

Scanning Laser Range Finder

UTM-30LX INSTRUCTION MANUAL

No. MRS-0039A



HOKUYO

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General

The sensor uses infrared a laser source ($\lambda=905\text{nm}$) to scan a 270° field with the angular step of 0.25° . It measures the distance for each angular step to the objects in its range. Maximum detection range will be 30m for White Kent sheet (500mm $\times$ 500mm). The measurement is obtained with each angular step. Therefore, it can use for the two-dimensional environment recognition of the sensor's surrounding.

※ Detection capability may differ according to the operating environment. User should verify detection capability before using actual object.

Safety Precautions

⚠ DANGER Procedures that could lead to dangerous situation, critical inquiry or death if not carried out properly.

- Due to mechanical vibration, excessive light interference and the electrical noise might lead to the measurement error.
- Make sure to switch off the power supply during maintenance and inspection.
- Handle the sensor carefully. Do not drop the sensor or collide with other objects.
- Objects in the dead zone of the sensor are not detected. Do not use for applications where the detection range does not satisfy the requirement.

⚠ CAUTION Procedures that could lead to dangerous situation, serious inquiry or physical damage if not carried out properly.

- Do not modify or disassemble the product. There might be possibility of damage due to short circuit. Also, any modification made to the sensor will void the guarantee.
- Avoid the place where oil scales or water is often used. The light receiving amount will fall. It will be the reason for the false detection. And, also inner part will corrode and becomes a cause of failure.
- Operating environment should be within the stated specification temperature, humidity, vibration, impact resistance. It could be reason of error or malfunction.
- Do not use or mount in an environment of organic solvents steam or in presence of corrosive substances.

⚠ NOTE Procedures that could lead to dangerous situation, if not carried out properly.

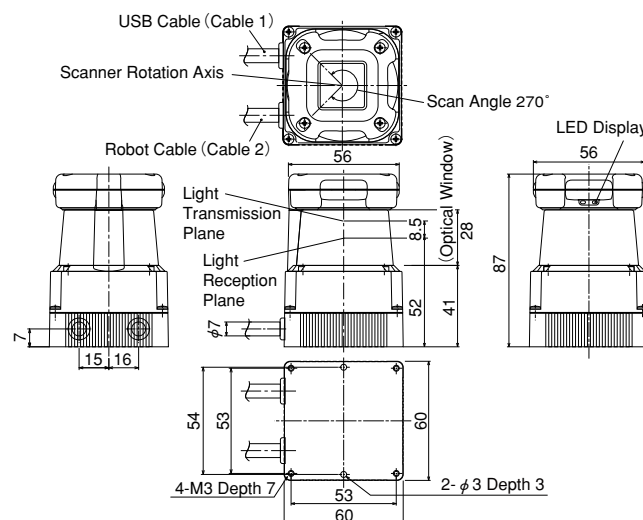
- Clean the optical window regularly with clean soft cloth. Accumulation of contamination on the optical window will affect sensor's detection capability.
- Sensor's external connections should be separated from power lines such as motor drive or brake connections.
- Connect frame ground wire to machine body when using switching regulator to supply the power.
- Synchronous output should be open when not in use.

- OUTPUT connection requires limit resistors.
- Shock and vibration should not loosen the mounting. Detection result will be different if the sensor is displaced due to such condition.

Make sure to read carefully and understand this document before installation, wiring, operation, inspection and maintenance.

Only use the sensor after gaining the sufficient knowledge, safety information and necessary cautions.

External Dimensions



Installation

(1) Do not use sensor in the environments stated below.

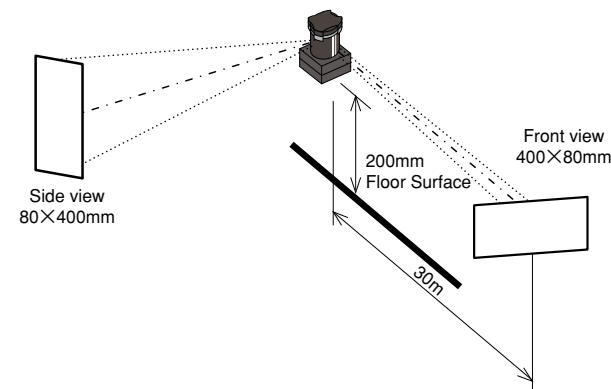
- Avoid the place where oil or water is often used. (Protective structure of the device is IP64. Wipe the optical window with a clean soft cloth. However, operation is not guaranteed in such environment).
- Do not use or mount in an environment of organic solvents steam or in presence of corrosive substances.
- Avoid the place where direct sunlight enters optical window of the sensor.
- Operating environment should be within the stated specification temperature, humidity, vibration, impact resistance.

(2) Installation Method

- Do not cover the optical window when the sensor is mounted.
- Install the sensor at a height of 200mm above the floor. When mounting below 200mm, incline 1° in upward direction. The spread of the beam differs on the front way 400 $\times$ 80mm and side way 80 $\times$ 400mm.

(The size value is for reference value only)

※ Scanning light source is rectangular in shape.

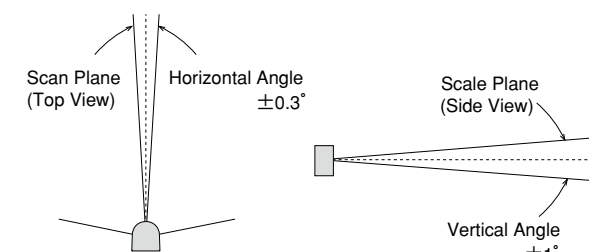


(Figure 1: Spread of laser beam)

- Firmly mount the sensor to avoid optical axis displacement due to vibration and shock.
- When cover is used it should be of highly transparent material that does not influence detection property. (Light wavelength 905nm)
- When using outdoors add necessary measures to prevent from rain and/or dust accumulation on the optical window.
- Base (bottom surface) is a frame ground (FG). Please mount on the stable structure.

(3) Optical-axis Adjustment

Angular tolerance with respect to structure axis is $\pm 0.3^\circ$ in horizontal plane and $\pm 1^\circ$ vertical plane (Figure 2). Use adjustment mechanism for precisely adjusting the detection plane. Detection plane can be checked by Optical-Axis Checker (Model: UES-930, Sold separately)



(Figure 2: Angular Tolerance with Respect to Structure Axis)

Perform optical-axis adjustment and check the sensor's operation before use.

(4) Mutual Interference

Mutual interference could occur when multiple identical sensors are mounted at the same detection plane. The sensor could not

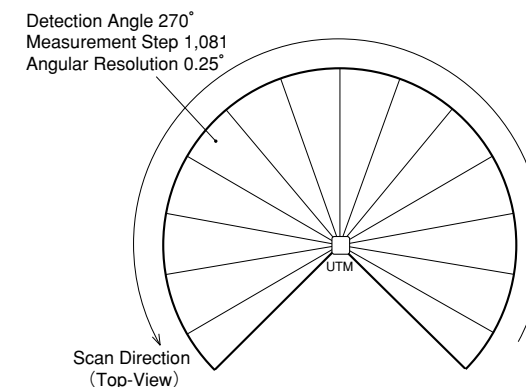
NOTE identify the origin of the received laser pulses. It might be the cause of measurement error for one or two steps. Perform data filtering to overcome this problem.

(5) Heat Dissipation

The heat is generated as the internal circuit of the sensor runs at a very high speed. The generated heat is concentrated at the bottom of the sensor. Mount a heat sink or any appropriate component to release the heat. An aluminum plate (200mm $\times$ 200mm $\times$ 2mm) is recommended as the heat sink.

Scan Area

Center point of the scan (X = 0, Y = 0) is the rotating beam's center.

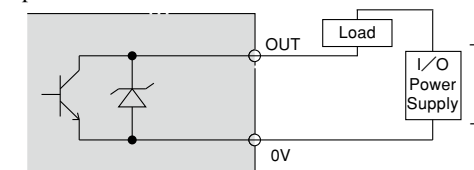


NOTE Figure above shows the detection area for 500mm white square Kent sheet. Maximum detection distance varies with reflectance of the object.

NOTE This product is an auxiliary/supplement safeguard product only not a safety device/tool. In case malfunction of this product there is a possibility of causing a serious accident so be sure to prepare another safeguard device/equipment. Also, take necessary measures such as backup circuit etc.

Connection

(1) Output Circuit



Output Rating: DC 30V, less than 30mA

NOTE OUTPUT connection requires limit resistors.

(2) Wiring

- Robot Cable (2000mm)

Wire Color	Function
Brown	Power Supply +12V
Blue	Power Supply 0V *
Green	Synchronous Output
White	COM Output (0V : Common to Power) *

NOTE Synchronous output should be open when not in use.

NOTE 0V of the power supply and Output are not internally connected. Connect it when it is necessary.

- USB Connector (TYPE-A 2000mm)

NOTE SG for communication and GND are connected internally (Isolated with Input -VIN). Isolate the device from any connection that generate electric noise. This sensor is compatible with SCIP2.0 communication protocol standard.

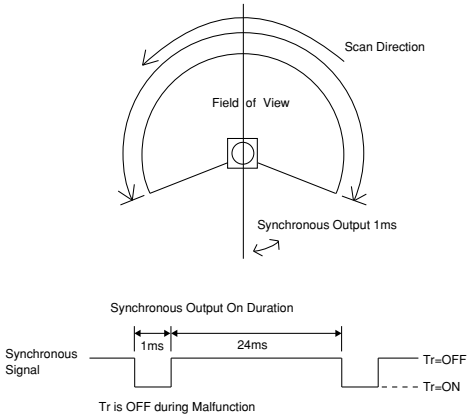
(3) Connection Method

- Connect the power supply, outputs and other lead wires as explained in section 2.
- Use power source with current capacity 1A or more. High rush current will flow when sensor is switched on. Range of supply voltage including ripple effect is DC 12V $\pm$ 10%. Normal current flow is 700mA or less.
- Connect frame ground wire to machine body when using a switching regulator to supply the power.

- Sensor's external connections should be separated from power lines such as motor drive or brake connections.
- Insulate all the unused wires to prevent short circuit.

■ Synchronous Output

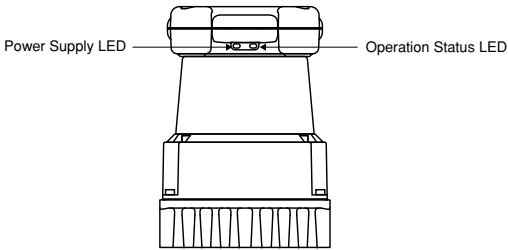
Sensor outputs a pulsed signal with approximately 1ms width in every scan cycle. Output timing of this scan synchronized signal is shown in Figure 3.



(Figure 3: Synchronous Output Timing)

■ LED Lights

1. Power Supply LED (Green) : ON when power is supplied.
2. Operation Status LED (Red) : Normal Operation (Continuous), Malfunction (Blink)



■ Communication

(1)Communication protocol

The communication protocol is based on SCIP2.0

- ※ Visit the web site bellow for details on sensor's communicaion protocol specification.
<http://www.hokuyo-aut.jp/02sensor/07scanner/download/products/utm-30lx/>

(2)Detail on Measurement Values

Table 1 shows the details of output value “x” for each measurement steps.

(Table 1)

Range of output value	Details
$x < 23$	Measurement error. Distance cannot be measured due to the light influence or noise.
$23 \leq x < 60,000$	Measured distance value (mm)
$60,000 \leq x$	Object does not exist or the object has low reflectivity.

■ Specifications

Model	UTM-30LX
Supply Voltage	DC12V $\pm 10\%$
Supply Current	700mA or less (1A during startup)
Light Source	Semiconductor Laser ($\lambda = 905\text{nm}$) Laser class 1 (FDA)
Detection Range and Object	Guaranteed Range : 0.1~30m (White Kent Sheet) ※2 Maximum Range : 60m (Measurement limit) Minimum detection width : 130mm at 10m (Varies with distance)
Measurement Accuracy	0.1~10m : $\pm 30\text{mm}$, 10~30m : $\pm 50\text{mm}$ (White Kent Sheet) ※2 Ambient light below 3000lx : 0.1~10m : $\pm 30\text{mm}$ (White Kent Sheet) ※1 Ambient light below 100,000lx : 0.1~10m : $\pm 50\text{mm}$ (White Kent Sheet) ※1
Measurement Resolution	1mm 0.1~10m : $\sigma < 10\text{mm}$, 10~30m : $\sigma < 30\text{mm}$ (White Kent Sheet) ※2 Ambient light below 3000lx : 0.1~10m : $\sigma < 10\text{mm}$ (White Kent Sheet) Ambient light below 100,000lx : 0.1~10m : $\sigma < 30\text{mm}$ (White Kent Sheet)
Scan Angle	270°
Angular Resolution	Approx. 0.25° (360°/1440 divisions)
Scan Frequency	25ms
Interface	USB Ver.2.0 Full Speed (12Mbps)
Outputs	Synchronous Output (NPN open collector DC30V, 30mA or less)
LED	Green display: ON during power supply. Red display: ON during normal operation, blinks during malfunction state.
Startup Time	Within 10 sec (start up time differs is malfunction is detected during start up)
Ambient Temperature	Operation : $-10 \sim +50^{\circ}\text{C}$ Storage : $-25 \sim +75^{\circ}\text{C}$
Ambient Humidity	Less than 85% RH (Without Dew/Frost)
Environment Resistance	Measured distance will be shorter than the actual distance under the influence of rain, snow and direct sunlight. ※3
Vibration Resistance	10~55Hz Double amplitude in each X,Y,Z axis for 2hrs 55~200Hz, 49m/s ² sweep of 2min in each X,Y,Z for 1hrs
Impact Resistance	196m/s ² in each X,Y,Z axis 10 times.
Protective Structure	IP64 (IEC Standard)
Insulation Resistance	10M Ω , DC500V Megger
Case Material	Polycarbonate
Weight	370g (With cable)

※1. Under standard test conditions.

(Accuracy cannot be guaranteed under direct sunlight.)

※2. Indoors environment with less than 1000lx.

※3. Please perform necessary tests with the actual device in the working environment. Use data filtering techniques to reduce the effect of water droplets when detecting objects under the rain.

NOTE Clean the optical window regularly with clean soft cloth. Accumulation of contamination on the optical window will affect sensor's detection capability.

■ Maintenance and Inspection

Stop using the sensor and perform necessary inspection(s) if any abnormal behavior is detected during the operation. Contact nearest distributor for support if the cause of abnormal behavior is unknown. Error details and troubleshooting measures are as shown in following table 2.

(Table 2)

Situation	Solution
Power supply LED is always OFF.	● Make sure that wire connections are correct. ● Make sure that supply voltage and current are within the specification.
Operation Status LED blinks continuously.	● The device is damaged/failed. Replace the device.

NOTE Switch off the power supply during maintenance and inspection.

■ Other Important Notes

About Laser Safety

Sensor complies with laser safety Class1 standard (IEC 60825-1)	
FDA Certified	21 CFR part 1040.10 and 1040.11
Average Power	Below 0.051mW
Wavelength	905nm (Infrared Laser)
Pulse cycle	55.5kHz
Beam size	400mm $\times$ 80mm (Distance: 30m at the sensor's front) Note

Note: Laser beam is rectangular in shape. At sensor's front, beam is flat. As the scanner rotates the beam shape also rotates gradually and becomes vertical at sides (Figure 1).

- About the Laser Class 1 safety standard
Laser safety is guaranteed under normal use (operations which can be foreseen rationally).
Additional measures are not necessary to maintain the laser safety.

NOTE Avoid looking at laser beam directly.

■ Disclaimer

- This sensor is not a certified for the functional safety.
- This sensor cannot be used for human body detection as per the machinery directives.
- Sensor emits laser for measurement. Sensor's operation may become unstable under the influence of strong interference light or when emitted lights are not reflected back from the object.
- Sensor's operation may become unstable due to rain, snow and fog or due to dust pollution on the optical window.
- Rules and regulations related to safety should be strictly followed when operating the sensor.
- When there is a risk that this sensor is used for mass-destruction weapons, weapons and equipment aimed at killing human beings, and relevant technologies, etc., or when its usage for those purposes has become clear, sales may be prohibited in accordance with the Foreign Exchange and Foreign Trade Act, and the Export Trade Control Order (Japanese law). Moreover, regarding export of products, the formalities according to laws/Export Trade Control Order are implemented in order to maintain international peace and safety.