vorliegende Bedienungsanweisung enthält Informationen und Warnungen, die vom Benutzer befolgt werden müssen, um einen sicheren Betrieb der Geräte zu ermöglichen.

WICHTIG

Allgemeine Hinweise des Herstellers:

- Die Geräte wurden in Übereinstimmung mit den Sicherheitsanforderungen für elektronische Messgeräte hergestellt.
- Die Geräte sind werkgeprüft und wurden in betriebssicherem Zustand ausgeliefert.
- Zum Betrieb darf nur Zubehör, insbesondere Tischnetzteil, ggf. Netzversorgungskabel und Datenverbindungskabel, verwendet werden, das mit dem Instrument oder von Berthold Technologies für die Arbeit mit diesem Instrument geliefert wurde.
- Das Instrument wurde von einem unabhängigen, akkreditierten Prüflabor getestet. Es erfüllt die Anforderungen der DIN EN 61326-1: Klasse A und entspricht den Grenzwerten und Methoden der DIN EN 55011 Klasse A. Falls erforderlich, sind Maßnahmen zur Minderung der Funkstörungen zu ergreifen, die möglicherweise in häuslicher Umgebung auftreten können.

Sicherheitshinweise:

Handeln Sie immer gemäß der vorliegenden Sicherheitshinweise, sowohl vor als auch während des Gerätebetriebs.

⚠ GEFAHR

Gefährliche elektrische Spannung:

- Es liegt im Verantwortungsbereich des Anwenders, dass die Geräte nach den lokalen elektrischen Vorschriften installiert werden.
- Die Netz-Stromversorgung darf den Spannungsbereich von 100 - 240 VAC ± 10%, 50 / 60 Hz, nicht überschreiten.
- Vor dem Öffnen des Gerätes ist die Stromzufuhr zu unterbrechen.
- Um das Gerät von der Stromversorgung zu trennen, muss der Stecker des Netzteils am Gerät abgezogen werden.
- Die Elektronik des Detektors erzeugt Hochspannung. Sie darf während des Betriebs nicht berührt werden.

- Elektrostatische Aufladungen (z.B. durch Teppichböden) müssen beim Öffnen des Gerätes verhindert werden, da Entladungen am Gerät zur Beschädigung empfindlicher elektronischer Teile, besonders am Computer oder den Elektronik-Boards, führen können. Dies gilt besonders bei Arbeiten an geräteöffnungen, z.B. Filteröffnungen.
- Die Netzadapter sind mit einem 3-poligen Netzkabel ausgestattet. Dies ist eine Sicherheitsausstattung. Wenn die Steckdose keinen 3-poligen Anschluss unterstützt, muss ein Fachelektriker eine passende 3-polige Steckdose installieren oder einen passenden Adapter zur Erdung des Anschlusses bereitstellen. Zerstören Sie niemals die Sicherheitsvorkehrungen des geerdeten Anschlusses.
- Alle gelieferten Geräte und Zusatzgeräte sind geerdet ans Netz anzuschließen: **Schutzkontaktstecker** verwenden!.

⚠ VORSICHT

Personen- oder Sachschäden durch unsachgemäße Inbetriebnahme:

- Vor Inbetriebnahme des Gerätes ist es zwingend erforderlich, die Bedienungsanleitung zu lesen, da ansonsten die Sicherheit des Gerätes und des Benutzers nicht gewährleistet wird. Wenn Sie den Angaben in der Bedienungsanleitung nicht folgen, kann die Garantie erlöschen.
- Bestehen für die Errichtung und/oder den Betrieb von Probenmessgeräten gesetzlich vorgeschriebene Regelungen, so ist es die Aufgabe des Errichters und Betreibers, diese einzuhalten.
- Der Hersteller hat alles unternommen, um ein sicheres Arbeiten der Geräte (bezüglich Elektrik, Elektronik und Mechanik) zu gewährleisten. Der Benutzer muss dafür sorgen, dass die Geräte so aufgestellt und installiert werden, dass ihr sicherer Gebrauch nicht beeinträchtigt wird.

- Die Geräte dürfen nur in Übereinstimmung mit Herstellerempfehlungen installiert und benutzt werden. Die Inbetriebnahme darf nur von ordnungsgemäß trainierten und autorisierten Personen durchgeführt werden.
- Stellen Sie das Gerät so auf, dass der Netzstecker leicht zugänglich ist.
- Die Öffnungen des Ventilators dürfen nicht abgedeckt werden. Der Abstand zum Nachbargerät oder zur Wand muss mindestens 10 cm betragen.
- Die Transportsicherung muss entfernt werden bevor das Gerät eingeschaltet wird.

⚠ VORSICHT

Personen- oder Sachschäden durch unsachgemäßen Gebrauch:

- Die Geräte dürfen nur von dafür geschultem Personal betrieben werden. Es wird allen Anwendern dringend empfohlen, diese Bedienungsanleitung vor Benutzung zu lesen.
- Berthold Technologies übernimmt keinerlei Gewährleistung für Schäden, auch gegenüber Dritten, die durch unsachgemäße Handhabung der Geräte hervorgerufen werden.
- Die Geräte sind nicht für den Einsatz in der In Vitro Diagnostik bestimmt und dürfen nur für den vorgesehenen Zweck eingesetzt werden. Lesen Sie hierzu die Angaben zum bestimmungsgemäßen Gebrauch.

- Die Geräte dürfen nur innerhalb von geschlossenen Räumen betrieben werden.
- Stellen Sie das Gerät so auf, dass Sie es leicht ein- und ausschalten können.
- Heiße Oberfläche: Vorsicht beim Berühren der Abdeckung bzw. der Lampe, sie können heiß sein. Berühren Sie niemals die Heizfolie im Gerät.
- Währund des Gerätebetriebs dürfen niemals Körperteile oder andere Geräte in das Instrument eingebracht werden.
- Bei Beeinträchtigung der Betriebssicherheit sind die Geräte abzuschalten und vom Netz zu trennen.
- Ist Flüssigkeit in das Innere des Gerätes gelangt, Netzstecker ziehen. Das Gerät durch eine autorisierte Servicestelle reinigen lassen.
- Das Gerät kann einen LASER der KLASSE 1 enthalten. Laser der Klasse 1 sind unter normalen, vorhersehbaren Betriebsbedingungen für das bloße Auge sicher. Laser können jedoch für das Auge schädlich sein, wenn der Strahl mit Hilfe optischer Vergrößerungsvorrichtungen betrachtet wird.

⚠ VORSICHT

Personen- oder Sachschäden durch chemische oder biologische Substanzen:

- Beachten Sie alle gesetzlichen Vorschriften für den Umgang mit biologischem Abfall, mit Reagenzien und Proben
- Vor der Messung/Benutzung von Reagenzien muss der Anwender eine individuelle Risikoanalyse durchführen.
- Einige Testsysteme, Testkomponenten oder Proben können potentiell eine biologische Gefährdung, ein Infektionsrisiko oder eine andere Art von Gefahr darstellen. Halten Sie immer die Sicherheitsmaßnahmen und die Empfehlungen für die Testdurchführung und den Temperaturbereich ein, wie sie in der Beilage des Testsystems angegeben sind. Tragen Sie angemessene Schutzausrüstung, wie Laborkittel oder Chemikalien- Schutzhandschuhe und arbeiten Sie vorsichtig, um chemische Verätzung, Kontamination und potentielle Infektion zu vermeiden.
- Die Anwendung der Reagenzien liegt im alleinigen Verantwortungsbereich des Benutzers. Befolgen Sie alle Sicherheitsanweisungen des Reagenzienlieferanten und des Testherstellers.
- Bestehen Zweifel an der Verträglichkeit von Dekontaminations- und Reinigungsmitteln mit Teilen des Gerätes oder mit darin enthaltenen Stoffen, wenden Sie sich bitte an den Gerätehersteller oder seinen lokalen Vertreter.

- Es dürfen nur vom Testhersteller empfohlene Reagenzien in Übereinstimmung mit seinen Angaben für den ausgewählten Test, das Füllen der Injektorschläuche oder Waschen und Reinigen, verwendet werden.
- Explosive Substanzen dürfen nicht mit dem Gerät verwendet werden.
- Vermeiden Sie das Spritzen von Flüssigkeiten auf die äußeren Oberflächen, den Plattenträger oder andere Teile des Instruments. Wischen Sie alle Spritzer sofort weg und dekontaminieren Sie die Oberflächen im Fall von verspritzten biogefährdenden Flüssigkeiten.
- Flüssigabfall vom Füllen oder Reinigen der Schläuche muss immer ordentlich entsorgt werden. Wenn eine Abfallpumpe installiert ist, muss eine Flasche angeschlossen werden. Falls keine Abfallpumpe vorhanden ist, muss ein passendes Auffanggefäß (prime plate) während des Füllens und Reinigens unter den Injektoren plaziert werden.
- Flüssigkeiten, die aus dem Abfallschlauch kommen, können ätzend sein (siehe Abschnitt Cleaning tubing)
- Flüssigkeiten aus den Injektoren dürfen nur zurückgepumpt werden, wenn die entsprechende Reagenzienflasche angeschlossen ist.
- Entsorgen Sie chemischen und biogefährdenden Abfall vorsichtig und entsprechend der lokalen Gestzgebung. Es wird empfohlen, potentiell bio-gefährdenden Abfall zu autoklavieren.

⚠ VORSICHT

Personen- oder Sachschäden durch unsachgemäße Wartung oder Reparatur:

- Es dürfen nur die im Handbuch beschriebenen Wartungsarbeiten vom Anwender ausgeführt werden.
- Bei Wartungsarbeiten dürfen nur die angegebenen Teile verwendet werden.
- Für die Sicherheit des Benutzers und die Funktionsfähigkeit der Geräte sind die vom Hersteller empfohlenen Überprüfungen und Wartungsmaßnahmen durchzuführen. Alle über die Betriebsanleitung hinausgehenden Wartungs-und Instandhaltungsmaßnahmen dürfen nur von autorisierten Technikern ausgeführt werden.
- Ordnungsgemäße Funktionalität kann nur bei Verwendung der Original-Ersatzteile garantiert werden.

- Service- und Reparaturarbeiten dürfen nur von Fachleuten ausgeführt werden.
- Öffnen Sie das Gerät nicht solange es in Betrieb ist.
- Vor dem Öffnen des Gerätes ist die Stromzufuhr zu unterbrechen.
- Wenn das Gerät geöffnet ist sind Sicherheitsmaßnahmen nicht mehr in Betrieb. Auf bewegliche Komponenten achten! Das Innere der Geräte kann Temperaturen erreichen, die Verbrennungen verursachen können. Einige Teile können heiß bleiben ohne sichtbare Zeichen, auch nachdem das Gerät abgeschaltet worden ist.
- Elektrostatische Aufladungen (z.B. durch Teppichböden) müssen beim Öffnen des Gerätes verhindert werden, da Entladungen am Gerät zur Beschädigung empfindlicher elektronischer Teile, besonders am Computer oder den Elektronik-Boards, führen können.
- Es gibt im Gerät keine austauschbaren elektrischen Komponenten. Rufen Sie im Fehlerfall autorisiertes Servicepersonal.

⚠ VORSICHT

Sachschaden durch fehlerhafte Transportverpackung:

Das Gerät sollte nur in der eigenen Verpackung transportiert werden. Beim Transport ist darauf zu achten, dass alle Transportsicherungen (z.B. für den Plattenträger) eingesetzt werden.

HINWEIS

Reinigung:

Zum Reinigen des Gerätes bitte den entsprechenden Teil dieser Bedienungsanleitung beachten.

2.4 Further Instructions

Storage conditions

Before delivery or if the instrument is not used for a longer period of time, store it in the original storage case in a dust-free environment and protected from direct sunlight and significant temperature fluctuations.

Storage temperature : 0-40°C
Humidity: 10 - 85% humidity, no condensation

Return shipment

If the instrument has to be returned to Berthold Technologies for re-calibration, servicing or inspection, we recommend to use the original storage case. Please contact the service for further instructions. Refer to chapter 9.3 for details.

Disposal

Decontaminate the instrument before disposal! This instruments contains electronic parts. To prevent environmental pollution please dispose the instrument and the corresponding accessories according to local legislation. Within the EC dispose the instrument and accessories according to the WEEE directive or contact your local representative.

3 Introduction

3.1 Intended Use

The Tristar 5 is a modular multi-technology microplate reader for different types of fluorescent, luminescent and absorbance research applications.

The units are not for use in in-vitro diagnostic (IVD) procedures.

These units are not designed for use in hazardous areas.

3.2 Description

The availability of measurement technologies in an individual instrument is dependent on your order. All Tristar 5 instruments are equipped with filter optics. One or two monochromators are available for measurement additionally.

The Tristar 5 microplate reader is distinguished by its exceptionally high sensitivity allowing detection limits in scientifically relevant magnitudes with low reagent consumption.

Detector sensitivity and stability are the result of Berthold Technologies´ experience with thousands of photon counters. The patent pending dual mode photodetector combines the advantages of true photon counting for high sensitive luminescence measurements with quasi background-free operation of the triggered analogue mode for best fluorescence results.

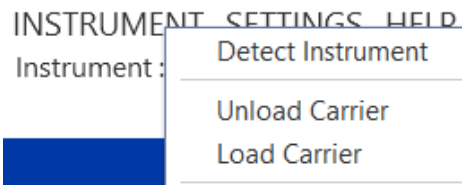
True photon counting has the benefit that no user parameters need to be set, ensuring the same conditions are used for every measurement during the instrument´s entire life time. The fast photon counting circuitry provides a dynamic range in excess of six orders of magnitude, which complements the range of the latest assays. For fluorescence measurements a pulse triggered analogue circuitry is implemented in the detector electronics, offering quasi temperature independent and noise-free operation.

A proprietary design of the optical system achieves absolute minimization of cross-talk down to 10^{-6} (depending on the type of microplate). A double grating monochromator in 3D design (option) can be used instead

of filters for wavelength selection with variable settings for the slit widths for adjustable spectral bandwidths.

The instrument can read solid plates as well as strip plates from 6 to 384 well formats with a height not exceeding 21 mm (respective adapter frames need to be applied).

3.2.1 Plate Tray



The instrument front panel includes the plate tray. It can be opened and closed under control of the LightCompass software using the commands **[Load Carrier]/[Unload Carrier]**.

3.2.2 Filter Slides

Behind the big front flap the filter sliders are accessible. To replace or clean the filter you have to manually open the flap and eject the slides via software.

Proceed as follows

- Open the flap by hand; make sure the plate carrier is inside the instrument
- In the **[Excitation Filter Slide]** dialog box, click on the button **<Eject Slide>**
- Clean or replace filter.
- Push in filter holder all the way into the slide.
- Click **<OK>** in the **[Excitation Filter Slide]** dialog box. The slide moves all the way into the instrument.
- Do this with the emission filters in an analogous way.

Cleaning filters

- Filters should be cleaned using a lint-free cloth or, better, a micro fibre cloth, as used for cleaning eye glasses.

3.2.3 Overload Detection

The detector has an overload detection function to prevent the PMT from damage by high levels of light.

LightCompass supports this by displaying the expression **Overload** instead of a value.

3.2.4 Injectors

The tubing from the solution bottles are connected to the injector ports using screw-type caps. The reagent trough and the reagent mounts provide means to position reagent vials safely.

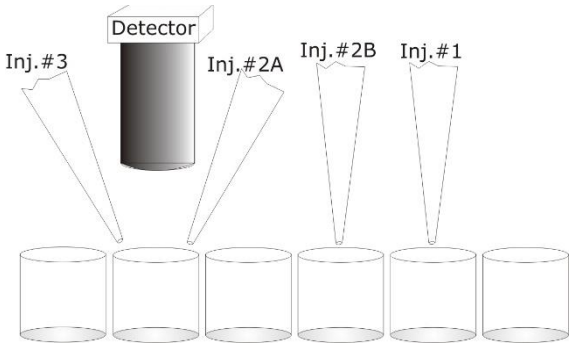
Injector parameters

The parameters for control of the injector are entered in the software:

- For measurement in the **[Measurement Page]** of the **Protocol Wizard** or in **[Protocol Tab]**
- For washing and priming in the **[Instrument]** menu.

Injector Tip Location

The outlet-tips of the injectors are located right above to top level of the microplate The tips may be installed in different locations in horizontal orientation with respect to the measurement position:



3.2.5 Alpha Screen™ Option

For AlphaScreen™ measurements the instrument may be equipped (optional) with a laser diode (5 mW) for excitation of the donor beads.

To ensure optimum yield of the laser excitation the laser is located right at well surface. The access port is the former channel for the tip of injector #2, which cannot be used when the AlphaScreen™ option is installed.

3.2.6 Shaking Function

Shaking is controlled by software. The following shaking modes are available with variable amplitudes and speed:

- linear
- orbital

- double-orbital

Shake Modus	Amplitude [mm]	Slow [RPM]	Normal [RPM]	Fast [RPM]
Linear	max 1	300	540	1020
	max 2	300	540	840
	max 3	300	540	660
	max 4	300	540	540
	max 5	300	420	420
Orbital	max 1	300	540	1020
	max 2	300	540	840
	max 3	300	540	660
	max 4	300	540	540
	max 5	300	420	420
Double Orbital	max 1	300	540	540
	max 2	300	420	420
	max 3	240	240	240
	max 4	240	240	240
	max 5	240	240	240

3.2.7 Aperture, Excitation Optics and Beam Size

The settings for the aperture, the excitation optics and the beam size of the monochromator are made in the software.

IMPORTANT

Berthold Technologies recommends to use the **Default** settings.

Refer to the following tables for the available settings:

Aperture

Options	Description	Use for

Default	Depending on the selected microplate format, one of the following options will be preset automatically.	
0-Rd. 6.7	Round aperture Ø 6.7 mm	Luminescence, 6-96 well format
1-Square 3.7	Square aperture 3.7 mm	Luminescence, 384 well format
2-Rd 11	Round aperture Ø 11 mm	Fluorescence and Absorbance, all plate formats; Priming
3-Rd-2	Round aperture Ø 2 mm	HTRF 384 well

Excitations optics (Tristar 5 only)

Options	Description	Use with
Default	Depending on instrument configuration and available technologies, one of the following options will be preset automatically.	
0-Open	No limitation of the excitation beam Ø 6-7 mm	Filter; HTRF only
1-Laser		currently unused
2-Small filter 0.25 mm	Excitation beam reduced	Filter (top)
3-Wide filter 0.45 mm	Excitation beam only slightly reduced ≙ Default when using filters	Filter (top)
4-Mono	Monochromator position setting	Mono
5-Mono Order Sorting Filter 1	Additional sorting filter; depending on selected wavelength the order sorting filter is selected by software automatically	Mono
6-Mono Order Sorting Filter 2	Additional sorting filter; depending on selected wavelength the order sorting	Mono

Options	Description	Use with
	filter is selected by software automatically	
7-Bottom Filter	For bottom reading	Filter (bottom)

IMPORTANT

The submenu Excitation Optics contains summerizing information about possible settings for filters and monochromator.

If excitation filters are used, it is possible to select between the options for filters (Default, or 0-, 2-, 3-, 7-).

If a monochromator is used, this submenu is invisible, as the 4-Mono setting is fix and the settings 5/6-Mono Order Sorting Filter are automatically selected by software.

Beam size Mono (Tristar 5 only)

Options	Description	Use for
Default	Default ≙ Wide no automatic preset depending on plate format! In cases of 384 well microplates select Narrow actively.	
Narrow	2.5 mm	384 well format
Wide	3.5 mm	96 well format

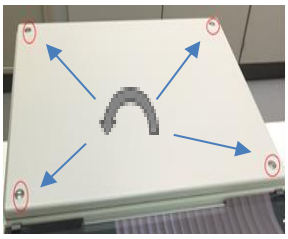
4 Installation

Read this part completely prior to starting the first steps and make sure that all prerequisites are met as described below.

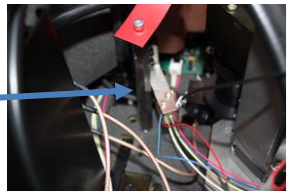
4.1 Unpacking and Setup

1. Unpack your Tristar 5 model and its accessories.
2. The instrument is heavy and unhandy to lift. It must be carried by 2 persons. Grab the device only from below (the device pedestals are raised therefore) and never at the lamp housing, and put it onto an appropriate laboratory desk.
3. Open the big front flap and remove the transportation safety device.

4. Open the top lid of the instrument by removing the four screws.



5. Remove the transportation lock indicated by the red tap. It's a magnetic fixation. Please pull upwards to release the magnet.



6. Remove external power supply from its box and connect to power cord. Connect the power cord to the respective socket of the instrument

Mains socket

7. Verify the mains switch is in **OFF** position
8. Check if your mains supply is within the permissible range of the external power supply operating voltage **(100 – 240 VAC ± 10%; 50 / 60 Hz).**

   Connect instrument only if it is matching!

9. Put the jack of the external power supply into the wall outlet
10. For the consecutive software installation the in-strument should remain **turned off**.

4.2 Software Installation

The instrument will be run with the LightCompass software.

The device names displayed by the software vary depending on model and are therefor referred to in this manual as **[Tristar x].**

IMPORTANT

LightCompass software description:

The installation description of the LightCompass software is part of this this manual. All additional information will be found in the LightCompass software manual, coming in electronic form with the software.

See chapter 4.2.2 for information about the destination location.

IMPORTANT

Precondition for the LightCompass software:

Windows compatible PC or tablet with Windows 10 or newer.

4.2.1 Installation of LightCompass Software

The LightCompass operating software is delivered on a USB stick which can be found in the accessories box of the instrument.

IMPORTANT

Software installation

- Do not connect the instrument to the PC during software installation.
- Install the LightCompass software first.
- For installation local administrator level is necessary.

Installation

1. Close all Windows applications before you start installing the LightCompass software.
2. Insert the USB stick into a free USB slot and browse to the USB root directory.
3. The USB stick contains the Setup file for the LightCompass software. Double-click the **.exe file** to start the installation.

   Depending on Windows security settings Security Warnings dialogues may appear during the installation steps. Always confirm the messages to continue the installation.
4. Follow the installation wizard. Select / insert your entries. Confirm your entries with **<OK>** or **<Next>**. Close the dialog with **<finished>**.
5. The LightCompass Software icon will appear on your desktop after installation.

4.2.2 Registration

1. Double-click the LightCompass icon. The software will open and show a **[registration form]** dialog box.
2. Use the LightCompass software within the trial period of 30 days after first run without registration. A prompt to enter a registration password will appear each time the software is started until the registration password is entered.

   User may close the **[Registration Form]** dialog box by clicking **<Run now, Register Later>** and continue working with the software. The remaining days of the trial period are decremented.

3. **Obtain Password:** Press the Web button on the registration form, insert the required information in the predefined web registration form and submit it to Berthold Technologies.

   Please provide the System ID of the PC. The number is printed in red in the registration dialog of the software (see picture above).

   The owner will receive the registration password from Berthold Technologies via E-Mail.

4. **Enter Password:** Enter the password within 30 days to enable unlimited use.

   When the **[Registration Form]** dialog box appears, enter the user's name, the company name and the provided password. Click **<Register Now>**. Upon entry of the correct password, continue using the software. The **[Registration Form]** dialog box will not appear again.

4.3 Installing Filters

The instrument comes with an excitation and an emission filter slide, each capable of holding up to 5 filters.

Emission filters →

Excitation filters →

Depending on your order the instrument is equipped with different measurement technologies and the following filters are included.

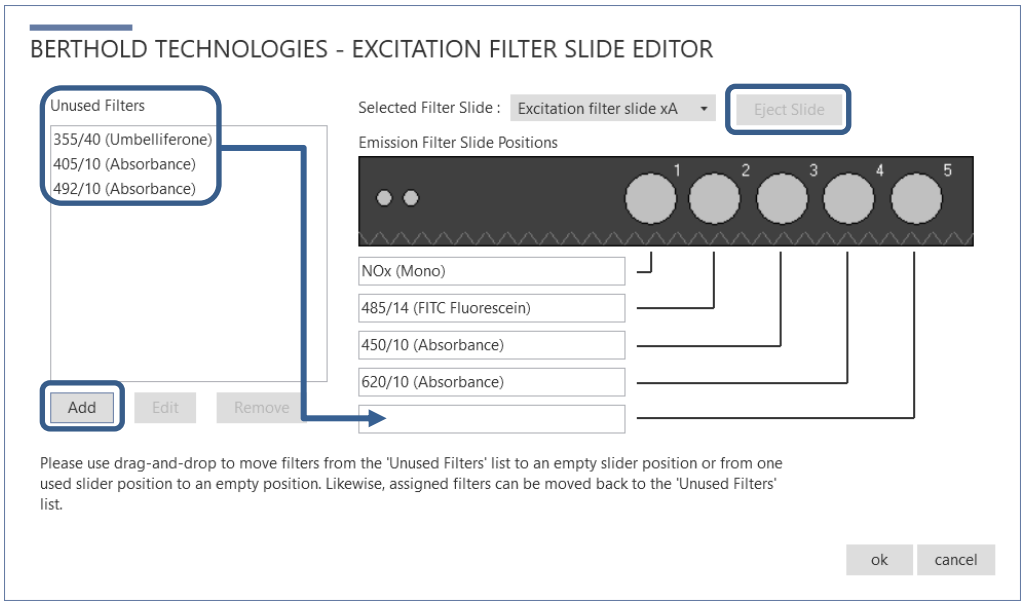
Measurement technology	Included filters
Absorbance reading	450nm absorbance filter
Fluorescence reading	Ex 485/14 nm Em 535/25 nm
TRF	Ex 350/40 nm Em 615/8 nm
TR-FRET/HTRF	Ex 320/40 nm Em 620/10 nm and 665/7 nm

Additional filters may be ordered individually and can be installed easily, both physically and in the software.

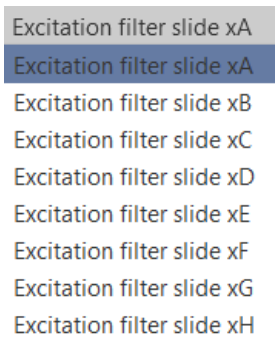
4.3.1 Installing Excitation Filters

Proceed as follows to define a new (additional) filter:

1. Select **[Instrument]/[Excitation Filter Slide]** in the software.
2. Click **<Add>**
3. Define a descriptive **[Name]** for the new filter and check the **[Usage]** in the **[Add Filter]** dialog box. Click **<OK>.**
4. Highlight the new filter in the list of **[Unused Filters]** and drag it into an empty **[Excitation Filter Slide Position]**.



5. Some filter slides are preconfigured for certain measurement technologies:



   xD = time resolved fluorescence (TRF) and TR-FRET
   xE, xF, xG = fluorescence polarization (FP).

6. Open the big flap at the front of the instrument.
7. Click **<Eject Slide>** in the **[Excitation Filter Slide]** dialog box.
8. Remove the excitation filter slide from the instrument.
9. Mount the filter(s) into the position(s) defined in the software. For excitation and absorbance, filters of 25 mm, 15 mm and 12.7 mm can be used. Filters of 15 mm and 12.7 mm diameter can only be mounted by using an adapter and a clamp ring.

Filters with diameter	to be mounted with

12.7 mm (1/2 inch)	adapter **ID 57194** and clamp ring **ID 57195**
15 mm	adapter **ID 54666** and clamp ring **ID 34767**
25 mm (1 inch)	-----

25 mm 15 mm 12.7 mm

Excitation filter mounted

10. Insert the slide again until the front of the slide is aligned with the front of the instrument
11. Click **<OK>** and close the front flap.

4.3.2 Installing Emission Filters

Emission filters are installed in almost the same manner as excitation filters.

1. Select **[Instrument]/[Emission Filter Slide]** in the software.

2.-8.Act according to the description in section 4.3.1 Installing Excitation Filtersfor the emission filter slide, too.

9. Mount the filter(s) into the position(s) defined in the software.

   25mm filters are recommended for emission as they ideally matching the emission light path. Filters with **12.7mm (1/2 inch) and 15 mm** diameter may be used, but not recommended, as sensitivity will be compromised. If these filters shall be used, they need to be mounted with the clamp rings and adapters stated in the table of item 9. in section 4.3.1

Emission filters mounted

Position 5 is reserved for Luminescence readings

10. **NOTE:** Emission filter mH for bottom measurement position (see instructions in the description of the distinct measurement technologies for details) use special filter slides with apertures and integrated 45° degree mirrors to redirect the bottom emission to the detector. Filters may be mounted above these mirrors as described above.

4.4 Bottom Reading Position

Some instrument models can measure microplates from the bottom reading position, exciting the sample and collecting the emission light from underneath the microplate. This measurement mode is available for selected readout technologies (see description of the respective technologies for details).

NOTE: To use the bottom reading position, make sure, an mH emission filter slider is installed and the red microplate frame is used.

4.5 Recommendations for proper handling

IMPORTANT

Recommendations for good and consistant results:

- Do not expose instrument to direct sunlight.
- Set up instrument in dry rooms.
- Open lid for loading filter/microplates or cleaning only to keep light and dust out.
- Keep the plate carrier free from dirt.
- Remove spilled reagents immediately with a damp cloth or optical grade tissue.
- Very bright samples may cause saturation of the PMT (indicated by an "Overload" message); let the PMT recover for a few seconds.

NOTICE

Rules to avoid damages to mechanical, electrical and optical components:

- Load microplates correctly.
- Do not use microplates or strip plates with heights exceeding 21 mm.
- Do not fill the microplates above their specified maximum volume.
- Do not shake completely filled microplates in the instrument.
- Do not overfill the reagent trough as liquid spills in the injector compartment may cause severe damage to the electrical system; take special care when ice in the trough starts to melt.

5 LightCompass Software

5.1 LightCompass Directories and Files

The directories for data and parameter files are defaulted as described below. Any accessible directory on the computer and the local network can be selected though when saving data and parameter files using the "**Save … File As…**" command.

Default directories

- Data files ProgramData\LightCompass\Measurement
- Protocol files ProgramData\LightCompass\Protocol

In consequence each Windows user has own directories containing his data and protocol files. Hence, when users log on, individually shared files may need to be copied to each user´s directory.

File Names

There is no limitation in naming data and protocol files other than the Microsoft Windows conventions.

Measurement file names need to be defined prior to the measurement start. Renaming is possible using the **[Save As…]** command producing a copy of the data file with a new name.

Protocol file names can be defined any time during the creation of a protocol. Renaming is possible using the **[Save As…]** command producing a copy of the protocol file with a new name.

File Types

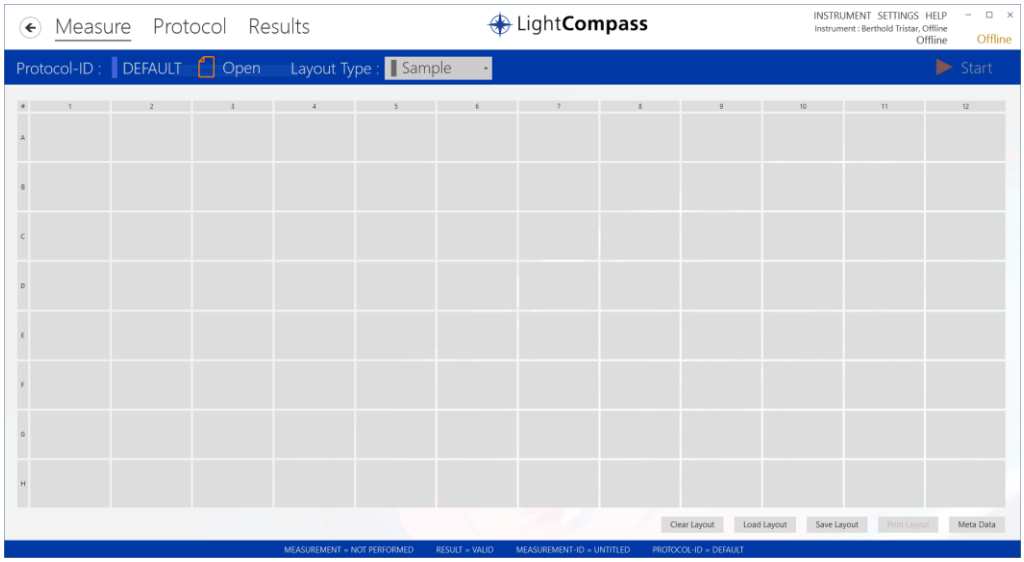
LightCompass works with different file types indicated by the respective file name extensions.

- Measurement files have the extension **.meas**
- Protocol files have the extension **.prot**

5.2 LightCompass User Interface

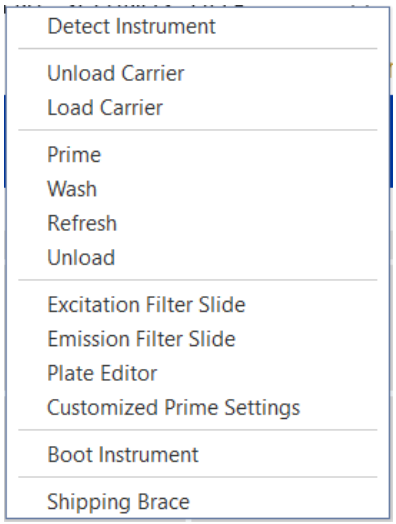
5.2.1 LightCompass Default Setup

Default main screen of LightCompass:



5.2.2 Instrument Menu

In the Instrument menu basic instrument settings and communication may be accessed.



[Detect Instrument] detects the connected Berthold instrument

[Unload Carrier] moves plate out of the instrument

[Load Carrier] moves plate into the instrument

[Prime] starts the priming sequence (filling the lines)

[Wash] starts the washing sequence (cleaning the lines)

[Refresh] injects once to fill the tip (e.g. after longer periods of idleness)

[Unload] starts the unloading sequence (recovering reagents back into the reservoir)

[Excitation Filter Slide] dialogue for definition and positioning of excitation filters

[Emission Filter Slide] dialogue for definition and positioning of emission filters

[Plate Editor] dialogue for definition of microplate dimensions. See section 6.1 for details.

[Custom. Prime Settings] dialogue for editing prime sequences
For the setting and options please read chapter "Priming Tubings"

[Boot Instrument] establishes communication and boots instrument

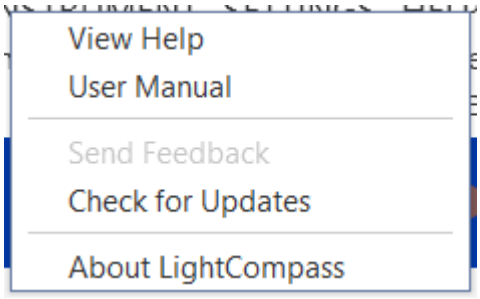
[Shipping Brace] moves XY table to a position enabling the insertion of the transportation lock

5.2.3 Settings Menu

In the **[Settings]** menu you can define the default root directory for the measurement and protocol files. Also you can manage security settings, instrument drivers and appearance of the software itself.

5.2.4 Help Menu

The **[Help]** menu allows you to view basic software information, open the software maual, send feedback and check online for updates.



6 Operation with LightCompass

Defining protocols and running measurements on the Tristar 3 and Tristar 5 is straight forward. The procedure is the same for all types of assay types, e.g. Raw Data, Dual Label, Kinetic, Repeated, Scanning and Spectral Scanning. A measurement can be carried out immediately after a stored protocol is selected. At the end of each measurement the results are stored and may be printed or exported.

Result file names can be given without limitation. The extension for result files as well as measurement files is fixed, though.

6.1 Adding and Editing Microplate Dimensions

Microplates must be defined in the plate editor prior to defining a measurement protocol. Some microplate models are predefined.

Microplates can differ in their dimensions dependent on brand and type. Please refer to the manufacturer´s most recent information for exact dimensions of the microplates.

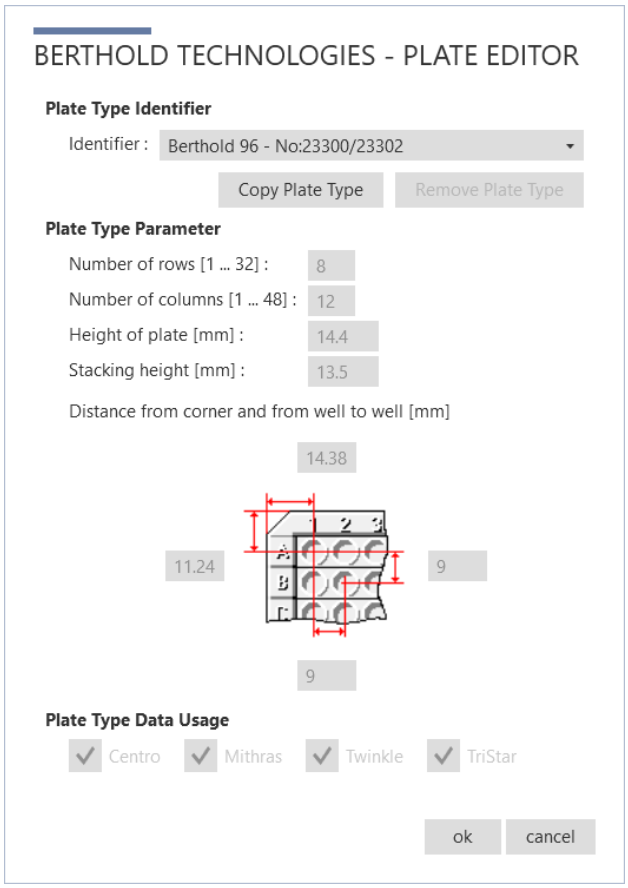
NOTICE

Microplate dimensions

Only 6 to 384 well plates with a plate height up to 21 mm are supported in the Tristar 5.

Petry dishes, Terasaki plates and filter membranes can be used, but have to be specified individually.

1. Click **[Instrument]/[Plate Editor].**



2. Click **<Copy Platy Type>** to create a new plate and change all necessary information to your new plate and name it accordingly.

[Identifier]	insert a descriptive name
[Number of rows]	e.g. 8 for a 96 well plate
[Number of columns]	e.g. 12 for a 96 well plate
[Height of the plate]	insert the plate height in mm. Most 96 and 384 well plates are between 14 and 15.5 mm.
[Stacking height]	the stacking height of the microplate is the resulting height (the visible part) when plates are put on top of each other (e.g. in a plate stacker). In case this information is not available from the plate manufacturer the stacking height can be derived by stacking 2 plates and measuring the total height; by subtracting the regular height of one of the plates the resulting value will be the stacking height

[Distance from corner and from well to well]:

Insert the distance between the left outer edge of the plate and the center of well A1.

Insert the distance between to upper outer edge of the plate and the center of well A1.

Insert the distance between the well centers of consecutive rows (vertical well distance).

Insert the distance between the well centers of consecutive columns (horizontal well distance).

[Plate Type Data Usage] check the **[TriStar]** checkbox

you may check additional instruments in case you have multiple instruments in operation

3. Click **<ok>** to take over the information. The plate can now be used in the protocol files

6.2 Define a Protocol – Protocol Wizard

IMPORTANT

The protocol setup can be guided through a wizard. Most of the steps passed through the protocol setup are similar in all kinds of protocols, both Raw Data and Curve Fit, and independent from the used measurement technology.

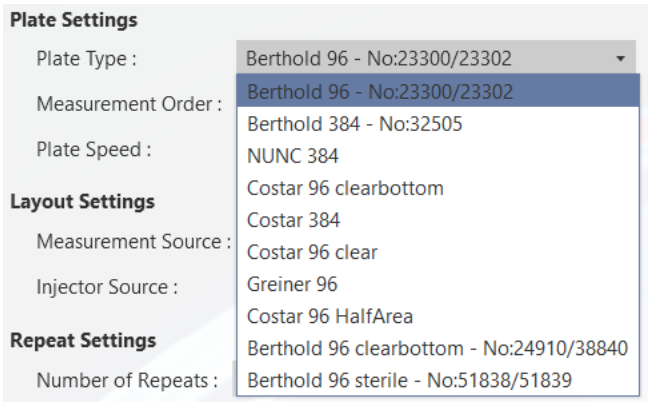
1. To set up a protocol via the Wizard proceed as follows:
   - Switch to the **[Protocol]** tab, click **[Open]** and then **[Protocol Wizard]** on the right side of the software window.
   - Click **[Add Step]** or **[Remove Step]** to edit your protocol
   - Click **[Next]** to get to the next page
   - After finishing all steps click on **[Finish]** so end the protocol wizard
   - Your protocol is loaded and ready to run

2. To set up a new protocol manually proceed as follows:

- Switch to the **[Protocol]** tab, click **[Reset]** to set everything to default
- Click **[Add Step]** or **[Remove Step]** to edit your protocol
- Set the Step Properties for each Step you add
- After finishing the setup click on **[Save As…]** to save the Protocol and give it a descriptive name
- Your protocol is loaded and ready to run

6.3 Settings

1. **[Plate Type]**



Some microplates are predefined in the software.

Additional microplates have to be defined in the **[Plate Editor]** prior to defining a protocol. See section 6.1 for details.

2. **[Measurement Order]**

Define if the plate shall be measured by row or by Column. Choose Meander and the plate will be moved in a meander-shape inside the machine. This will make the measurement faster as it saves time in plate movement.

3. **[Plate Speed]**

Define how fast the plate shall be moved inide the machine. Please don't choose fast if the wells are filled to the maximum to prevent spilling.

4. **[Measurement Source]**

This defines the wells to be measured with this protocol file. Choose **Layout** and all wells that you define in the **Measure tab** will be measured.

5. **[Injector Source]**

   This defines the wells that will be injected into with this protocol file. Choose **Layout** and all wells that you mark with the available injectors in the **Measure tab** will be injected into.

6. **[Repeat Settings]**

   Here you can define the number of repeats and the corresponding cycle time.

7. **[Temperature Settings]**

   If you habe an instrument with temperature control you can activate the temperature control here and set the desired temperature. The current temperature of the instrument can be obsereved in the status bar in the upper right corner of the software.

8. **[Plate movements]**

   Here you can define how the hadling of the plate should be before and after a measurement.

6.4 Endpoint

1. **[Label Settings]**

   Here you can define a name for this specific step and give a description.

2. **[Measurement Settings]**

   Choose the Technology with wich you want to measure. Please note that the list may vary depending on the features your instruments is equipped with.

   You can set a delay before each reading of a well and define the measurement time (counting time) for each well. Depending on the selected technology you may also be given more options to choose from e.g. voltage setting for the photomultiplier.

3. **[Filter Settings]**

   Here you can choose between measuring with filters only or if you want to measure with 1 or 2 monochromators. Again this setting may vary depending on the features your instruments is equipped with and the selected Measurment technology.

   Please select the filters you want to use and/or set the Emission Wavelength and Slit Width of the monochromator(s).

   Please leave the Aperture and Excitation Optic setting on Default. In this case the machine uses the optimal setting for the measurement.

You can also set up a second measurement wich is then performed directly after the first measurement with different setting that you can program here.

4. **[Operation Mode]**

   Choose to measure by well or by plate.

6.5 Kinetic

1. **[Label Settings]**

   Here you can define a name for this specific step and give a description.

2. **[Measurement Settings]**

   Choose the Technology with wich you want to measure. Please note that the list may vary depending on the features your instruments is equipped with.

   You can set a delay before each reading of a well and define the measurement time (counting time) for each well. Depending on the selected technology you may also be given more options to choose from e.g. voltage setting for the photomultiplier.

3. **[Kinetic Settings]**

   Here you can set up the total time the measurement should last, the counting time for each well and an optional delay time for each well. From these data the number of repeats is calculated automatically.

4. **[Filter Settings]**

   Here you can choose between measuring with filters only or if you want to measure with 1 or 2 monochromators. Again this setting may vary depending on the features your instruments is equipped with and the selected Measurment technology.

   Please select the filters you want to use and/or set the Emission Wavelength and Slit Width of the monochromator(s).

   Please leave the Aperture and Excitation Optic setting on Default. In this case the machine uses the optimal setting for the measurement.

   You can also set up a second measurement wich is then performed directly after the first measurement with different setting that you can program here.

6.6 Repeated

1. **[Label Settings]**

   Here you can define a name for this specific step and give a description.

2. **[Measurement Settings]**

   Choose the Technology with wich you want to measure. Please note that the list may vary depending on the features your instruments is equipped with.

3. **[Repeat Settings]**

   Here you can set up the total time the measurement should last, the counting time for each well and the cycle time for one cycle. From these data the number of repeats is calculated automatically.

4. **[Filter Settings]**

   Here you can choose between measuring with filters only or if you want to measure with 1 or 2 monochromators. Again this setting may vary depending on the features your instruments is equipped with and the selected Measurment technology.

   Please select the filters you want to use and/or set the Emission Wavelength and Slit Width of the monochromator(s).

   Please leave the Aperture and Excitation Optic setting on Default. In this case the machine uses the optimal setting for the measurement.

   You can choose to use 1 or more Injectors and choose at which cycle, speed and volume the injectors should be operational.

5. **[Operation Mode]**

   Choose to measure by well or by plate.

6.7 Area Scan

1. **[Label Settings]**

   Here you can define a name for this specific step and give a description.

2. **[Measurement Settings]**

   Choose the Technology with wich you want to measure. Please note that the list may vary depending on the features your instruments is equipped with.

You can set a delay before each reading of a well and define the measurement time (counting time) for each well. Depending on the selected technology you may also be given more options to choose from e.g. voltage setting for the photomultiplier

3. **[Filter Settings]**

   Here you can choose between measuring with filters only or if you want to measure with 1 or 2 monochromators. Again this setting may vary depending on the features your instruments is equipped with and the selected Measurment technology.

   Please select the filters you want to use and/or set the Emission Wavelength and Slit Width of the monochromator(s).

   Please leave the Aperture and Excitation Optic setting on Default. In this case the machine uses the optimal setting for the measurement.

4. **[Scanning Settings]**

   Here you can select the numbers of steps per well scan, the displacement between each scanning step and the scanning mode.

6.8 Spectral Scan

1. **[Label Settings]**

   Here you can define a name for this specific step and give a description.

2. **[Measurement Settings]**

   Choose the Technology with wich you want to measure. Please note that the list may vary depending on the features your instruments is equipped with.

   You can set a delay before each reading of a well and define the measurement time (counting time) for each well. Depending on the selected technology you may also be given more options to choose from e.g. voltage setting for the photomultiplier.

3. **[Scanning Settings]**

   Here you can set up the way the scan shall take place by setting the excitation/emission start and end wavelength as well as the slit width. You can either scan with the excitation or emission monocharomator and use a filter or monochromator on the other side.

   You can set up the scanning quality wich defines the increment wavelength to make the scan faster with low resolution or slower with a

high resolution. It is also possible to manually set the increment wavelength by selecting **Customized**.

Please leave the Beam size and Aperture setting on Default. In this case the machine uses the optimal setting for the measurement.

6.9 Dispense

With this step you define an injection with one injector. To dispense with more than 1 injector just select this step multiple times and place it at the desired postion in your protocol workflow.

1. **[Injector Settings]**

   Here you can define which injector shall be used for the injection, which volume shall be dispensed and at what speed.

2. **[Repeat Settings]**

   In case you have programmed more than 1 plate repeat you can choose here in which cycle the injection shall take place.

3. **[Operation Mode]**

   Choose to operate by well or by plate.

6.10 Shake

With this step you define a shaking step. If you want to shake the plate more often during the protocol just select this step multiple times and place it at the desired postion in your workflow.

1. **[Shake Settings]**

   Here you can define the duration of the shaking in seconds (0.1 – 3600 seconds), at what speed the shaking should take place, how far the plate carrier should move and how the movement shall look like.

2. **[Repeat Settings]**

   In case you have programmed more than 1 plate repeat you can choose here in which cycle the injection shall take place.

3. **[Operation Mode]**

   Choose to operate by well or by plate.

6.11 Delay

With this step you define a delay step. If you want to insert a delay time more often during the protocol just select this step multiple times and place it at the desired postion in your workflow.

1. **[Delay Settings]**

   Here you can set the delay time from 0.1 to 3600 seconds.

2. **[Repeat Settings]**

   In case you have set up more than 1 repeat you can select if the delay should be performed with every repeat or only with the first repeat.

3. **[Operation Mode]**

   Choose to operate by well or by plate.

6.12 Unload

With this step you define an unload step of the microplate. If you want to insert an unload step more often during the protocol just select this step multiple times and place it at the desired postion in your workflow.

1. **[Unload Settings]**

   Here you can set up the time how long the microplate shall remain outside of the instrument (from 0.1 to 3600 seconds).

2. **[Repeat Settings]**

   In case you have set up more than 1 repeat you can select if the unload should be performed with every repeat or only with the first repeat.

3. **[Operation Mode]**

   Choose to operate by well or by plate.

7 Maintenance

7.1 Priming the Tubing

7.1.1 Priming before Measurement

Some assays require the injection of reagent prior or during measurement. For good operation the injection lines have to be primed previously.

NOTICE

Priming injectors:

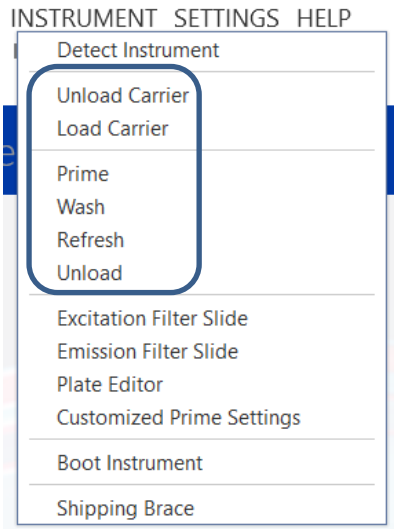
It is strongly recommended to perform the priming with deionized water first and leaving the lines filled with deionized water before priming with reagents.

This procedure avoids reagents aerosol splashes at the injector tips and thus contamination of the instrument.

⚠ CAUTION

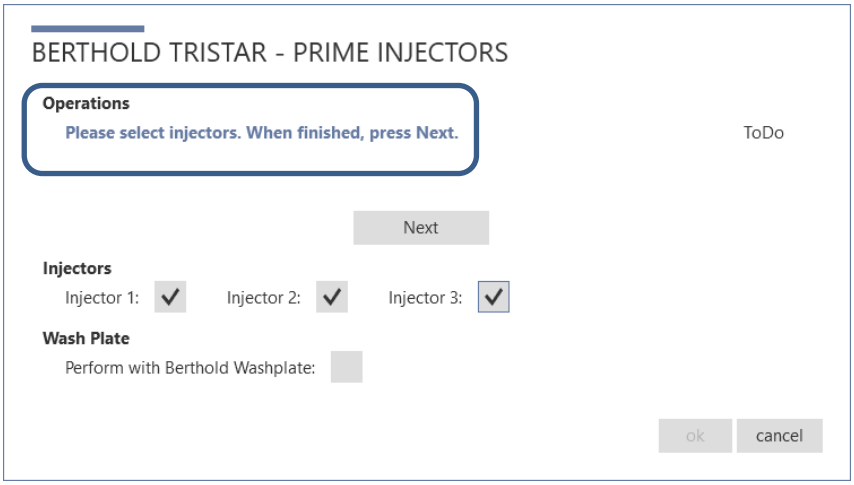
Reagent trough:

Do not overfill the reagent trough as liquid spills in the injector compartment may cause severe damage to the electrical system. Take special care when ice in the trough starts to melt.



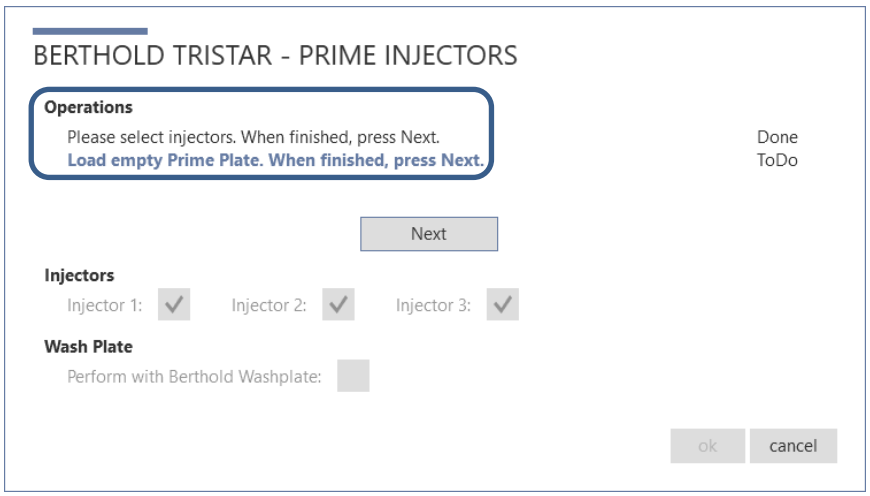
To prime the injection lines act as follows:

1. Click **[Instrument]/[Prime]** and set the information as requested on the screen.



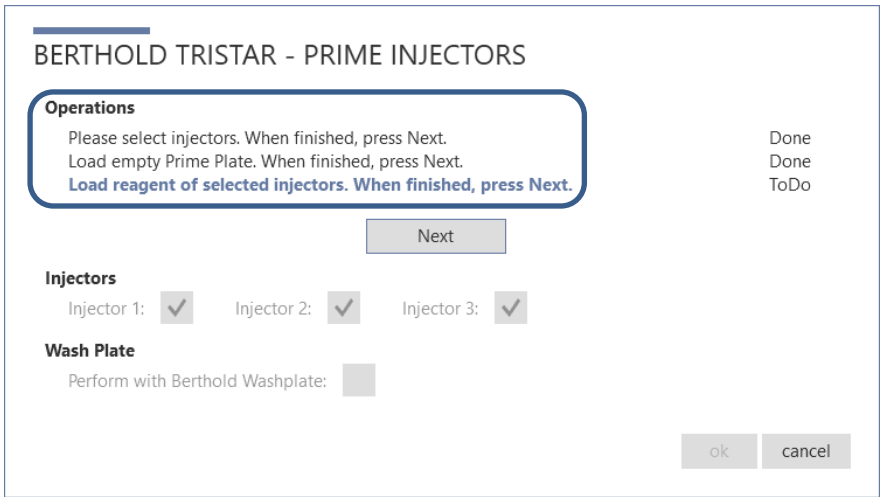
[Perform with Berthold Washplate] Check if available.
[Injectors] Check the repective Injectors to be primed.
Click **<Next>**.

2. Load the empty Berthold Washplate or any other empty 96 well microplate.



Click **<Next>**.

3. Load the selected injectors with the desired reagents.



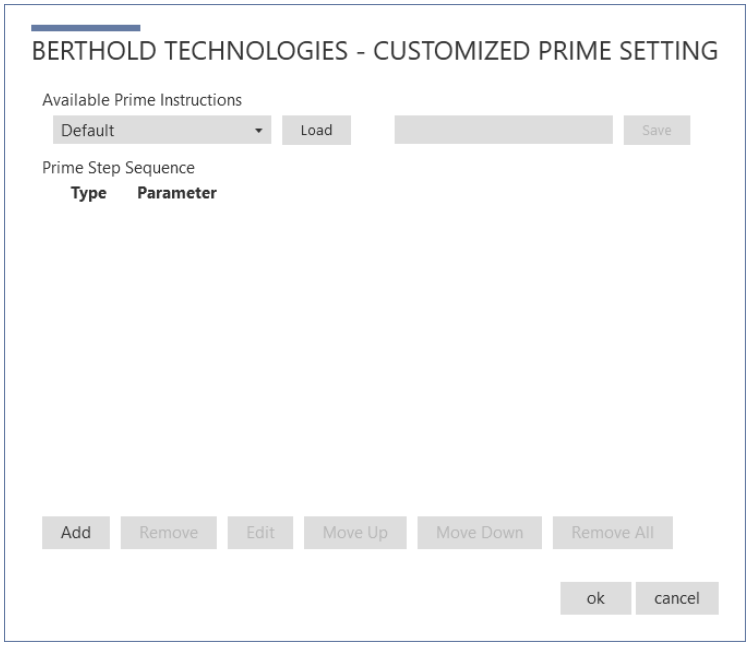
Click **<Next>**.

4. The injection cycle will begin. Click **<ok>** after the procedure is finished to exit the dialog
5. Remove the prime / wash plate by clicking **[Unload Carrier]** in the **[Instrument]** menu. The injectors are now ready to use.

7.1.2 Customizing the Priming Sequence

Some reagents (e.g. with high viscosity) or solutions (e.g. cells) require special priming procedures which can be defined individually.

1. Click **[Instrument]/[Customized Prime Settings]** to open the Prime Customize dialog. By Standard the Default Settings are used. To see the procdure behind that click on **<Load>**



2. You can add, remove or edit steps in the procedure by clicking **<Add>**, **<Remove>** or **<Edit>**. To edit a step you can also double click it.

   The following operations and settings are available:

   - Injection

     The injector is filled with the max. injection volume from the reagent reservoir and injects the set volume.

[Volume]	[%] of the max. injection volume
[Delay]	delay before operation [s]
[Speed]	1 … 10
[Repeats]	number of repeats

   - Delay

     The delay time that elapses between operations, e.g. to mimic the injection timing of the assay (this can be important with a cell suspension)

[Delay]	elapsing time [s]

   - Oscillate

     The injector is (partly) filled and oscillates between the set positions (back into the reagent reservoir).

[Start. Point]	% of the max. injection volume
[End Point]	% of the max. injection volume
[Speed]	1 … 10
[Repeats]	number of repeats

   - Ventilate

     The injector is completely filled (beyond the max. injection volume) from the reagent reservoir and injects the total volume of the bellow.

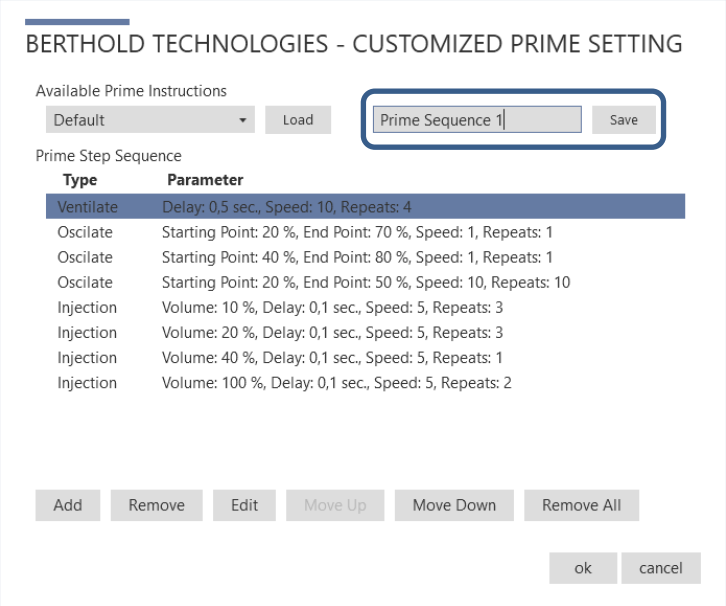
[Delay]	delay before operation [s]
[Speed]	1 … 10
[Repeats]	number of repeats

   - Prime

     The injector is filled with the max. injection volume from the reagent reservoir and injects the full volume.

[Delay]	delay before operation [s]
[Speed]	1 … 10
[Repeats]	number of repeats

3. You can change the order of the priming sequence by clicking on the specific step you want to move and then click **<Move Up>** or **<Move Down>**
4. To save the new or edited priming sequence please give it a name and click **<Save>**.



5. Now this sequence will be used in the Prime procedure described in 7.1.1.

7.2 Cleaning the Instrument

NOTICE

If there is any doubt about the compatibility of cleaning agents with parts of the device or with substances contained therein, please contact the device manufacturer or his local representative.

7.2.1 Cleaning the Surfaces

The surface of the instrument is protected by a washable finish.

- Dirty or dusty surfaces should be cleaned using a damp cloth or optical grade tissue.
- If necessary, use a mild detergent or diluted Ethanol (70%).

  Do not use a scouring agent!
- For bio-hazardous spills use an appropriate disinfectant, e.g. 5 % bleach. Use a damp cloth or an optical grade tissue.

7.2.2 Cleaning the Inside of the Instrument

The inside does not need to be cleaned regularly. Only in case of liquid spillage it may be necessary to clean the inside. Call a Berthold Technologies technical support person.

NOTICE

Do not open the instrument by yourself!

Call a Berthold Technologies technical support person.

Service Technicians only: Before opening the instrument, turn it off and disconnect it from power supply! Open the screws on the instrument cover to clean the instrument inside. Then detach the cover by moving or lifting it carefully.

Always keep the sample holders and the entire inside of the instrument clean. Wipe off any dirt using a damp cloth or optical grade tissue. Use cotton buds for corners. Remove dirt quickly so it does not get fry and may not have any adverse effect on moving parts.

7.3 Cleaning the Tubing

Injector tubing has to be washed

- before starting work
- before changing reagents
- at the end of each work session before turning off the instrument
- after longer periods of inactivity

IMPORTANT

CLEANIT DAILY:

The injector cleaning solution CLEANIT DAILY, to be ordered at Berthold Technologies, product code 45218, is an efficient and proven cleaning solution for most of the common reagents in use. It is recommended to use this solution at least once a weak to ensure a long lifetime of the injectors!

CAUTION

Solutions recommended by the kit manufacturer

may be used for daily cleaning. Some of these reagents may be hazardous. Please refer to the respective safety instructions (e.g. H and P codes) of the supplier.

Potential recommended cleaning reagents may be

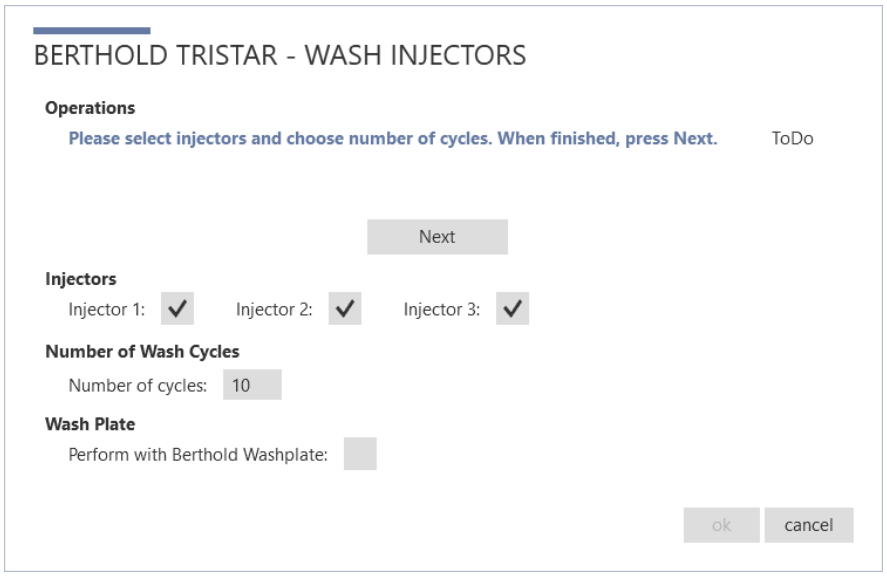
- deionised water
- diluted alcohol: 70 % Ethanol or Isopropanol
- 2 - 5 % hypochlorite solution (“bleach”)
- 0.5 – 1 M Chloric acid (HCl)
- 0.5 – 1 M Sodium hydroxide (NaOH)
- 0.1 % SDS
- Non-foaming detergent (up to 10 %)

IMPORTANT

Wash with deionised water

After use of any reagent for cleaning and decontamination, wash with deionised water then to replace the reagent.

1. Click **[Instrument]/[Load Carrier]** and insert the wash plate or another 96 well plate.
2. Click **[Instrument]/[Wash]** to open the **[Wash Injectors Menu]** and set the information as requested on the screen. Choose the Injectors that shall be wahed and define the **[number of wash cycles]**.



[Number of Wash cycles] usually ≥ 20, depending on assay reagents and microplates (see warning in section 3. below)

[Perform with Berthold Washplate] Check if available. Without the wash plate a maximum of only 24 cycles is possible.

[Injectors] Check the repective Injectors to be washed

3. Click **<Next>** and follow the instruction that appear on the screen.

⚠ CAUTION

Make sure the total Wash volume does not exceed the volume of the plate being used!

4. Wait until the wash cycles are completed and click **<ok>.**
5. Click **[Instrument]/[Unload carrier]** to remove the wash plate.

After cleaning, the tubings have to be re-primed with the respective assay reagent prior to use.

IMPORTANT

Recommendations for of idle periods:

- For periods of hours up to a few days leave deionised water in the injection lines.
- For longer periods of multiple days up to weeks wash the lines with a reagent of choice and with distilled water then. Empty the lines by starting the Wash procedure without water, then.

IMPORTANT

Check the tubing connections regularly for leaks. Faulty tubing connections must be replaced.

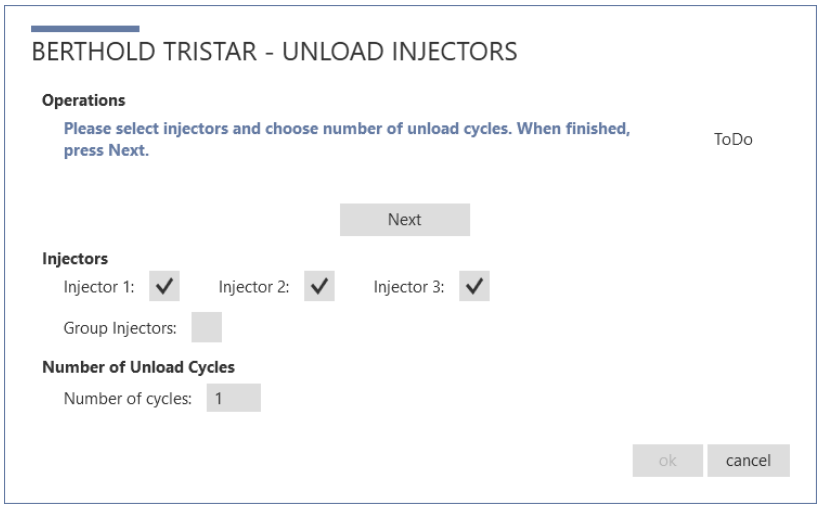
7.4 Emptying the Tubing

IMPORTANT

This operation can be used to empty the injection lines after the measurement and re-collect valuable reagents in the reagent reservoirs.

Make sure the reagent reservoirs are connected to the injection tubing !

1. Click **[Instrument]/ [Unload]**.



2. The following operations and settings are available:

   [Injectors] Check the respective check box or any combination of check boxes.

   [Number of Unload cycles] A cycle is equivalent to the max. injection volume of the injector installed.
   Recommendation: 10 cycles in minimum

3. Click **<Next>** and follow the instructions that appear on the screen.
4. Wait for the unload operation to be finished and click **<ok>.**

7.5 Decontamination

In cases of biohazard spillage, other kinds of pollution or before service and reshipment, all accessible parts of ther instrument must be decontaminated.

NOTICE

If there is any doubt about the compatibility of decontamination agents with parts of the device or with substances contained therein, please contact the device manufacturer or his local representative.

Follow the instructions of the reagent suppliers, too.

1. All outer surfaces, including the microplate holder, must be decontaminated, e.g. by wiping with 70% isopropanol or ethanol. Wipe with distilled water afterwards to remove reagent residues and dry the surfaces.
2. Decontaminate the injector system by following the instructions for cleaning, but leave the reagent, e.g. 70% isopropanol or ethanol, in

the tubing for approx. 10 minutes. Wipe the outside of the tubing multiple times, too.

3. Replace the reagent for decontamination with distilled water now to remove reagent residues.
4. Empty and dry the tubings.

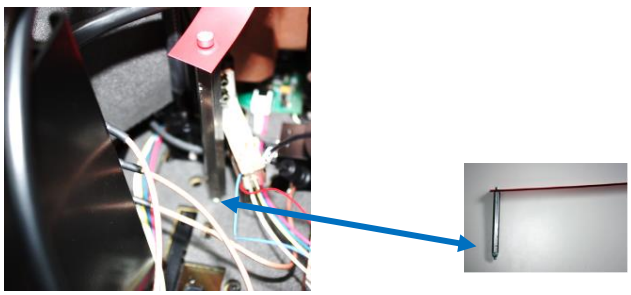
7.6 Preparations for Transport

IMPORTANT

The following safety provisions have to be taken to transport or ship the instrument:

1. Remove the microplate from the instrument.
2. Turn instrument off and disconnect it from mains.
3. Make sure the instrument is decontaminated properly before removing it from the laboratory and fill in the decontamination form.
4. Click [Instrument]/[Shipping Brace] in the Instrument menu.
5. Turn the instrument off and disconnect it from mains.
6. Insert the two transport safety devices.

Open the big front flap and insert the transportation safety device



Tristar 5 only: Open the top lid of the instrument by removing the four screws.
Insert the magnetic transportation lock indicated by the red tape.

Refer to chapter 4.1 for additional information.

7. For shipping you must use the original transportation case.
8. Encase the instrument with the styrofoam parts.
9. Tape shipping carton tightly.
10. When shipping back the instrument to Berthold Technologies or one of its representatives a Return Material Authorization number (RMA-number) and your Confirmation on Decontamination are necessary. Please observe the instructions in chapter 9.3.1.

8 Trouble Shooting

Symptom	Possible cause	solution
LED flashes red accompanied by 2 beeps	CAN module not correctly installed	1) switch instrument off and on again 2) call service
LED stays orange	Cable between instrument and computer is not connected Wrong COM assigned	1) attach cable properly 2) use service software and run “Scan COM ports” command
Instrument does not respond to software commands (status “Timeout Error”)	Cable between instrument and computer is not connected Wrong COM assigned	1) attach cable properly 2) use service software and run “Scan COM ports” command
LED stays dark	Instrument not switched on Mains not plugged in mains supply deactivated mains plug defective	1) switch instrument on 2) plug in mains 3) check with local house electrician 4) call service
Lower signal than expected	Pipetting/preparation error substrate consumed	1) verify by checking replicate and other samples / controls / standards and prepare faulty sample again

		2) prepare new plate and read immediately after adding substrate
Signal not above background readings	No sample No reagents added	1) check sample preparation 2) add reagents
No signal at all	Faulty PMT	Call service
Plate is not moved to measurement position	Plate not correctly inserted Wrong frame Plate too high	1) insert plate correctly 2) change frame 3) use another plate with a total max. height of 16 or 21 mm respectively
Error message no plate	No plate Wrong frame	1) insert plate 2) insert black frame for 15 mm plates
High background signal	Reagents not prepared properly Reagents contaminated Plate contaminated	1) prepare reagents properly 2) prepare fresh reagents 3) use another clean plate 4) call service
Standard curve cannot be calculated	Standards pipetted in wrong order	1) prepare new plate with correct layout of standards 2) use the edit function in the standard curve tab
Excel Files cannot be opened	Excel is not installed	Install Excel
Adobe PDF files cannot be opened	Adobe Acrobat Reader is not installed	Install Adobe Acrobat

9 Warranty and Technical Issues

9.1 Special Spare Parts

The following spare parts are safety parts: Use only the specified original part. For support contact Berthold Technologies or its local agent only.

	Specification	ID-No.
External Power supply unit GST220A24-R7B	**Input** 100-240 VAC ± 10%; 50 / 60 Hz; Class I **Output** 24 VDC, 9.2 A, max 221 W	59048

9.2 Warranty Statement

The instrument is sold in accordance with the general conditions of sale of Berthold Technologies GmbH & Co KG and its affiliates and representatives.
Berthold Technologies warrants this product to be free of defects in material and workmanship for a period of 12 months from the date of delivery, ex works Bad Wildbad.
Berthold Technologies or its authorized representative will repair or replace, at its option and free of charge, any product that under proper and normal use proves to be defective during the warranty period.
Berthold Technologies shall in no event be liable or responsible for any incidental or consequential damage, either direct or indirect.

The above warranty shall not apply if:

- the product has not been operated in accordance with the operating manual
- the product has not been regularly and correctly maintained
- the product has not been repaired or modified by a Berthold Technologies authorized representative or user
- parts other than original Berthold Technologies parts are used
- the product and parts thereof have been altered without written authorization from Berthold Technologies GmbH & Co KG

- the product has not been returned properly packed in the original Berthold Technologies packaging

This warranty does not apply to any third party product involved in the application.

9.3 Customer Service

Customer service will be provided in the first instance by the network of Berthold Technologies representatives. In the event of any problem experienced with your instrument, the first recourse should be your local Berthold Technologies representative. For further problems requiring hardware or software expertise, contact the Technical Support group at Berthold Technologies GmbH & Co KG. Here are the contact data:

Berthold Technologies GmbH & Co KG
Technical Support
Calmbacher Str. 22
75323 Bad Wildbad
Germany
Phone: +49 7081 177 114
Fax: +49 7081 177 301
Email: service@berthold.com

Please have the relevant information available:

- serial numbers, part number, revision: see production label on instrument
- software and firmware versions
- monitor and log files, if available.

9.3.1 Return Shipment to BERTHOLD TECHNOLOGIES

In case of an instrument return shipment please refer to our website and follow the instructions:

http://berthold.com/rma

An RMA number (return material authorization number) is required to ship an instrument for repair and identify your instrument when it arrives.

Confirmation on Decontamination

If you return an instrument to BERTHOLD TECHNOLOGIES for servicing purposes which is not properly decontaminated, there will be a health risk for BERTHOLD TECHNOLOGIES employees.
We therefore need your confirmation that the instrument was decontaminated and cleaned properly before shipping. Follow the instructions in chapter 7.2 – 7.6. and confirm the decontamination on the online-form.

10 Technical Data

10.1 Instrument

Operating voltage	24 VDC ± 5%
Max. power consumption	140 VA
Certifications	CE, NRTL (USA/CAN)
Protection class	III
Laser standards	IEC 60825-1:2014, EN 60825-1:2014+A11:2021
Temperature range	storage: 0° - 40°C operation: 15° - 35°C
Humidity	10 – 80%, not condensing maximum relative humidity of 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity up to 40 °C
Altitude	Max. 2000 m (above sea level)
Pollution degree	2
Dimensions	(W x D x H) depending on variant 391 x 470 x 395 mm
Weight	Approx. 32 kg
Plate formats	6 to 384 well, solid and strip, Dimensions 128 x 86 mm (L x W), height 14.0 – 21.0 mm (adapters necessary) Petri dishes 35 and 60 mm Eppendorf µPlate G 0.5 Standard cuvettes (with cap)
Measurement technology	Luminescence BRET, BRET^2 Fluorescence (top) FRET Absorbance VIS & UV Time-Resolved Fluorescence

	TR-FRET/ HTRF FP AlphaScreen™
Operation modes	Integral measurement 0.05 – 600 seconds (single and multiple endpoint) Kinetics measurement (total length up to 7 days) Repeated measurement (total length up to 7 days) Plate repeats (up to 50,000) Scanning (up to 10,000 single data points) Spectral Scanning Dispensing with 3 independent variable injectors Shaking Delay (up to 600 second) Unload
Excitation source	Xenon flash lamp, 10 W, 200 to 1000 nm Laser diode, 5mW, 670 nm (with AlphaScreen™ option only)
Detector	Photomultiplier operated in single or dual mode, spectral range 280-650 nm Photodiode, spectral range 200 to 1000 nm
Monochromator	f number: 2.7 (high light transmission) variable bandwidth: 4-22nm increment: 1 nm stray light rejection: 10^{-6}
Excitation filters	High quality filters Ø 15 mm or 12.7 mm with adapter; 25 mm; 25.4 mm
Emission filters	High quality filters up to Ø 25.4 mm
Sensitivity	Luminescence: ATP: <6 amol/well (96) Fluorescence: FITC: <7 amol/well (384sv) Absorbance: Accuracy better 2 % (96)

	precision better 0.6 % (96) Time-Resolved Fluorescence: Eu: <5 amol/well (96)
Dynamic Range	6 orders of magnitude (photon counter) 0-3.5 OD (photodiode)
Crosstalk	10^{-6} (black plates)
Injector	up to 3 injectors, JET injection technology variable volumes: 10 – 100 µL speed 200 – 440 µL/sec accuracy better 2% precision better 2% injections into microplates with up to 384 wells (384 wells: in preposition only)
Temperature control	Optional: +5°C above room temperature to 45°C
Shaking	3 modes (linear, orbital, double-orbital) variable amplitude and speed
Interface(s)	USB
Operating system	Win 7 (32/64 bit), Win 10 (32/64bit)
PC requirements	Pentium like CPU (2 GHz or better/intel Core iX recommended), 1 free USB 2.0 port
LightCompass Software	wizard support for parameter entries input of plate format selection of wells raw data assays (reporter genes, caspases, etc) dual raw data assays (e.g. dual reporter genes) kinetic repeated scanning spectral scanning ratio calculation or subtraction data export: EXCEL

10.2 External Power Supply

Type	Desktop power supply
Input	100-240 VAC ± 10%, 50/60 Hz
Output	24 VDC / 9.2 A
Protection class	Class I
Energy efficiency	Level VI

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Modifications due to technical advancement reserved.