

Laser-Light-Module LLM01



Description and Operation



D A N G E R

**The LLM01 emits visible and/or invisible laser beams.
The laser beams (direct and/or reflected) are dangerous for
unprotected eyes.
Read the safety precautions as described in Chapter 4 before
setting the LLM01 into operation.**

1.	Description	3
2.	Operation and Care	4
2.1	Install the Lamp/Laser Head	4
2.2	Install the Filter Disc.....	4
2.3	Attach a Shape Generator to the Filter Disc	5
2.4	Mount the LLM01 to the Weapon.....	5
2.5	Install the Batteries	5
2.6	Select and Switch on a Marker or Illuminator	6
2.7	LLM01 Functions depending on the Software Configuration.....	7
2.7.1	LLM01 Software Configuration Type 1	8
2.7.2	LLM01 Software Configuration Type 2	8
2.7.3	LLM01 Software Configuration Type 3	8
2.7.4	LLM01 Software Configuration Type 4	8
2.7.5	LLM01 Software Configuration Type 6	8
2.8	Special Functions.....	9
2.8.1	Special Function A – Switch on the two Markers simultaneously.....	9
2.8.2	Special Function B – The External Trigger acts as Momentary Type Pushbutton Switch or as Permanent Type Pushbutton Switch	9
2.8.3	Special Function C – The External Trigger function is identical to that of the left/right Pushbutton Switches, or to that of the rear Pushbutton Switch.....	9
2.8.4	Special Function D – Switching on the IR Marker/IR Illuminator even though the Mode Switch is set to VIS 1 or VIS 2	10
2.8.5	Special Function E –Setting the Intensity of Marker/Illuminator	10
2.9	Adjust the Markers	11
2.10	Preventive Maintenance on the LLM01	12
3.	Corrective Maintenance	12
3.1	Diagnostic Checks	12
3.2	Replace Filter Disc.....	13
3.3	Replace the Bulb of the Lamp Head	13
4.	Safety	13
4.1	Laser Safety	14
4.1.1	Assignment of the LLM01 to the corresponding Laser Class	14
4.1.2	General Safety Information	15
4.1.3	Safety Information for Laser of Laser Class 3R/3a.....	15
4.1.4	Warning Labels for Laser of Laser Class 3 R	15
4.1.5	Operate the LLM01 with different types of Filter Discs	16
4.2	Safety Precautions when handling Lithium Batteries.....	16
4.3	Safety Precautions when using the Lamp	17
4.4	Safety when Selecting Special Functions	17
5.	Technical Data	18
6.	Accessories.....	18
6.1	Mount Filter Disc (Standard and with extended Frame)	20
6.2	Mount Red-light Filter/Infrared-Filter	20
6.3	Install the Laser Head	20
6.4	Mount the Sleeve	20
6.5	Mount the Shape Generator	20

1. Description

The Laser Light Module 01 (LLM01) is an optical aiming device for hand-held weapons. The LLM01 permits aiming on targets using a laser beam and/or illumination of targets or target areas.

Independent of the actual hardware configuration the LLM01 contains the following light sources:

- One VIS-Marker (Fig.1/3); red-light laser with a visible beam;
- one Infrared (IR)-Marker (Fig. 1/1); IR laser with an invisible beam; and
- one IR-Illuminator (Fig. 1/2); Light Emitting Diode (LED) emitting invisible light.



Figure 1: LLM01, Light Sources

Additionally the LLM01 is equipped either with a Lamp Head (visible light as shown in Figure 1/4) or with a Laser Head. The Laser Head is available in different versions, e.g. as marker or as illuminator – with visible or with invisible beam. Lamp Head and Laser Head can be easily exchanged – tools are not required.

The markers, the IR-Illuminator and the controls are integrated in the housing which is made of glass fibre reinforced plastic. The Lamp Head/Laser Head is screwed on the LLM01 housing. The battery case is accessible after opening the cover (Fig. 2/8). Two 3V Lithium batteries are required to operate the LLM01. Protection against batteries installed with reverse polarity is provided.

The adapter required to mount the LLM01 to a weapon varies depending on which type of rail is used on the weapon. In Figure 1 and 2 the adapter for a Picatinny rail is shown which consists of a bracket (Fig. 2/2), locking nut (Fig. 2/3), locking lever and clamp jaw (Fig. 2/4).

The rotary type mode switch (Fig. 2/9) is used to select a light source (marker, illuminator or a combination of both) – the three pushbutton type switches left (Fig. 2/7), rear (Fig. 2/6) and right (not shown in Fig. 2) or the switch on the external trigger cable connected to the socket (Fig. 2/5) are used the switch the selected light source on or off.



Figure 2: LLM01, Controls

To adapt the LLM01 on different type of weapons the two markers are adjustable in bearing and elevation. The adjustment screws are located on the left (Fig. 2/1) and right side of the housing and between housing and Lamp Head/Laser Head.

A Filter Disc is mounted in front of each marker.

Different type of Filter Discs are available:

Standard frame size with frame colour black

(light transmission $>98\%$) and blue (light transmission $\leq 20\%$); or extended frame size with **T** printed on the frame (light transmission $>98\%$) and without **T** printed on the frame (light transmission $\leq 20\%$).

The Filter Disc version with the extended frame permits installation of a sleeve which reduces the area from where an observer can recognise the laser beam.

To avoid direct reflections the disc is mounted to the frame with an tilt angle of 5 degrees. Additionally the disc is coated with an anti-reflection film.

The LLM01 should not be operated without Filter Discs installed. For further information refer to Chapter 4.1, Laser Safety.

A Shape Generator can be attached to the Filter Disc. When using a Shape Generator the markers generate a geometric pattern on the target instead of a simple laser spot. This facilitates the assignment of laser spots (aiming point) to the related weapons when more than one weapon equipped with LLM01 are active within the same scenario and all LLM01 are equipped with different Shape Generators.

2. Operation and Care

2.1 Install the Lamp/Laser Head

- Switch off the LLM01 (mode switch to position **0**);
- if applicable, remove the Lamp/Laser Head already installed by turning the Lamp/Laser Head fully to the left;
- verify that the o-ring on thread of the LLM01 is placed correctly and not damaged;
- remove the protective cover from the Lamp/Laser Head to be installed;
- verify that the thread on the LLM01 as well as on the Lamp/Laser Head is clean and not damaged;
- if installing a Lamp Head, verify that the bulb is placed correctly inside the Lamp Head;
- screw the Lamp/Laser Head onto the thread of the LLM01, turn the Lamp/Laser Head fully to the right (tight but without excessive force); and
- switch on the LLM01 and check the function of the Lamp/Laser Head (note that a Laser Head need to be adjusted, for detailed information on how to perform the adjustment refer to the documentation for the Laser Head)

2.2 Install the Filter Disc

- Switch off the LLM01 (mode switch to position **0**);
- if applicable, remove the Filter Disc already installed by turning the Filter Disc fully to the left using the appropriate tool (pin wrench);
- verify that the o-ring on the Filter Disc to be installed is placed correctly and not damaged;
- if necessary, clean the Filter Disc to be installed using a cotton stick moistened with Isopropyl-Alcohol;
- if applicable, attach the Shape Generator to the Filter Disc (refer to Chapter 2.3);
- screw the Filter Disc onto the LLM01, turn the Filter Disc fully to the right (tight but without excessive force) using the appropriate tool (pin wrench); and
- check and if necessary; correct the adjustment of the corresponding marker (refer to Chapter 2.9)

2.3 Attach a Shape Generator to the Filter Disc

- Switch off the LLM01 (Mode switch to position **0**);
- remove the Filter Disc (Fig. 3/2) by turning the Filter Disc fully to the left using the appropriate tool (pin wrench);
- attach the Shape Generator (3/1) to the Filter Disc as shown in Fig. 3;
- verify that the o-ring on the Filter Disc to be installed is placed correctly and not damaged;
- if necessary, clean the Filter Disc and/or the Shape Generator using a cotton stick moistened with Isopropyl-Alcohol;
- screw the Filter Disc to the LLM01, turn the Filter Disc fully to the right (tight but without excessive force) using the appropriate tool (pin wrench); and
- check and if necessary; correct the adjustment of the corresponding marker (refer to Chapter 2.9).

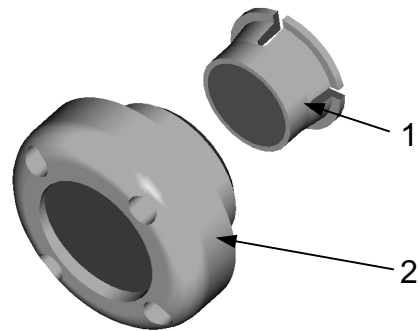


Figure 3 Install Shape Generator

2.4 Mount the LLM01 to the Weapon

NOTE

The installation procedure using a clamping screw is described below. The installation using a tensioning screw is very similar except that a 2.5 mm Allen key is needed.

- Hold the locking lever in position 'unlocked' (flat side towards clamp jaw, Fig. 2/4);
- open the two clamp jaws (if necessary, release the locking nut, Fig. 2/3) and position the LLM01 on the weapons sight rail;
- tighten the locking nut, then return it approximately one turn;
- turn the locking lever completely to lock the LLM01 tight to the sight rail; and
- install the trigger cable to the socket (Fig. 2/5).

2.5 Install the Batteries

CAUTION

The Lamp/Laser Head is switched on regardless of the mode switch position if both batteries are installed with reverse polarity. If necessary, cover the lamp during replacement of batteries.

For additional safety precautions concerning the handling of lithium batteries refer to Chapter 4.2.

- Switch off the LLM01 (mode switch to position **0**);
- open the cover of the battery case (e.g. using a coin);
- remove the empty batteries;
- verify that the contacts inside the battery case as well as on the cover are not damaged and not oxidised;

- verify that the o-ring for the cover is placed correctly and not damaged;
- insert the new batteries, verify that the polarity is correct (as indicated on the housing); and
- close the cover of the battery case.

NOTE

If both batteries are inserted with wrong polarity, the Lamp Head is switched on regardless of the mode switch position. If switching on the Lamp Head fails, this feature can be used to check if either the bulb is defective or the batteries are low (the Lamp Head is switched off automatically if the battery voltage drops below a certain level).

To perform the check just insert both batteries with wrong polarity. If the Lamp Head remains off with correct inserted batteries but is on (possibly with reduced brightness) with incorrect inserted batteries, the batteries are low – otherwise the bulb may be defective.

If a Laser Head is installed instead of a Lamp Head, the Laser Head is not switched on if both batteries are inserted with wrong polarity.

2.6 Select and Switch on a Marker or Illuminator

DANGER

If installed, do not cover the Lamp Head when switched on. The Lamp Head may become extremely hot and can cause fire or burning.

NOTE

Whenever the mode switch is actuated, all markers/illuminators of the LLM01 are switched off regardless of the current operation mode.

As soon as the LLM01 is switched on (mode switch in any position except **0**) the battery voltage is continuously monitored. Drops the voltage below a certain value, the Lamp Head (largest power consumer) will be switched off automatically or cannot be switched on. Because of the lower power consumption the marker as well as the IR Illuminator remain operable as long as the batteries are not completely empty.

However, the batteries should be replaced as soon as possible if the Lamp Head is switched off automatically due to low batteries.

The marker/illuminator to be switched on is selected using the mode switch. The selected marker/illuminator is switched on/off using the momentary type pushbutton switches on the LLM01 and on the external trigger.

The exact function of each pushbutton switch depends on the actual software configuration. For a detailed description of the possible software configurations (i.e. switch functions) refer to 2.7.

2.7 LLM01 Functions depending on the Software Configuration

NOTE

The column *Type* in the table below is the reference to the software depending relation between:

Mode switch position ⇒ actuated pushbutton ⇒ marker/illuminator switched on/off as described in the Chapters 2.7.1 to 2.7.5

		Special Function (refer to Chapter 2.9)					External Trigger ¹⁾		
TT	Type	A	B	C	D	E			LLM01 ID-No.
1 m	1	X	—	—	—	—	P	L	JT 403 225
1 m	2	X	—	—	—	—	M	L	JT 403 131
10 m	3	X	—	—	—	—	P	L	JT 403 249
30 m	3	X	—	—	—	—	P	L	JT 403 760
10 m	3	X	—	—	—	—	M	L	JT 403 263
10 m	3	X	X	X	—	—	P	L	JT 403 400
30 m	3	X	X	X	—	—	P	L	JT 403 770
10 m	4	X	—	—	—	—	M	L	JT 403 226
30 m	3/6	X	X	X	X	—	P	L	JT 403 630
30 m	3/6	X	X	X	X	X	P	L	JT LMT 630
30 m	3	X	—	—	—	X	P	L	JT LMT 760
30 m	3	X	X	X	—	X	P	L	JT LMT 770

The external Trigger acts as:

Momentary type switch (= M), **P**ermanent type switch (= P)

External Trigger is functional identical to pushbutton **L**eft/right (= L)
pushbutton **R**ear (= R)

Table 2-1 LLM01, Overview of LLM01 Software Configurations and Special Functions

X = This special function is available

— = This special function is not available

TT = Watertight down to the indicated depth

¹⁾ Factory settings for the external Trigger:

The left of these two columns indicates whether the pushbutton switch acts as momentary type or as permanent type switch. As momentary type switch the assigned marker/illuminator is switched on only as long as the switch is depressed. As permanent type switch the assigned marker/illuminator is switched on when the switch is briefly depressed and remains on until the switch is depressed again.

The second column indicates whether the external Trigger is functional identical to the left/right pushbuttons or to the rear pushbutton on the LLM01.

The function of the external Trigger is fix and cannot be changed except the special functions B and C are available. For these types of LLM01 the factory setting is indicated.

2.7.1 LLM01 Software Configuration Type 1

Position Mode Switch:	Pushbutton Switches left/right and External Trigger:	Pushbutton Switch rear:
IR 2	IR-Marker + IR-Illuminator	Lamp/Laser Head ¹⁾
IR 1	IR-Marker	Lamp/Laser Head ¹⁾
Centre Position	LLM01 off	LLM01 off
VIS 1	Red Light Marker	Lamp/Laser Head ¹⁾
VIS 2	Red Light Marker + Lamp/Laserhead ¹⁾	Lamp/Laser Head ¹⁾

2.7.2 LLM01 Software Configuration Type 2

Position Mode Switch:	Pushbutton Switches left/right and External Trigger:	Pushbutton Switch rear:
IR 2	IR-Marker + IR-Illuminator	Lamp/Laser Head ¹⁾
IR 1	IR-Illuminator	Lamp/Laser Head ¹⁾
Centre Position	LLM01 off	LLM01 off
VIS 1	Red Light Marker	Lamp/Laser Head ¹⁾
VIS 2	Red Light Marker + Lamp/Laserhead ¹⁾	Lamp/Laser Head ¹⁾

2.7.3 LLM01 Software Configuration Type 3

Position Mode Switch:	Pushbutton Switches left/right and External Trigger:	Pushbutton Switch rear:
IR 2	IR-Marker + IR-Illuminator	IR-Illuminator
IR 1	IR-Marker	IR-Illuminator
Centre Position	LLM01 off	LLM01 off
VIS 1	Red Light Marker	Lamp/Laser Head ¹⁾
VIS 2	Red Light Marker + Lamp/Laserhead ¹⁾	Lamp/Laser Head ¹⁾

2.7.4 LLM01 Software Configuration Type 4

Position Mode Switch:	Pushbutton Switches left/right and External Trigger:	Pushbutton Switch rear:
IR 1	IR-Marker	IR-Illuminator
Centre Position	LLM01 off	LLM01 off
VIS 1	Red Light Marker	Lamp/Laser Head ¹⁾

2.7.5 LLM01 Software Configuration Type 6

Position Mode Switch:	Pushbutton Switches left/right and External Trigger:	Pushbutton Switch rear:
IR 2	IR-Marker + IR-Illuminator	IR-Illuminator
IR 1	IR-Marker	IR-Illuminator
Centre Position	LLM01 off	LLM01 off
VIS 1	IR-Marker	Lamp/Laser Head ¹⁾
VIS 2	IR-Marker + Lamp/Laserhead ¹⁾	Lamp/Laser Head ¹⁾

¹⁾ Depending on whether a Lamp Head or a Laser Head is mounted to the LLM01

2.8 Special Functions

Whenever available in the actual software configuration (refer to Table 2-1) the special functions described below can be used to customise the LLM01.

2.8.1 Special Function A – Switch on the two Markers simultaneously

The two markers integrated in the LLM01 can be switched on simultaneously. This function is usually selected to facilitate laser adjustment. To switch on the two markers proceed as follows:

- Switch off the LLM01 (set mode switch to position **0**);
- On the LLM01 press one of the pushbutton switches left/right and the rear pushbutton switch simultaneously and keep it pressed, then set the mode switch to position **VIS 1**, keep the pushbutton switches depressed until the two markers are switched on (after approximately 3 seconds).

As soon as the mode switch is actuated again, the LLM01 returns to normal operation.

2.8.2 Special Function B – The External Trigger acts as Momentary Type Pushbutton Switch or as Permanent Type Pushbutton Switch

If the external Trigger acts as momentary type pushbutton switch, the marker/illuminator is only switched on as long as the corresponding switch is depressed. If the external Trigger acts as permanent type pushbutton switch, the marker/illuminator is switched on when the external Trigger is briefly depressed, and switched off when the external Trigger is depressed again.

To switch between the two functions proceed as follows:

- Switch off the LLM01 (set mode switch to position **0**);
- On the LLM01 press the rear pushbutton switch and the external Trigger simultaneously and keep it pressed, then set the mode switch to position **VIS 1**, keep the pushbutton switches depressed until the Lamp/Laser Head is switched on (after approximately 3 seconds). This indicates that switching over the function has been completed.

2.8.3 Special Function C – The External Trigger function is identical to that of the left/right Pushbutton Switches, or to that of the rear Pushbutton Switch

The function of the external Trigger at mode switch positions VIS 1 and IR 1 can be toggled between switching the marker (as LLM01 left/right pushbutton switches) or switching the illuminator (as LLM01 rear pushbutton switch).

To switch between the two functions proceed as follows:

- Switch off the LLM01 (set mode switch to position **0**);
- On the LLM01 press the rear pushbutton switch, one of the left/right pushbutton switches and the external Trigger simultaneously and keep it pressed, then set the mode switch to position **VIS 1**, keep the pushbutton switches depressed until the Lamp/Laser Head is switched on (after approximately 3 seconds). This indicates that switching over the function has been completed.

2.8.4 Special Function D – Switching on the IR Marker/IR Illuminator even though the Mode Switch is set to VIS 1 or VIS 2

If an IR Laser Head is used or an IR Filter is mounted to the lamp it may be useful to switch on the IR Marker and/or the IR Illuminator while the mode switch is set to position VIS 1 or VIS 2 (necessary to switch on the Laser Head or the lamp with IR Filter).

The difference between these two operation modes is shown in the table below. Mode A corresponds to software configuration type 3 (refer to Chapter 2.7.3), Mode B corresponds to software configuration type 6 (refer to Chapter 2.7.5).

Mode Switch setting	Operation Mode A		Operation Mode B
IR 2	R/L/E: IR-M, IR-II	Re: IR-II	No change
IR 1	R/L/E: IR-M	Re: IR-II	No change
Centre	AUS		No change
VIS 1	R/L/E: RL-M	Re: La/LH	R/L/E: IR-M Re: La/LH
VIS 2	R/L/E: RL-M, La/LH	Re: La/LH	R/L/E: IR-M, La/LH Re: La/LH

R/L/E/Re = Switch **R**ight/**L**eft/**E**xternal/**R**ear, M = **M**arker, II = **I**lluminator, La = **L**amp Head, LH = **L**aser Head, IR = **I**nfra**R**ed, RL = **R**ed**L**ight

To switch between the two modes proceed as follows:

- Switch off the LLM01 (set mode switch to position **0**);
- On the LLM01 press the rear pushbutton switch and one of the left/right pushbutton switches simultaneously and keep it pressed, then set the mode switch to position **IR 1**, keep the pushbutton switches depressed and wait until the two markers are switched on, keep the pushbutton switches depressed and set the mode switch to position **IR 2** and wait until the Lamp/Laser Head is switched on. This indicates that switching over the function has been completed and the pushbutton switches can be released.

2.8.5 Special Function E –Setting the Intensity of Marker/Illuminator

The intensity of the markers as well as of illuminators can be set in 5 different steps. To change the intensity keep the pushbutton switch depressed when switching on the marker/illuminator. After a short while the intensity of the marker/illuminator assigned to the depressed pushbutton switch starts to change continuously. Release the pushbutton switch as soon as the desired intensity level is reached. The selected intensity level is stored in memory will be recalled every time the LLM01 is switched on until another intensity level is set.

Note that for setting the intensity the assignment of the pushbutton switches to markers/illuminators is predetermined as shown in the Table below.

	Set intensity using ...		
Mode Switch	Switch right/left	Switch rear	External Trigger
VIS 1 or VIS 2	Red Light Marker	Lamp ¹⁾	---
Centre	---	---	---
IR 1 or IR 2	IR Marker	IR Illuminator	---

¹⁾ Laser Head, if mounted

Reset all Marker/Illuminator to the maximum intensity:

- Switch off the LLM01 (set mode switch to position 0);
- on the LLM01 press one of the pushbutton switches left/right and the rear pushbutton switch simultaneously and keep it pressed, then set the mode switch to position **VIS 1** (keep the pushbutton switches depressed),
- wait until the two markers are switched on (after approximately 3 seconds) and the Lamp Head/Laser Head is switched on (after approximately another 5 seconds). This indicates, that all markers/illuminators are set to maximum intensity and that the pushbutton switches can be released.

2.9 Adjust the Markers

NOTE

The beam of the IR-Marker is not visible for human eyes. Therefore a night vision device or a video camera with monitor is required to adjust the laser.

Even if using a night vision device or a video camera, the visibility respectively the range of the laser beam depends essentially on the surrounding brightness – during daylight the range may be reduced to just a few meters. However, this does not reduce the danger of the beam for unprotected eyes.

Illumination of objects using the IR-Marker requires an environment where the level of brightness is very low.

If installed, the Laser Head needs to be adjusted too. For a description of the adjustment procedure refer to the Documentation of the Laser Head.

To adjust the markers proceed as follows (it's easier doing the adjustment by two persons):

- Mount the LLM01 to the weapon;
- define a fixed target point (e.g. on a building, truck etc.) where the laser spots of the markers are visible (for the IR-Marker use a night vision device or the video camera), the distance should be >10 m, as greater the distance as more precisely the adjustment;
- switch on the LLM01
(do not look directly into the laser beam !!!)
- aim at the selected target point using the standard aiming device (usually optical sight or back and front sight) so that the weapons line of sight¹⁾ aligns exactly with the target point and hold the weapon in place;
- adjust each laser by turning the appropriate adjustment screws (bearing and elevation) alternating until the laser spot points to the target point or if desired, to a point with a defined deviation to the target point.

¹⁾ If available, a laser based adjustment device installed into the barrel of the weapon can be also used to aim at the target point. In this case the barrel axis is the reference instead of the line of sight. Note that in this case the laser spot emitted by the adjustment device represents purely the extended barrel axis of the weapon without considering ballistic data of the ammunition. The target point defined by the laser spot of the adjustment device and the target point defined by using back and front sight do not have the same meaning.

2.10 Preventive Maintenance on the LLM01

The LLM01 requires no regular preventive maintenance. If required, e.g. after or during outdoor missions in rough environment, check that:

- The Filter Discs (refer to Fig. 1/1 and 1/3) are clean, without excessive scratches, not damaged, if necessary clean the Filter Disc carefully, e.g. using cotton sticks moistened with isopropyl alcohol;
- the electrical connection (at the rear of the Lamp Head/Laser Head, accessible if the Lamp Head/Laser Head is removed from the LLM01) is clean, not oxidised, not damaged;
- the thread for the Lamp Head/Laser Head is clean and not damaged, the o-ring is placed correctly and not damaged;
- the battery contacts inside the battery case and on the battery case cover are clean, not oxidised and not damaged; and
- the o-ring for the battery case cover is placed correctly and not damaged.

3. Corrective Maintenance

3.1 Diagnostic Checks

NOTE

Only the manufacturer may open the LLM 01. Improper handling excludes manufacturers obligation of warranty and liability. This applies also for an improper installation to a weapon.

The table in Fig. 3.1-1 shows a summary of possible malfunctions, possible casuals and the resultant activities.

Malfunction	Possible cause	Activity
No function at all	Batteries completely empty	Replace batteries
	One of the two batteries is inserted with wrong polarity	Insert batteries correctly
	Cover of battery case not completely closed	Close cover
	Battery contacts soiled and/or oxidised	If possible, clean the battery contacts; otherwise replace the LLM01
	Breakdown of the electronics	Replace LLM01
Lamp Head/Laser Head is continuously switched on	Both batteries are inserted with wrong polarity	Insert batteries correctly
	Breakdown of the electronics	Replace LLM01

Figure 3.1-1 LLM01, Diagnostic Check List (1 of 2)

Malfunction	Possible cause	Activity
The Lamp Head switches automatically off or cannot be switched on, the markers work correctly.	Battery capacity is reduced	Replace batteries
	Bulb of Lamp Head defective	Replace bulb
	Breakdown of the electronics	Replace LLM01
The Lamp Head/ Laser Head works correctly, the markers and/or the IR Illuminator cannot be switched on.	Breakdown of the electronics or of a marker/IR Illuminator	Replace LLM01
The external Trigger does not work	External Trigger defective	Replace external Trigger
	On the LLM01 the socket for the external Trigger is soiled or defective.	If possible, clean the socket; otherwise replace the LLM01
	Breakdown of the electronics	Replace LLM01

Figure 3.1-1 LLM01, Diagnostic Check List (2 of 2)

3.2 Replace Filter Disc

For detailed information on how to replace the Filter Disc refer to Chapter 2.2.

3.3 Replace the Bulb of the Lamp Head

Do not touch directly the glass of the new bulb, use packing material or a soft cloth.

- Switch off the LLM01 (set mode switch to position **0**);
- remove the Lamp Head from the LLM01 by turning the Lamp Head to the left;
- remove the defective bulb from the Lamp Head;
- verify that the o-ring on the thread for the Lamp Head is placed correctly and not damaged;
- verify that the thread on the LLM01 as well as on the Lamp Head is clean and not damaged;
- insert the new bulb into the Lamp Head;
- mount the Lamp Head by turning the Lamp Head fully to the right (tight but without excessive force) to ensure tightness of the LLM; and
- check the function of the Lamp Head (set mode switch to VIS1, depress rear pushbutton switch).

4. Safety

Improper handling of the LLM01 may lead to hazard for the operator or for personnel in close vicinity. The potential hazard can be divided into the following categories:

- Hazard caused by visible and/or invisible laser beams (refer to Chapter 4.1);
- Hazard caused by Lithium batteries (refer to Chapter 4.2);

- Hazard caused by overheating of the Lamp Head (refer to Chapter 4.3); and
- Hazard caused by improper operation of the LLM01 (refer to Chapter 4.4).

4.1 Laser Safety

DANGER

Unless otherwise stated all laser safety regulations described below refer to the LLM01 with Lamp Head, **not** to the LLM01 with Laser Head. Depending on the type of Laser Head to be mounted to the LLM01 additional Hazard may take place.

Before a Laser Head is mounted to the LLM01 and set to operation the operator has to check whether the laser class of the LLM01 changes after installation of the Laser Head and further safety precautions need to be observed.

More information concerning the laser class of the different types of Laser Heads and special safety precautions to be observed are included in the documentation for the Laser Head.

4.1.1 Assignment of the LLM01 to the corresponding Laser Class

LLM01, Assignment of Marker to a Laser Class		
Type	Red-light Laser (visible)	IR Laser (invisible)
Wavelength	650 nm	850 nm
Max. Laser Output Power	4.8 mW	0.4 mW
Divergence	<1 mrad	<1 mrad
Laser Class according EN 60825-1:2003	3R	1
Laser Class according ANSI Z 136.1-2000	3a	1

Table 4-1 Assignment of the individual Lasers to the corresponding Laser Class

As shown in Table 4-1 the red-light laser integrated in the LLM01 is assigned to laser class 3R according EN 60825-1:2003 (laser class 3a according ANSI Z 136.1-2000). As a result the entire LLM01 is assigned to laser class 3R (3a).

DANGER

Neither the LLM01 nor the different Laser Head types contain a laser emission warning device which would give an audible or visible warning as soon as the laser is switched on. Therefore, whenever the current mission status permits, the mode switch of the LLM01 should be set to **0** (LLM01 off) to avoid unintentional switching-on of the laser.

4.1.2 General Safety Information

For reasons of personal safety, looking directly into the laser beam should never be done independent of the laser class. Functional checks for example can be done by pointing the laser in a slant angle to a diffuse reflecting surface. Personnel should not stay within the area of the direct/reflected beam. Red-light laser can be seen with naked eyes, for IR lasers special equipment (night vision device or a video camera with monitor) is required.

The operator is responsible for following the safety precautions.

4.1.3 Safety Information for Laser of Laser Class 3R/3a

D A N G E R

Radiation of laser assigned to laser class 3R/3a is potential dangerous for unprotected eyes. Short time radiation to the skin causes usually no damage. Looking at diffuse reflections is usually not dangerous.

Safety regulations for equipment assigned to laser class 3R are specified in EN 60825-1: 2003.

Beside further regulations and precautions the following preconditions are required to operate equipment assigned to the laser class 3R:

- The laser should be switched on only inside a area monitored under the aspects of laser safety;
- unintended reflections of the laser beam should be avoided;
- if possible, the laser should be pointed to less reflecting and/or diffuse reflecting objects; and
- eye protection (e.g. laser safety goggles) is necessary for personnel which is or may be exposed to the laser beam.

4.1.4 Warning Labels for Laser of Laser Class 3 R

For products, which contain lasers of the laser class 3R, the following laser warning labels are necessary:

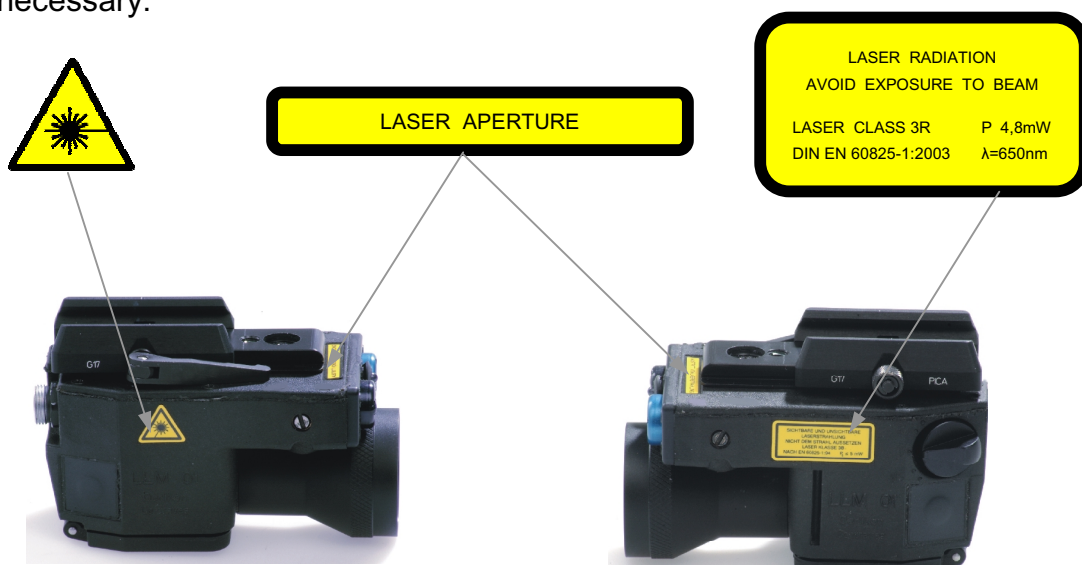


Figure 4.1-1 Position of Laser Warning Labels

4.1.5 Operate the LLM01 with different types of Filter Discs

The red-light laser integrated in the LLM01 is assigned to laser class 3R (according EN 60825-1:2003). Is a Filter Disc installed with a light transmission of $\leq 20\%$ (Filter Disc with blue frame or with extended frame without making (T)) the laser output power is reduced to a value below 1 mW. As a result the LLM01 can be handled like a laser class 2 product. If properly installed, the Filter Disc can be removed only with a special tool.

Laser of laser class 2 are safe for unprotected eyes provided the irradiation time is less than 0,25 seconds. Safety precautions are necessary only to prevent personnel from looking permanent directly into the laser beam. Using optical instruments (magnifier, binoculars, spectacles etc.) could be dangerous for unprotected eyes. According EN 60825-1:2003 it is not allowed looking directly into the laser beam using optical instruments.

4.2 Safety Precautions when handling Lithium Batteries

When improper handled lithium batteries may explode and can cause serious injuries. The rules listed below must be strictly observed while handling lithium batteries.

- **Do not** mix empty batteries with new batteries;
- **Do not** short-circuit the battery contacts;
- **Do not** charge Lithium Batteries;
- **Do not** throw Lithium Batteries into fire;
- **Do not** open Lithium Batteries;
- **Do not** check Lithium Batteries for capacity;
- **Do not** use damaged Lithium Batteries;
- **Do not** store Lithium Batteries close to fire or other sources of heat;
- **Do not** store Lithium Batteries together with other hazardous material; and
- **Do not** dispose Lithium Batteries into the environment or as standard waste – empty Lithium Batteries are hazardous waste, dispose in accordance with national rules.

4.3 Safety Precautions when using the Lamp

As with all type of filament bulbs a large part of the input power to the lamp is not converted into light but into heat. As long as dissipation of the heat is not blocked the temperature will remain at acceptable values, and continuous operation of the lamp is possible. The temperature of the glass as well on the front of the Lamp Head will increase but briefly touching this area causes no hazard of burning.

If dissipation of the heat is completely or partially blocked, e.g. by an installed Infrared-Filter or by operating the lamp inside a bag or holster, the temperature may increase such that the LLM01 may be damaged and/or burning may be possible if touching the Lamp Head.

DANGER

In principle the lamp should not be switched on when covered. If a filter is installed, continuous operation of the lamp is limited to 10 minutes at 20°C environmental temperature. After this allow the lamp to cool down before switching on again.

When using the version JT LMT xxx and the brightness of the lamp is set to the lowest level, the operation time of the lamp is not limited.

4.4 Safety when Selecting Special Functions

After setting the special functions (refer to Chapter 2.8), the lamp may be switched on to indicate that the selected function has been activated. The lamp is also switched on whenever both batteries are inserted with wrong polarity.

If installed, the Laser Head is not switched on with batteries inserted in the wrong way but a small current flows which discharges the batteries.

After setting special function the Laser Head is switched on in the same way as the Lamp Head. This applies also to a Laser Head with infrared-laser installed where the beam is invisible for the operator unless special equipment, e.g. a night vision device, is used.

DANGER

If mounted to the LLM01, the Laser Head may be switched on after selecting special function even though an infrared-laser is installed. Depending on the type of Laser Head installed the hazard by laser radiation may increase for the operator or for personnel in close vicinity compared to a LLM01 without a Laser Head installed.

After selecting a special function, change the setting of the mode switch to any position to ensure that all lamps and lasers are switched off.

After replacing the batteries check the function of at least one laser or of the lamp to ensure that the batteries are inserted correctly.

5. Technical Data

	Infrared-Marker	Infrared-Illuminator	Red-light-Marker	Lamp ¹⁾
Wavelength	850 nm	880 nm	650 nm	White light
Power output	≤ 0,40 mW	approx. 25 mW	≤ 5 mW	8 W
Laser class according DIN EN 60825-1:2003	1	1M	3R ²⁾	---
Range Darkness/daylight	> 200 m using night vision device		> 200 m/20 m	> 10 m
Size of spot	~15 x 30 mm at 25 m distance	~2 x 2 m at 3 m distance	~15 x 30 mm at 25 m distance	~2 x 2 m at 10 m distance
Dimension	86 x 46 x 58 mm (L x W x H)			
Weight	< 220 g incl. Batteries			
Operating voltage	6V, 2 x 3V Lithium-cells CR17345, DL123A or CR123A			
Operation time (-10°C to + 20°C)	> 28 h	> 13 h	> 15 h	> 1 h
Temperature range	Operation: -20°C to +55°C Storage -40°C to +70°C			
Watertight down to:	Refer to table 2.1, column TT			

¹⁾ If a Laser Head is mounted, refer to the Laser Head documentation for technical data.

²⁾ If a Filter Disc with ≤20% light transmission (Filter Disc with blue frame; or extended version without 'T' engraved on the frame) is installed to the LLM01, the laser power output is reduced to below one mW. As a result the LLM01 can be handled like a laser class 2 (according DIN EN 60825-1:2003) product.

6. Accessories

In the table below a selection of accessories available for the LLM01 is listed. Refer to the actual product catalogue for more details and additional accessories.

D A N G E R

If a filter is installed, continuous operation of the lamp is limited to 10 minutes at 20°C environmental temperature. After this allow the lamp to cool down before switching on again.

When using the version JT LMT xxx and the brightness of the lamp is set to the lowest level, the operation time of the lamp is not limited.

Designation and Part Number	Function/Description	Illustration
Filter Disc JT 403 105	Attenuation of laser power output to $\leq 20\%$ of the nominal power output	
Red light-Filter JT 403 318	Filter for the Lamp Head, permeable for red-light (Wavelength 630 nm and above)	
Infrared-Filter JT 403 315	Filter for the Lamp Head, permeable for infrared-light (Wavelength 850 nm and above)	
Laser Head JT 403 627	Infrared Illuminator (850 nm/3,4 to 3,7 mW) Divergence: 30 mrad	
Laser Head JT 403 695	Infrared Marker (850 nm/3,4 to 3,7 mW) Divergence: <1 mrad	
Laser Head JT 403 702	Red light Marker (650 nm/4,3 to 4,8 mW) Divergence: <1 mrad	
Laser Head JT 403 780	IR Illuminator (850 nm/50 to 55 mW) Divergence: 24 mrad	
Filter Disc JT 403 530	Attenuation of laser power output to $\leq 20\%$ of the nominal power output, with extended frame (without engraved T) to install a sleeve (JT 302 350)	
Filter Disc JT 403 611	Laser transmission >98%, with extended frame (with engraved T) to install a sleeve (JT 302 350)	
Sleeve JT 302 350	The Sleeve reduces the area from where an observer can recognise the Laser beam (requires a Filter Disc with extended frame)	
Shape Generator JT 403 614	Symbol: Circle with centre dot	
Shape Generator JT 403 616	Symbol: square with centre dot	
Shape Generator JT 403 618	Symbol: H with centre dot	
Shape Generator JT 403 621	Symbol: + (plus sign)	

6.1 Mount Filter Disc (Standard and with extended Frame)

Refer to Chapter 2.2.

6.2 Mount Red-light Filter/Infrared-Filter

If mounted, remove the rubber protection from the Lamp Head. Then install the Filter to the Lamp Head.

D A N G E R

If a Filter is installed, continuous operation of the lamp is limited to 10 minutes at 20°C environmental temperature. After this allow the lamp to cool down before switching on again.

When using the version JT LMT xxx and the brightness of the lamp is set to the lowest level, the operation time of the lamp is not limited.

6.3 Install the Laser Head

To install the Laser Head refer to the documentation for the Laser Head.

D A N G E R

When using a Laser Head the operator must check **before installing and first operation of the Laser Head** whether the laser class of the LLM01 changes; and whether additional safety precautions need to be observed after the Laser Head is installed. Further information are included in the documentation of the Laser Head.

6.4 Mount the Sleeve

To mount a Sleeve, a Filter Disc with extended frame must be installed to the LLM01. Attach the Sleeve to the frame of the Filter Disc.

6.5 Mount the Shape Generator

To mount a Shape Generator refer to 2.3.