Product:

LMT260

Subject:

Assembly instructions

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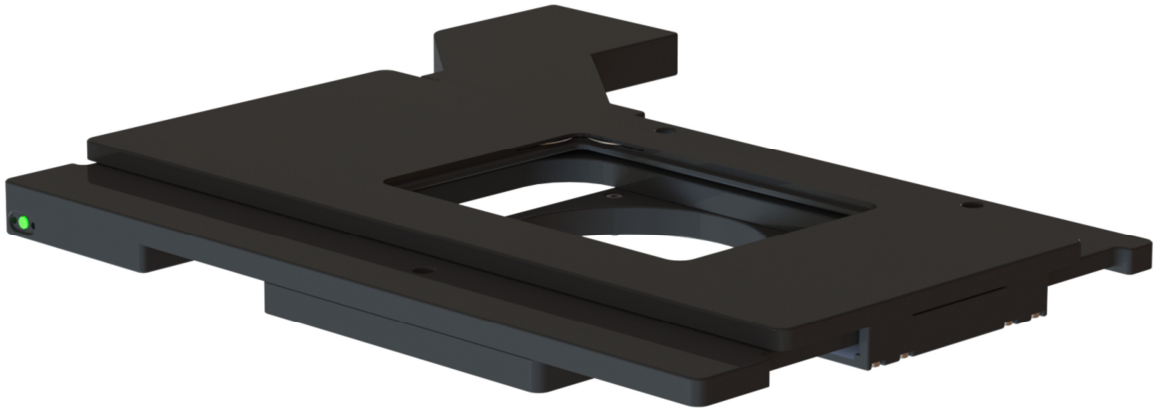
LMT260

Motorised microscope stage with external controller and linear motors



1 About this manual/Definition and disclaimer

1.1 Preface

Before you assemble the LMT260, commission it and/or make changes to the connections or electrical connections of the partly completed machine, make sure that you carefully read the following documents:

- the safety information in this manual (Chapter 4)
- these assembly instructions
- the software manual "Hydra_Venus_X_Y.pdf" (X,Y: indicates the version)

Please observe the safety instructions that are marked by these symbols:

Warning!
This symbol indicates risks which may endanger a person's health, or cause physical injury or death.

Warning! Dangerous voltage!
Warning of risk of danger from electricity. Ignoring this warning may lead to serious injury or death.

Attention! Stop
This symbol indicates important notes. Ignoring this symbol leads to machine damage and causes the machinery to malfunction.

Information:
This symbol indicates important information and notes.

1.2 Application information

Any applications that are described here for any of these products are for illustrative purposes only. ITK Dr. Kassen GmbH makes no claim or guarantee that such applications will be suitable for the specified use without further testing or modification.

1.3 Life support application

These products are not designed for use in life support appliances, devices, or systems where malfunctions of these products can reasonably be expected to result in personal injury. ITK Dr. Kassen GmbH does not accept any financial responsibility for the misuse of its products by the customer that results in personal injury.

1.4 Right to make changes

ITK Dr. Kassen GmbH reserves the right to make changes to the products, without prior notice. Products include integrated circuits, logic modules and the related software which are described in this document in order to improve the design and/or performance of these.

1.5 Responsibility and liability

ITK Dr. Kassen GmbH assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or prototype right to these products, and makes no claims or guarantees that these products are free from patent, copyright, or prototype right infringement, unless otherwise specified.

1.6 Others

Partly completed machinery (definition from EC machinery directive 2006/42/EC) has no CE label. The Declaration of Incorporation (referred to in Annex II, part 1, section B), which is also specified in this manual, is valid.
For all other machinery parts and components for which the CE safety directives apply, commissioning is prohibited until all appropriate requirements are met.
ITK Dr. Kassen GmbH assumes no responsibility or liability if you make any changes that affect the CE-conformity of the machine without the consent of the machine manufacturer.

1.7 Manufacturer

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1.8 Change history

Version	Date	Change description	Status	Author
"1.0"	01/25/2013	Created	Draft	OW, HR
"1.1"	02/21/2013	Transportation lock	Draft	RGG
"1.2"	03/18/2013	IP protection, Declaration of Incorporation	Released	OW
"1.3"	03/22/2013	Technical data	Released	HR, RGG
"1.4"	04/15/2013	Pairing of LMT260 & Hydra DT, Chapter 6	Released	HR, RGG

Updated versions of this document are available on request. Please contact the manufacturer.

2 Introduction

The LMT 260 is a motorised x-y stage with Hydra DT LMT260 external motion controller that can be used for different types of microscopes with the following features:

- Max. movement range of 120 mm (x) x 80 mm (y)
- Extremely flat arrangement enables easy mounting to the application
- Extremely dynamic linear motor drives
- Maximum speed of 500 mm/s
- Maximum acceleration of up to 2000 mm/s²
- Absolute position measurement system
- Position accuracy < ±2.0 µm
- Position repeatability < ±0.5 µm
- Low-noise operation up to max. speed
- Ethernet interface up to 100 MBit/s
- USB or RS232 interface
- Voltage: 24 V operation
- Six user-specific programmable buttons
- Mechanical mounting device for standardised microscope sample up to 0.5 kg load
- Enhanced load range up to 1.5 kg available

In particular, the use of linear motors in combination with the absolute position sensor and the state-of-the-art motion controller (ITK Hydra with VENUS motion language) enables superior dynamic features and extremely fast computer access.

Special accessories, such as a Joystick and/or Handwheel (which are both based on CAN bus communication), mean that it is easy and ergonomic to use, and also mean that it is easier to initiate automated tasks, thanks to its integrated buttons which can be freely programmed using the VENUS commands.

The 100 MBit/s Ethernet interface enables fast access to the data stream that is generated by the movement and the applications.

Modern data management through the use of web-based data services, such as ftp, udp, tcp-ip, etc., enables easy application design using Hydra for complex tasks.

Furthermore, the web-based service (including software updates) and stand-alone operation can be easily implemented using the ASCI-based command high-level language "VENUS".
Please refer to the VENUS software manual "Hydra_Venus_X_Y.pdf" (X,Y: indicates the version).

3 Intended use and reasonably foreseeable misuse

Intended use for the LMT260 is the x-y positioning (horizontal positioning, locked position control mode) of one or more samples mounted on the sample fixture in microscope application.

In addition, the LMT260 is suitable for the horizontal positioning of samples for other applications without any horizontal forces.

The LMT260 is designed for use in a laboratory environment.

The LMT260 is not designed for non-horizontal use and/or using the moving parts of the LMT260 in order to apply static forces to samples e.g. for supporting a milling spindle or other tools.

4 Safety information

The LMT260 must not be used in areas in which there is a risk of explosion.
The LMT260 is a partly completed machine in accordance with MD 2006/42/EU, and is delivered without a CE label.

As the operator of the LMT260, you are responsible for implementing suitable protection measures that arise from your risk assessment. These measures must comply with all of the safety requirements of MD 2006/42/EU.

Always take care when mounting/clamping the samples. Due to the high dynamics of the x-y stage, samples can be unclamped and ejected from the stage due to high speeds or high acceleration and this may cause material damage and/or personal injury.

Internal (driving) forces are limited in order to avoid injuries to fingers, etc., caused by clamping inside the LMT260.

To avoid injuries to fingers, etc., caused by clamping inside the LMT260, do not apply external forces to the LMT260.

In case of emergency, you can lock off the control loop and the driving forces using the button shown in Fig 6.5.3. However, you can lock off each axis by moving it slightly in the opposite direction. The motion controller will lock off the corresponding axis which can be easily moved afterwards.
Ensure that every operator of the LMT260 is familiar with how it functions.

To set the motion controller back to its normal operation state (locked position mode), use the button again or use the Venus software command "init".

A power-on cycle or the Venus software command "reset" allows you to completely restart the system. The restart finishes as soon the button is permanently illuminated. During the restart, no communication is possible.

If none of the actions mentioned above is successful, the error is still present.

5 Delivery

5.1 Standard scope of delivery

The standard scope of delivery for the LMT260 includes:

ITK code	Description
101-0102-006	LMT260
100-0100-201	Hydra DT LMT260
101-0102-900	HW/SW manual CD-ROM LMT260
400-1600-015	IEC power cable
100-0600-255	USB cable USB A connector to mini USB connector, 2 m
400-1600-097	Ethernet (RJ-45) cable, 5 m
100-0600-003	RS232 (D-Sub, 9-pin), 3 m

The current (customer-specific) scope of delivery for your LMT260 is specified on the packaging note.

5.2 Accessory parts

We recommend that you use the following components:

ITK code	Description
100-0800-013	CAN Handwheel
100-0700-014	CAN Joystick, 2D
100-0600-246	CAN device cable, shielded, 1.5 m
100-0600-251	CAN termination
101-0103-001	Slide holder triple, LMT accessories
101-0103-003	Petri dish (40 mm diameter) holder, dual, LMT accessories
101-0103-004	Petri dish (50 mm diameter) holder, dual, LMT accessories
101-0103-005	Petri dish (60 mm diameter) holder, dual, LMT accessories
101-0103-006	Mounting frame, LMT accessories
401-2900-008	AFC grease for a standard environment
401-2900-010	AFC grease for a clean room
401-0033-005	Transport lock screw

5.3 State of delivery

The accuracy of the independent x and y axis of each delivered LMT260 is checked by a laser interferometer system – the MI500 from SIOS Meßtechnik GmbH.
Data evaluation is carried out for VDI/DQG 3441 in 5 mm steps within the complete range.

6 Assembly/installation and connection

6.1 Space requirements

Fig. 6.1 shows a drawing of the LMT260, the mounting points and the space that is required for movement.
The zero point is located at the upper right edge. See also Fig. 6.1.

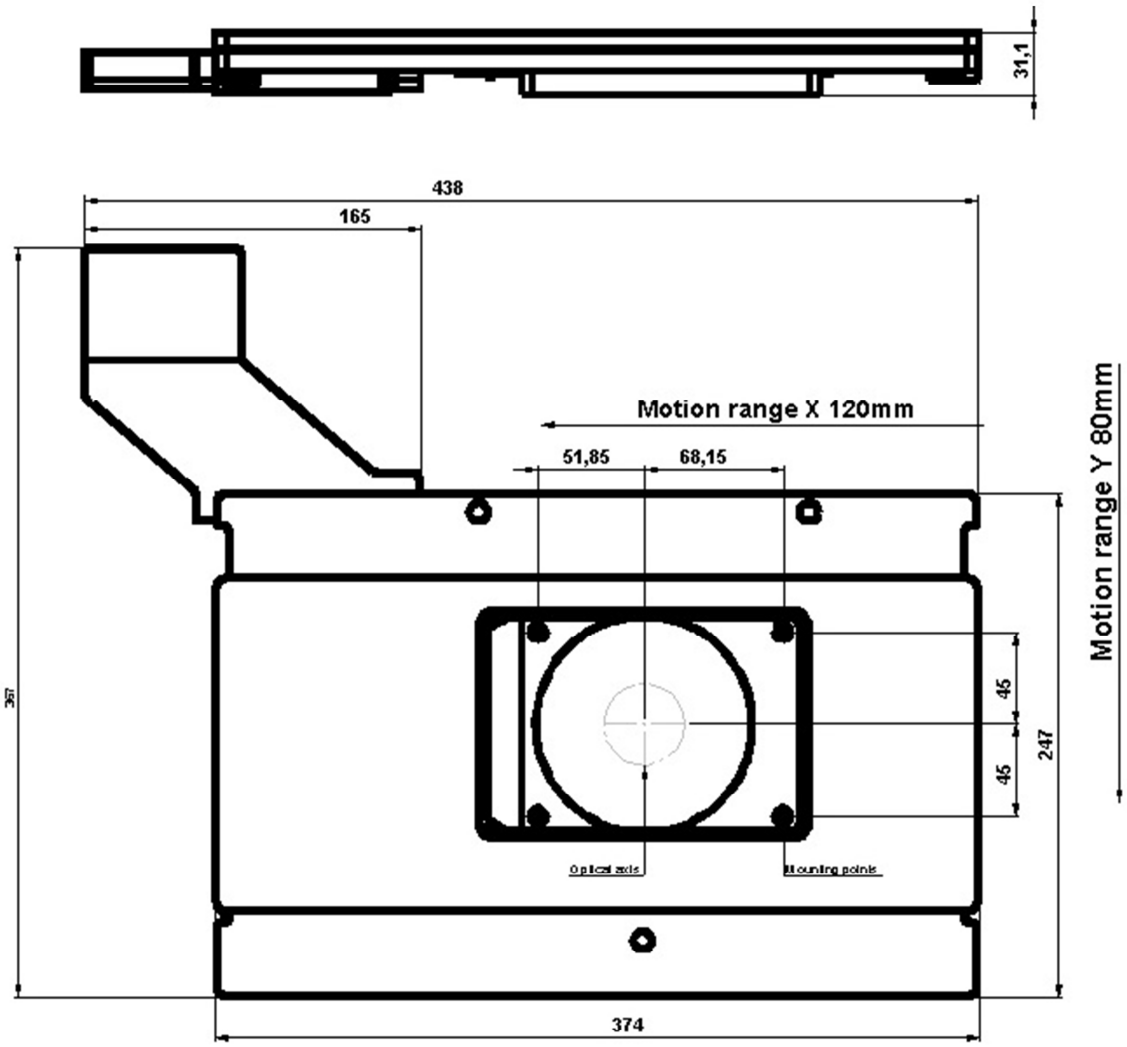


Fig. 6.1 Drawing of the LMT260 with dimensions, zero point (upper right edge), mounting point and axis direction

Ensure that the moving parts of the LMT260 can never trap fingers, etc.

6.2 Transporting the LMT260

During transportation and mounting, ensure that the slides of the LMT260 never bend. A special transportation box is therefore recommended and can be delivered on request by ITK Dr. Kassen GmbH.

The low weight of the LMT260 and its transportation box means that it is easy to handle. Avoid any heavy vibrations during transport.

6.3 Unpacking and mounting the LMT260

Note that the LMT260 is a precision assembly and is therefore highly sensitive to accelerations. Avoid any uncontrolled movement of the axes.

To do this, proceed as follows:

- Ensure that the package is the right way up ("up" signs)
- Open the package
- Carefully remove the LMT260 from the package
- Place it face-down on a textile-covered level surface, for example

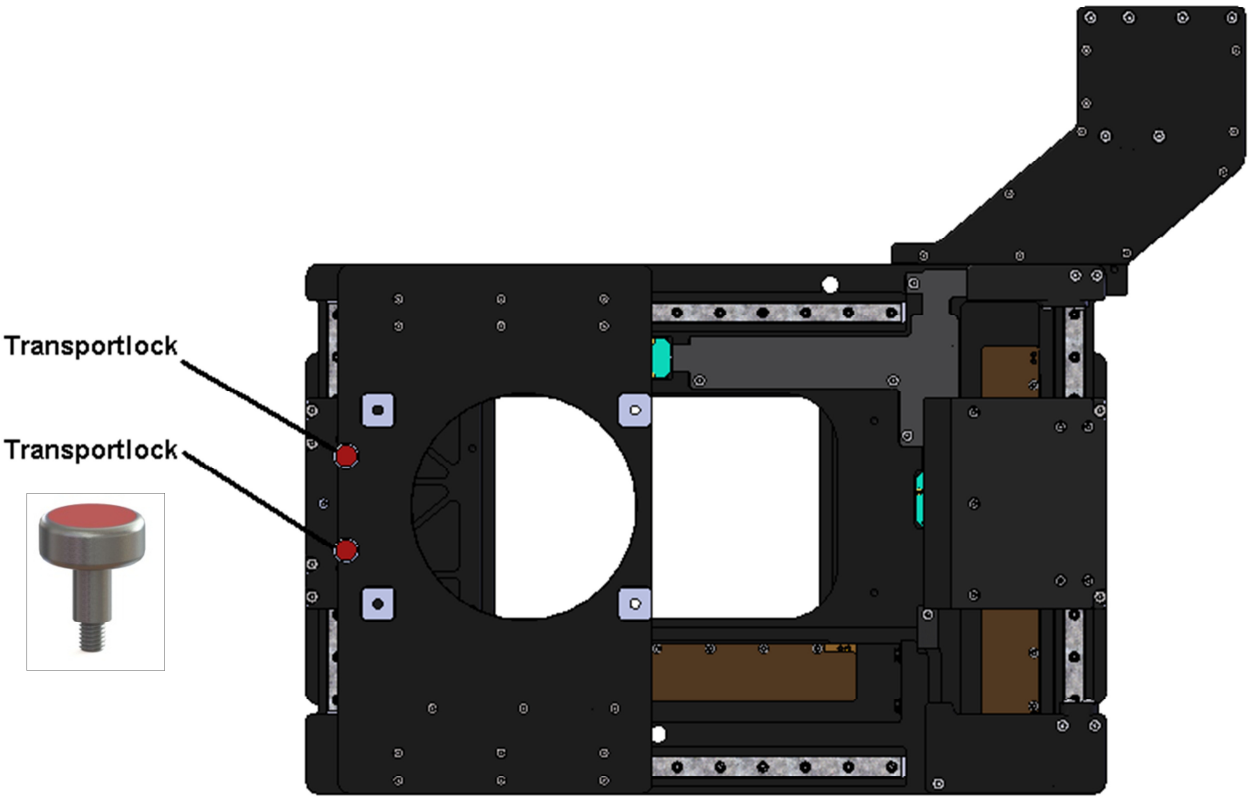


Fig. 6.3.1 Position of the transport lock screws (ITK code: 401-0033-005)

- Remove the two transport lock screws that are shown in Fig. 6.3.1

For transportation, do not use any other screws as the transport lock. Using normal screws may damage the entire LMT260.

Ensure that your fingers do not become trapped during the following steps as a result of normal movement (gravity) or movement of the LMT260's parts due to external forces.

- Level (less than 0.1°) and prepare the microscope (so that it is in a stable position)
- Manually hold both axes when mounting the LMT260 on a microscope
- Attach two screws (e.g. M4x16 DIN 912) to the mounting points on the front (closest to you)
- Attach two screws (e.g. M4x16 DIN 912) to the mounting holes on the rear (furthest from you)
- Tighten the four screws to a torque (hinge moment) of 1.6 Nm

6.4 Implementing suitable protective measures

Not applicable, due to the embedded functionality in the microscope.

6.5 Product overview and wiring

The wiring diagram shows the connection between the LMT260 and other components. Each LMT260 is securely connected to a preprogrammed Hydra DT.
The corresponding serial numbers are specified on the label that is affixed in the right-hand lower corner on the connector side of the Hydra DT LMT260 controller. See also Fig. 6.5.

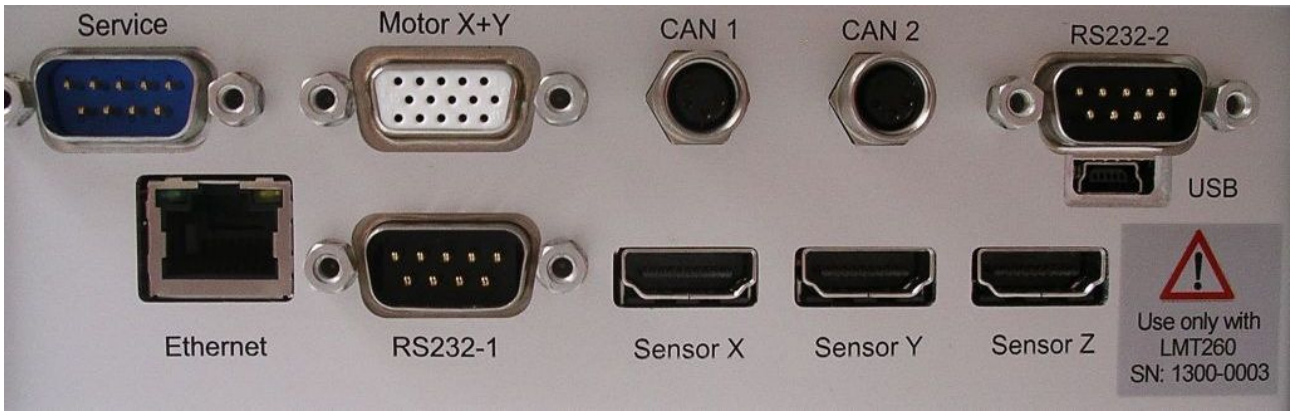


Fig. 6.5 Connector side of the Hydra DT LMT260 controller

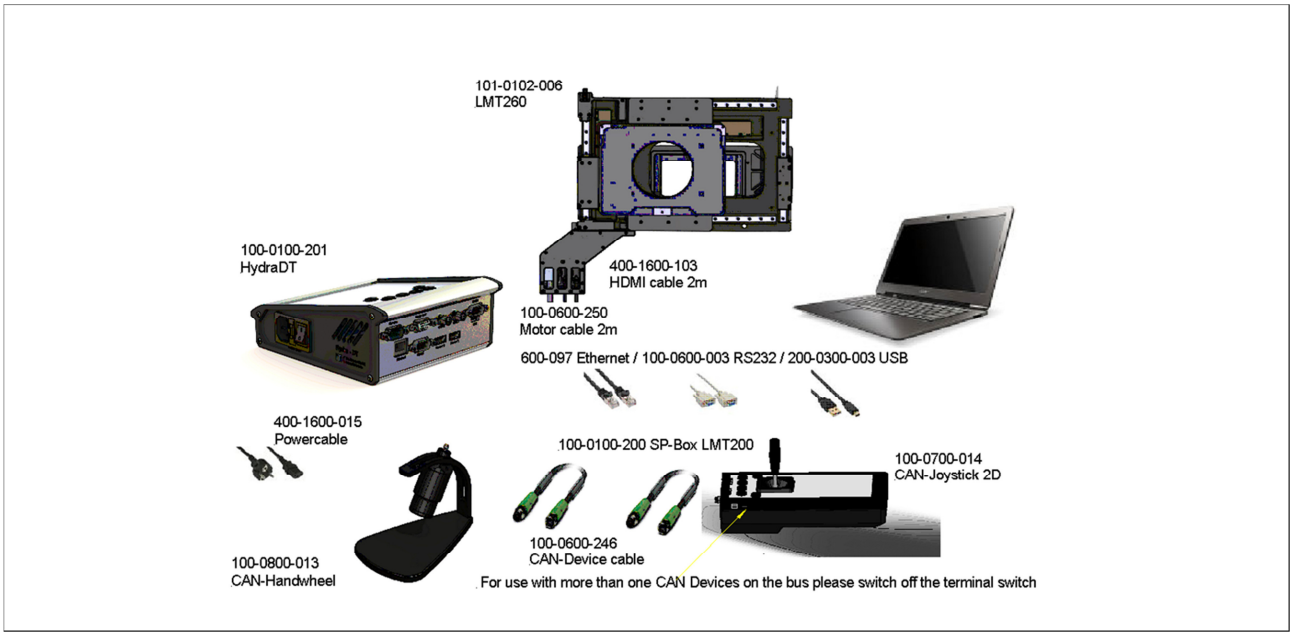


Fig. 6.5.1 Product overview of the LMT260 with different external components for intended use

Always place the Hydra DT (line voltage), which is rated as protection class IP20, in a dry and water-proof location in order to avoid dangerous short circuits.

For wiring, proceed as follows:

- Connect the peripheral devices (Handwheel and Joystick) to the Hydra DT
- If more than one CAN peripheral device is used on the Hydra DT, switch off the terminal switch on the Joystick
- Check the serial number (SN) of the LMT260 using the SN that is specified on the Hydra DT LMT260 (connector side). See also Fig. 6.5.
- Connect the LMT 260 motor cable to the Hydra DT motorX/Y
- Connect the LMT260 HDMI cable to the Hydra DT sensorX and sensorY
- Connect (if used) the Ethernet and/or RS232 or USB connector to the Hydra DT
- Connect (if used) the Ethernet/RS232/USB connector to the host (e.g. a PC)
- Connect the power supply connector to the Hydra DT
- Connect the power connector to the power line
- Switch on the power switch on the Hydra DT
- The green power indicator on the Hydra DT should be on
- Once the green LED of the LMT260 button is switched on, the LMT260 is in the locked position control mode and is ready for operation
    - or wait until the host shows that there is a connection (Ethernet: [IP No. 192.168.1.200 port:400], RS232: [38400,8,1,N]. Detailed information is provided in the software manual
    - or wait until the red LED on the Handwheel switches off

The button on the LMT260 can be used to change the state from locked to unlocked position control mode and vice versa.

If the green button LED flashes, this always indicates that one or both axes are unlocked.

In case of emergency, you can lock off the position control mode and/or, in doing so, the driving forces of both axes by using the LMT260 button described in Fig 6.5.3.
However, you can lock off each axis by moving it slightly in the opposite direction. The motion controller will lock off the corresponding axis which can be easily moved afterwards.

Ensure that every operator of the LMT260 is familiar with how it functions.

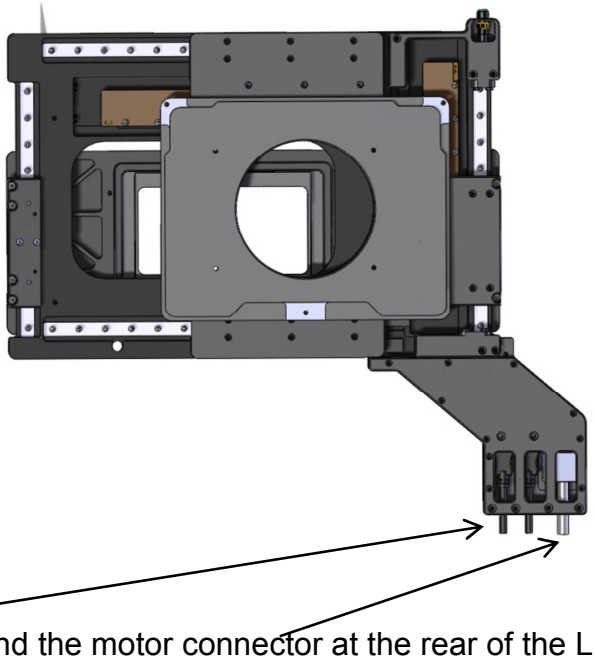


Fig. 6.5.2 HDMI connector and the motor connector at the rear of the LMT260

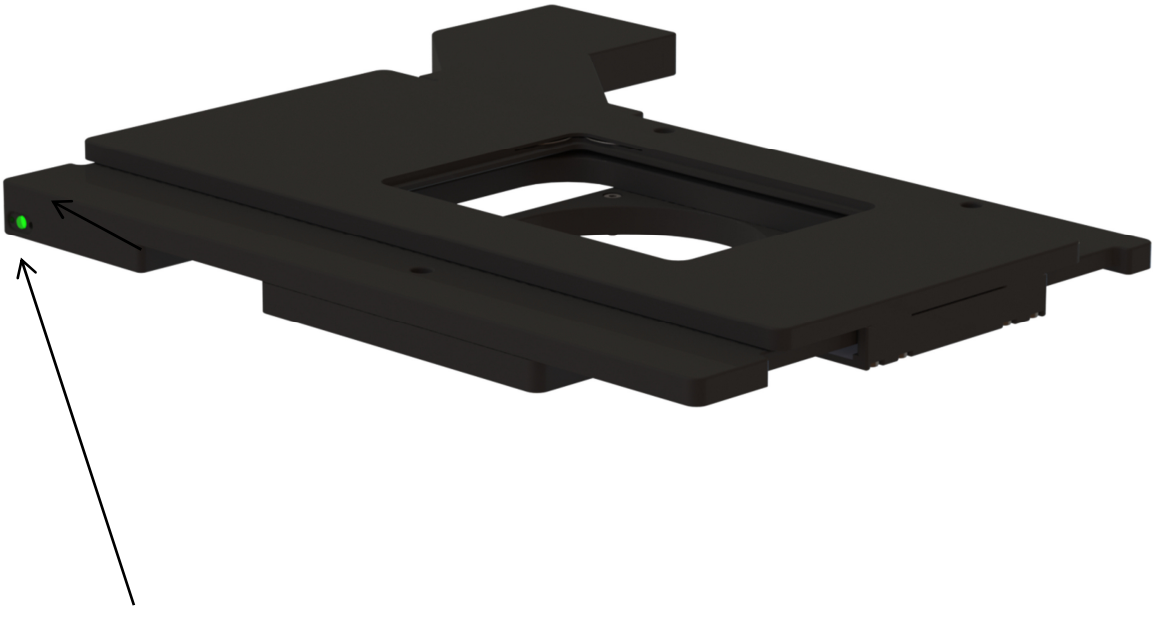


Fig. 6.5.3 Button with integrated green lamp for unlocking/locking the position control loop. If the green button LED flashes, this indicates that one or both axes are unlocked

Continued...

6.5.1 LMT260 <-> motor connector

Cable colour	***LMT260:*** ***15-pin HD Sub*** *female*	***Hydra DT:*** ***15-pin HD Sub*** *male*
Yellow	1	1
Green	2	2
Grey	3	3
Brown	4	4
Grey3	6	6
Grey4	7	7
Grey1	9	9
Grey2	10	10
Brown	11	11
Black	12	12
Pink	13	13
White	14	14
Braid	Housing	Housing

6.5.2 LMT260 <-> HDMI sensor connector

MHDMI pin no.	MHDMI assignment	Cable colour	HDMI pin no.
1	Insulation of 1/3		2
2	TMDS Data2+	Red	1
3	TMDS Data2-	White	3
4	Insulation of 4/6		5
5	TMDS Data1+	Green	4
6	TMDS Data1-	White	6
7	Insulation of 7/8		8
8	TMDS Data0+	Blue	7
9	TMDS Data0-	White	9
10	Insulation of 10/11		11
11	TMDS clock+	Brown	10
12	TMDS clock-	White	12
13	DDC	Red	17
14	CEC	Grey	13
15	SCL	Yellow	15
16	SDA	Orange	16
17	Reserved	Purple	14
18	+5 V	White	18
19	Hot plug detection	Pink	19
Shell	Shield	Braid	Shell

6.6 Hydra DT connector description

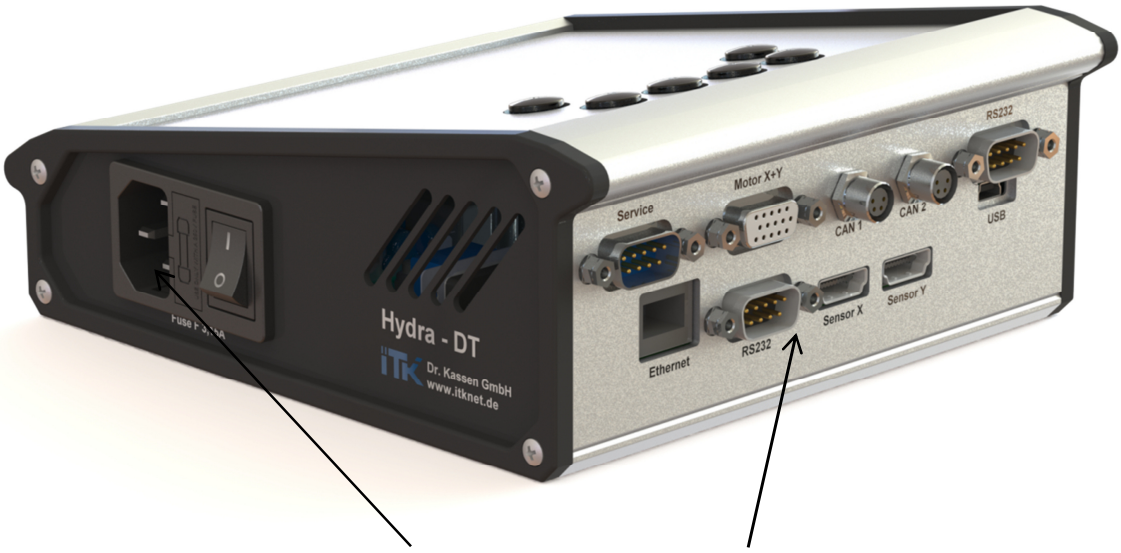
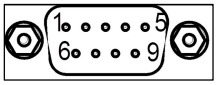


Fig. 6.6.1 Hydra DT with power connector/switch and connector board

6.6.1 Ethernet

Type RJ45, 8-pin	Name	Description
1	TX+	Transmit+
2	TX-	Transmit-
3	RX+	Receive+
4	nc	-
5	nc	-
6	RX-	Receive-
7	nc	-
8	nc	-

6.6.2 RS232



D-Sub 9, male	Name	Description
1	nc	-
2	RxD	Data input
3	TxD	Data output
4	nc	-
5	GND	Earth
6	nc	-
7	nc	-
8	nc	-
9	nc	-

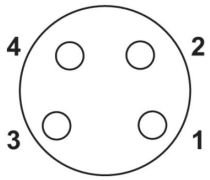
Use an RS232 or USB. Only one connector can be plugged in at a time.

6.6.3 USB

Mini USB, male	Name	Description
1	VCC	USB +5 V
2	D -	Data in, negative
3	D +	Data in, positive
4	nc	-
5	GND	USB earth

Use an RS232 or USB. Only one connector can be plugged in at a time.

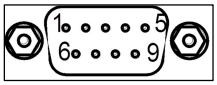
6.6.4 CAN



Connector SACC-E-M5FS-4CON-M5/0.5 "Phoenix contact".

Type M8, female, 4-pin	Name	Description
1	GND	Earth
2	CAN bus H	CAN HIGH
3	CAN bus L	CAN LOW
4	User +5 V	Power 5 V/400 mA

6.6.5 Hydra DT service connector



Connector, 9-pin D-Sub, male
Comment: This connector is for service use only and must not be used by the customer.

The service connector is not for customer use.

Mechanical and/or electrical damage may occur if unauthorised persons use the connector.

7 Commissioning

7.1 Coordinate system, axis assignment, mounting points and zero point

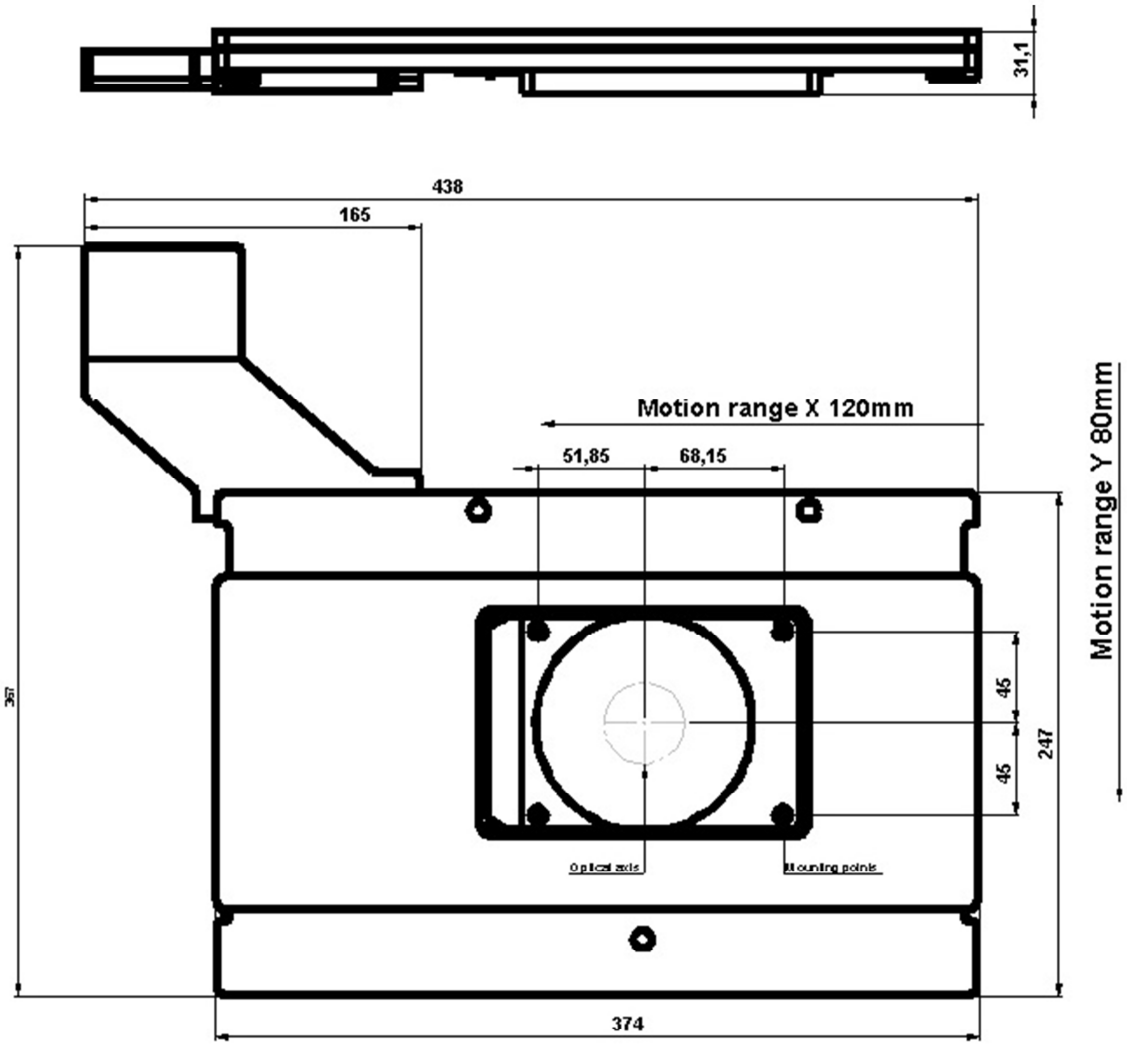


Fig. 7.1.1 Coordinate system, axis assignment specified in a sketch

The LMT260 is moved to the zero point if the x-axis is in the right-hand position and the y-axis is positioned at a distance from the user (rear position).

7.2 Work-piece mounting and clamping

The LMT260 can be used with a standardised sample plate. The dimensions of the sample plate are specified in Fig. 7.2.1.

This sample plate will be secured to the LMT260 using a click-in spring.

Ensure that the sample plate is securely connected to the LMT260 and that the samples are securely mounted on the sample plate in order to avoid injuries and damage caused by ejected parts that result from the high speeds/acceleration created by the LMT260.

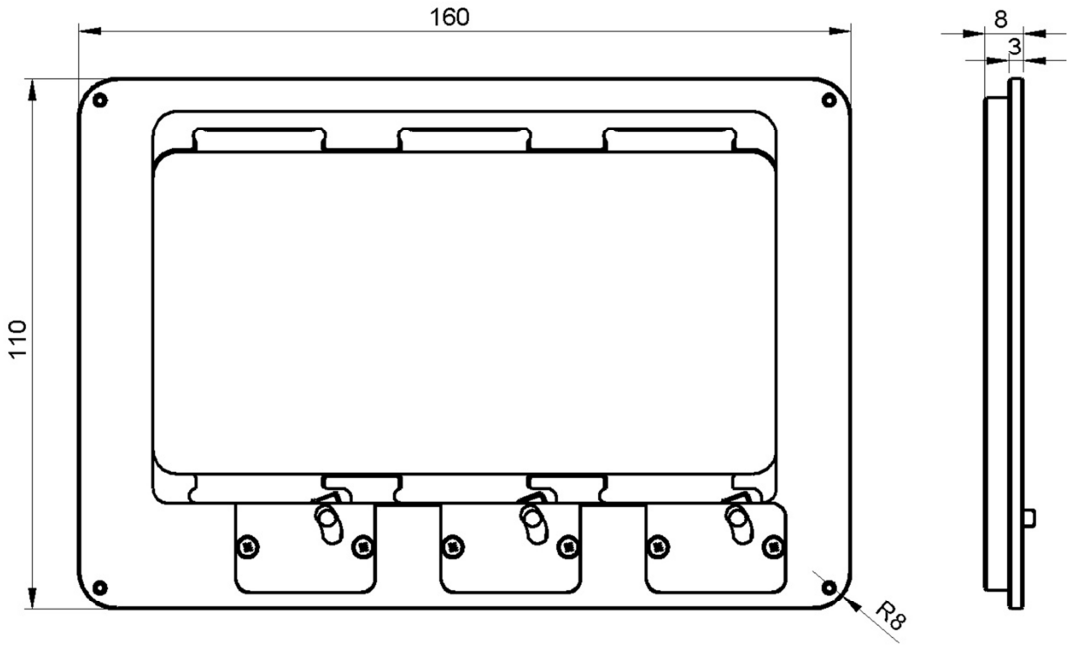


Fig. 7.2.1 Outer dimensions of the sample plate, e.g. slide holder triple, LMT accessories

7.3 Operation

Once assembly and wiring are complete and once the sample has been mounted, supply the system with power by actuating the Hydra DT power switch. Wait until the system power-up sequence is complete; avoid shifting stage axes manually or operating peripheral input devices during this period of time – for approx. 30 seconds. Completion of the power-up sequence is indicated by either *permanent* illumination or *perpetual* flashing of the LMT 260 button LED.

In case of emergency, you can lock off the position control mode and/or, in doing so, the driving forces of both axes by using the LMT260 button shown in Fig 6.5.3. However, you can lock off each axis by moving it slightly in the opposite direction.

The motion controller will lock off the corresponding axis which can be easily moved afterwards.
Ensure that every operator of the LMT260 is familiar with how it functions.

Permanent illumination of the button LED indicates that both table axes are operating correctly in locked position control mode. Otherwise, if the LED is flashing, at least one stage axis has failed to power up due to an emergency condition (e.g. manual table shifting during the power-up sequence) and it remains unsecured. The LED will also start to flash if an emergency condition occurs later on during operation.
One axis or both axes may be released from an emergency condition by actuating the LMT260 button once if the cause of the emergency has been eliminated. Do not shift either of the stage axes after actuating the button. The securing procedure may result in a small position shift at both axes. The LED stops flashing, indicating that normal operation can be resumed.

During normal operation, the LMT260 button may be used to alternately lock and unlock the position control mode of the table axes, which allows for manual table shifting. An unsecured state is indicated by the button LED flashing.

If a stage axis fails to be released from the emergency condition or unsecured state (which is indicated by the continued flashing of the button LED even though the button has been actuated), a perpetual error condition is present. In this case, the cause of the error must be eliminated before normal operation can be resumed.

The LMT260 can be controlled by different devices simultaneously:
- Manually using the buttons of the Hydra DT
- Manually using the Handwheel (CAN)
- Manually using the Joystick (CAN)
- Computer-controlled operation using the VENUS instruction (Ethernet and/or RS232/USB)

To operate VENUS, refer to the software manual "Hydra_Venus_X_Y.pdf" (X,Y: indicates the version). Using VENUS, the user has sole responsibility for archiving all of their application programs.

8 Cleaning, lubrication and maintenance

During cleaning and maintenance procedures, disconnect the power line by unplugging the line connector for the power adaptor before starting any work in order to prevent electric shocks.

8.1 Cleaning

Do not destroy the embedded electronics (non-waterproof) by applying too much liquid to the LMT260/Hydra DT.

Use water with cleaning agents that contain alcohol and/or normal household cleaning agents on a damp soft cloth to clean the black surfaces of the LMT260/Hydra DT.

The LMT260/Hydra DT has black anodized aluminium surfaces.
You must therefore not use any strong alkaline-based cleaning agents for this.

8.2 Lubrication and maintenance

The LMT260 is a fully assembled device. Apart from lubrication, the user cannot carry out any additional maintenance work.

All bearings are lubricated at the factory using special grease.
The linear bearings must be lubricated once a year.

Grease for normal use: AFC grease
Grease for clean-room use: AFF grease
Do not use any other types of grease.

We recommend that you proceed as follows:

Ensure that your fingers do not become trapped during the following steps as a result of normal movement (gravity) or movement of the LMT260's parts due to external forces.

- Disconnect from the power line
- Remove the LMT260 from the microscope (while manually holding the axes)
- Place the LMT260 face-down on a textile-covered level area
- Use a jet of air, soft hand-brush and/or a soft cloth to clean any dust from the LMT260
- Remove the "old" grease from the linear bearing X1, X2, Y1, Y2 (see Fig. 8.2.1) with a cloth. Move both axes in order to do this properly.

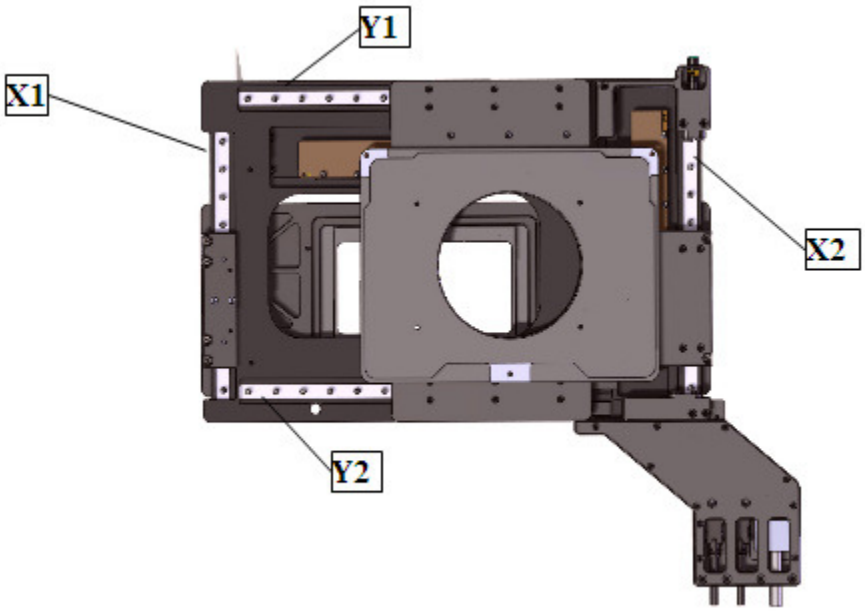


Fig. 8.2.1 Face-down LMT260 with linear bearings and lubrication points

- Apply a small amount of the grease to the eight specified points shown in Fig. 8.2.1
- Move both axes several times over the full range in order to distribute the grease
- Remove the excess grease carefully using a cloth
- Carefully remount the LMT260 on the microscope (holding the axes)

9 Technical data

Description	Values		
Line voltage	100-240 V_{AC}, 50/60 Hz		
Line fuse	F3.15A		
Internal operating voltage	24 V_{DC}		
Power consumption	Max. 160 W		
Ambient temperature	10 °C - 40 °C		
Motors	2-phase linear motors		
Measurement system	Absolute measurement system (MR-based), no limit switches		
Travel range	X= 120 mm, Y=80 mm		
Load (max.)	< 0.5 kg	0.5 kg	1.5 kg
Travel speed (max.)	500 mm/s	500 mm/s	200 mm/s
Travel acceleration (max. X/Y)	1.0/2.0 m/s^2	1.0/2.0 m/s^2	0.1/0.1 m/s^2
Position repeatability	< ± 0.25 µm	< ± 0.5 µm	< ± 1.0 µm
Position accuracy	< ± 1.0 µm	< ± 2.0 µm	< ± 4.0 µm
Position resolution	Max. 5 nm		
Motion controller	HYDRA with power PC unit (760 Mips)		
Memory (ROM/RAM)	64/8 MByte		
CAN	1 MBit/s		
RS232	Max. 460 kBaud		
Ethernet	Up to 100 MBit/s		
Software language	Venus-3		
Material stage	Aluminium alloy		
Surface stage	Anodised aluminium, black		
Weight (without Hydra DT)	Approx. 4.8 kg		

10 Exploded view/spare parts list

Due to the position resolution that is achieved, the speed and the accuracy, it is not possible for the customer to remove and/or repair the LMT260. There is no exploded view/spare part list available.

Please contact the manufacturer’s service department for this.

For transporting, only use the special screws (Fig. 6.3.1, ITK code: 401-0033-005) for the transport lock. Using normal screws may damage the entire LMT260.

Removing the LMT260 may also be harmful to those who wear a pacemaker, due to the magnets in the linear motors.

Order codes for the LMT260 system and accessories are provided in Chapter 5.

11 Declaration of Incorporation for partly completed machinery Corresponding Machinery Directive 2006/42/EU, Annex II B

The manufacturer **ITK Dr Kassen GmbH**
Beim Eberacker 3
35633 Lahnau, Germany
hereby declares that the following product
Microscopy Stage LMT260 (ITK code: 101-0102-006)
operated by Hydra DT for LMT260 (ITK code: 100-0100-201)

conforms to the health and safety requirements of the **Machinery Directive 2006/42/EU, Annex I** including any modifications that were valid at the time of the declaration.

The following EU Directives have also been applied:
EMC directive 2004/108/EU
Low-voltage directive 2006/95/EU

The following harmonised standards have been applied:
EN 12100:2010
EN 61010-1:2010
EN 61326-1:2006
EN 61000-3-2:2006+A1,A2:2009
EN 61000-3-3:2008
EN 61000-4-2:2009
EN 61000-4-3:2006
EN 61000-4-4:2004 + A1:2010
EN 61000-4-5:1995 + A1:2001
EN 61000-4-6:2009
EN 61000-4-11:2004
EN 55011, Kl. B:2009+A1:2010

The technical documentation for this partly completed machine was created in accordance with Annex VII Part B. The manufacturer shall undertake to provide the technical documentation in electronic format if and when requested by the authorised governmental agency. The representative for compiling technical documentation is: Ralf Gottfried-Gottfried.

The product (partly completed machine) is designed to be integrated in a machine or to be combined with another partly completed machine in compliance with the **Machinery Directive 2006/42/EU**, Article 1, Chapter (1), Paragraph a).

The partly completed machinery must not be commissioned until the final machinery into which it is to be incorporated has been declared to be in conformity with the provisions of the Machinery Directive 2006/42/EU.

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ITK Dr. Kassen GmbH

Dr. Folkert Kassen, Managing Director,
Lahnau, 18th March 2013