Introduction

Light arrays from this series reliably and rapidly measure an object. When measurement is completed, the highest measured values are communicated to a PLC. Figure 1 shows a typical application.

Figure 1 - Typical Application

The controller transmits data in serial mode, through a so-called handshaking protocol. This protocol means that the data transmission can be done simply, with any PLC, over two inputs and two outputs. Therefore no RS-232, RS-485, RS-422 Interface, nor bus system is required. Transmission of the saved height measurement to a PLC takes only 60...90 ms.

To confirm an efficient transmission, only the highest interrupted beam information is communicated. This transmission is possible because the controller contains a measured-value memory; after a measurement period, the highest value is transmitted. The PLC determines the duration of measurement and does not limit it.

WARNING: Controller/Light Array systems are not safety systems. Any use for the protection of people is forbidden. Controller/Light Array systems can only achieve their function if the instructions given in this Operation Manual, and any referenced documents, are followed exactly. Also consult the valid laws and regulations at the time of installation.

The non-observance, or partial observance, of these instructions can lead to a premature malfunction of the system. The installer or system integrator is held fully responsible for the results of a non-compliant installation.

This manual is part of the Controller/Light Array system. It must be kept accessible with any other machine documentation during its entire lifecycle. Be sure it is made available to all personnel responsible for assembly, installation, operation, and maintenance of the system.

IMPORTANT Follow the instructions that are provided in this manual carefully. The non-observance of these instructions can cause customer complaints and/or serious call backs. Always keep these installation instructions on site.
Special Features
The outstanding characteristics of the Light Array system are:

- Universal handshake interface
- Fast height measurements
- Removable DIN rail mounting bracket for wall mounting
- IP54 controller (depending on the mounting option)
- Wide temperature range
- Universally applicable
- Standalone solution (the controller does not need to be installed in a control cabinet)
- Optical interface for fast software configuration
- Light arrays available in various pitches
- Light array length: $n \times 50$ mm (1.97 in.)
- Cascaded systems possible
- Additional pitches adjustable on the controller
- Compact light array housing
- Special optic to reduce mirrored reflections
- Slim aperture confirms the detection of small objects
- Large operating range
- Robust construction
- Optical interface
- Up to 255 beams
- Light arrays with connector termination
- Integrated diagnostic-indicators in the light array
- Modern technology

Applications

Typical Applications
The Light Array system is specially designed for applications in:

- Conveyor systems
- Storage systems
- Sort systems
- Paint systems

Typical application areas are:

- Wood measurement
- Quality control
- Transport systems
- Automatic storage systems

In different industries:

- Metal processing
- Paper processing
- Wood processing
- Textile industry

And every situation in which a distance or height must be measured quickly and precisely.

Application Restrictions
The Light Array system height measuring system is not intended for applications in explosive (EX) or in radioactive environments.

The light array operates in a temperature range between -20...+55 °C (-4...+131 °F) (noncondensing). For the controller, a temperature range of 0...55 °C (32...131 °F) is allowed. An excellent reliability operation is possible in any mounting orientation.

For a professional installation and connection, consult the relevant laws and regulations. You can also address any queries to our extensively trained employees.
Equipment Specifications

Controller

Figure 3 shows the dimensions of the Controller. The housing is sealed according to IP54 (EN 60529).

Figure 3 - Dimensions of the Controller [mm (in.)]

Figure 4 shows the position of the housing on a DIN rail. If necessary, the DIN rail-mounting bracket can be removed.

Figure 4 - Position of the Controller on a DIN Rail [mm (in.)]

Light Array

The Controller can be connected to the following types of light arrays:

- 45MLA-F
- 45MLA-T

The Light Array has the following special properties:

- Flange profile (see Figure 6)
- The distance between the middle, of the lowest beam, and the end of the profile is 7 mm (0.27 in.).
- The first lens at the end of the profile is always active.

In this installation, we only discuss the properties of the Light Array. For more information on the Light Array, contact your local distributor.
The flange also features an additional, smaller hole (a reference hole). With a pin, use the extra hole to mount the light array at a specific height. The following figure shows the position of the mounting holes and the reference hole.

If necessary, additional mounting holes are available for longer systems (if mechanically possible) with a pitch of 510 mm (20.08 in.).

The 45MLA-CTRL-100F light array system is offered in the following pitches:

- 10 mm (0.39 in.)
- 25 mm (0.98 in.)
- 37.5 mm (1.48 in.)

Not every lens visible in the light array is necessarily active. In other words, various types of light arrays can look identical from the outside, but can contain different electronic components.

**IMPORTANT** The pitch that is built in the light array is indicated on the light array label (see Figure 9).

Use the appropriate selection input on each controller, the height measurement process is stopped. Communication with the controller now begins (see the Interface on page 7 section).

**Connections and Terminal Positions**

**Controller**

Figure 10 shows the connection diagram of the Controller to a PLC.

If several Controllers are connected to a PLC, each Controller can be selected separately using the Select wire.

**IMPORTANT** Before operating a controller, it is essential to set the DIP switch settings (see the DIP Switch Settings on page 6 section) and the pitch of the attached light array. Any erroneous DIP switch setting can result in a false height measurement. This error, in turn, can result in significant damage to the storage system.
In some instances, grounding the controller (connect to the earth) can ultimately reduce Electro Magnetic Compatibility (EMC) disturbances in the system.

**Light Array**

The connection of the light arrays to the controller is only possible with the connector that is supplied by Rockwell Automation. For longer systems, Rockwell Automation supplies 1 m and 3 m (3.28 ft and 9.84 ft) extension cables. The cables for the emitter (white marking) and receiver (blue marking) can reach a maximum length of 10 m (32.8 ft). Different cables lengths for the emitter and receiver components do not negatively impact the functionality of this system.

*Figure 13* shows the M12 connection for the transmitter (white) and the receiver (blue).

If you invert the connections by mistake, the terminals do not damage any electronic component. The light arrays can even be attached after the controller has been powered-up. In such a case, however, the controller must be powered up again to confirm proper communication during transmission.

**Display Elements**

Status indicator elements are present on the controller and on the light arrays.

**Controller**

Positions of the status indicator (D1 to D7) on the controller are shown in *Figure 14*.

**Light Array**

The emitter and receiver light arrays feature two additional indicators near the cable input.

*Figure 15* - Emitter and Receiver Status Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Color / Meaning</th>
<th>Color / Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Green: light array that is not interrupted Green blinking: Intensity inadequate</td>
<td>Off: light array that is interrupted</td>
</tr>
<tr>
<td>D2</td>
<td>Red: light array that is interrupted Red blinking: Height measurement failure</td>
<td>Off: light array that is not interrupted</td>
</tr>
<tr>
<td>D3</td>
<td>Green blinking: Communication present</td>
<td>Off: No communication</td>
</tr>
<tr>
<td>D4</td>
<td>Green blinking: Communication present</td>
<td>Off: No communication</td>
</tr>
<tr>
<td>D5</td>
<td>Green blinking: Communication present</td>
<td>Off: No communication</td>
</tr>
<tr>
<td>D6</td>
<td>Green blinking: Communication present</td>
<td>Off: No communication</td>
</tr>
<tr>
<td>D7</td>
<td>Green: Power on</td>
<td>Off: Power off</td>
</tr>
</tbody>
</table>

**IMPORTANT**

The Light Array and Control systems are designed so that the ground connection can be made either over the light array profile (use the mounting bracket) or via the controller. If the system is grounded both on the profile and through the controller, you can create ground loops. For this reason, we recommend that you initially avoid making the ground connection on the controller. If the profile is not grounded, then a connection to ground in the controller is recommended.
The two lights near the cable input correspond to the D1 and D2 indicators in the controller and indicate the following conditions:

### Condition         | Green Indicator | Red Indicator |
----------------------|-----------------|---------------|
Light array that is    | On              | Off           |
not interrupted        |                 |               |
Light array that is     | Off             | On            |
interrupted             |                 |               |
Failure in height       | Off             | Blinking      |
measurement system      |                 |               |
(See Diagnostics and   |                 |               |
Solutions on page 10)  |                 |               |
Inadequate intensity   | Blinking        | Off           |
Power off or light      | Off             | Off           |
array not attached      |                 |               |

The **Diagnostics and Solutions** section offers additional information about specific problems shown by the status indicators.

### Jumper Settings

*Figure 14* also shows two jumpers (J1 and J2) and a DIP switch. These jumpers are present only on some hardware versions of the light array. If they are present, both of these jumpers (J1 and J2) define the logic (PNP or NPN) of the inputs to the controller.

For handshake communication with the controller, both jumpers must be set to the PNP position.

### DIP Switch Settings

*Figure 14* shows a DIP switch with eight switches.

Switches 1 to 4 allow the software to increase the active pitch dimension of the light array. This change means that the measurement pitch can be set to any multiple of the hardware pitch: 10 mm (0.39 in.), 25 mm (0.98 in.), and 37.5 mm (1.48 in.).

#### Example:

A light array with a 25 mm (0.98 in.) hardware pitch is connected to a controller. However, the application requires a measuring pitch of 75 mm (1.67 in.). If the DIP switch is set to factor three, the software is only evaluated every third beam. The measuring pitch can be calculated with the following formula:

\[
\text{[Measurement pitch]} = \text{Factor} \times \text{[Hardware pitch]}
\]

The hardware pitch is shown on the light array label.

#### Table 16 - DIP Switch Positions for the Setting the Pitch

<table>
<thead>
<tr>
<th>Factor</th>
<th>Switch 1</th>
<th>Switch 2</th>
<th>Switch 3</th>
<th>Switch 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>2</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>3</td>
<td>off</td>
<td>on</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>4</td>
<td>on</td>
<td>on</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>5</td>
<td>off</td>
<td>off</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>6</td>
<td>on</td>
<td>off</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>7</td>
<td>off</td>
<td>on</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>8</td>
<td>on</td>
<td>on</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>9</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>10</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>11</td>
<td>off</td>
<td>on</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>12</td>
<td>on</td>
<td>on</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>13</td>
<td>off</td>
<td>off</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>14</td>
<td>on</td>
<td>off</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>15</td>
<td>off</td>
<td>on</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>16</td>
<td>on</td>
<td>on</td>
<td>on</td>
<td>on</td>
</tr>
</tbody>
</table>

DIP switches 5 and 6 define how many measurement pitches (on the side where the cable is located) are ignored. They allow you to define a "blind" area that is not influenced on the system output. The following table describes the functionality of this system.

<table>
<thead>
<tr>
<th>Ignored Pitches</th>
<th>Switch 5</th>
<th>Switch 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>1</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>2</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>3</td>
<td>on</td>
<td>on</td>
</tr>
</tbody>
</table>

1 Number of ignored measured pitches near the cable input.

DIP switches 7 and 8 have no function currently.

#### IMPORTANT

A change of the DIP switch settings will only be acknowledged after a power-up.

Before the first start-up of the controller it is important to verify the DIP switch setting and the hardware pitch value (= pitch length) of the connected light.

A wrong DIP switch setting can lead to erroneous measurements, which in turn can result in significant consequential losses to the installation (see the 45MLA-CTRL-100F Light Array System on page 11).

#### TIP

The number of beams of the attached light array must be larger or equal to the value [Factor+1]. This consideration means that as a minimum two beams must be active in any light array system.
**Interface**

**Communication Content**

For each light array scan, the Controller determines the highest interrupted beam and compares this value with the previous light array scan. If the most recent scan value is higher than the previous scan value, then this value is stored in memory. Thereafter the Select input is monitored to see if it's high. If it is high, the value that is stored in memory is transmitted, this representing the number of the highest interrupted beam (not the lowest beam).

![Figure 16 - Flowchart of the SW Process](image)

After a successful transmission, the stored value is deleted from memory, and another measurement is immediately made. The PLC determines the time when communication starts (momentary setting of the Select signal; min. 20 ms).

The height measurement duration is not limited. Theoretically the height measurement could be made over many hours, and at the end of this period, the highest measured value over the entire period is transmitted.

**Type of Interface**

The Controller transmits in serial mode, and sends the results in a 6-bit or 9-bit code (8 bits for data + one parity bit). The actual number of bits depends on the number of beams in the connected Light Array.

Communication takes place with a handshake process over four wires: Select, Data, Ack, and Ready. Figure 17 on page 7 shows the associated flow diagram for the Handshake protocol.

This protocol means that the data transmission takes place with every standard PLC with two inputs and two outputs. No RS-232, RS-485, RS 422, or other bus system is required for communication.

![Figure 17 - Flow Diagram for the Handshake Protocol](image)

For light arrays with a beam number ≥ 32, the handshake communication takes place with a 9-bit sequence. After the eighth bit, a parity bit is transmitted (parity: odd).

![Figure 18 - Example of the Signal Sequence for 8-bit Transmission](image)
For light arrays with a beam number ≤ 31, communication is effected through a 6-bit sequence. In this case, the transmission takes place without the parity bit. To detect a breakage of the Data wire, the measurement result is transmitted with an offset of 32 beams (hex 20).

Figure 19 - Example for 6-bit Transmission

A transmission only contains information for the highest interrupted beam, and not the lowest interrupted beam.

The times that are mentioned in Figure 17 and Figure 18 are specified as follows:

T1: The time from which the PLC applies the Select signal, until the transmission takes place. The PLC Select signal can be applied to the controller for a short time (for minimum, see the Controller table). If the Select signal is continuously "High," the value that is stored in memory is continuously communicated. In order for the communication to be conducted once, the T1 time for the PLC and the Select signal must be larger than the minimal value. The T1 time must also be smaller than the maximum value of the communication duration.

T2: The time from which the PLC applies the Ack signal, until the controller Ready signal goes to "Low."

T3: The time from applying the Data signal until the Ready signal goes to "High."

T4: The time from which the Ack signal from the PLC = "Low" until the "Ready" signal from the controller = "High." This feature represents the time from when the last bit is read, until the point in time when the new data bit is available.

If the Controller suddenly stops receiving an answer while communicating with the PLC (t > Time out, see the Controller section), the controller terminates the communication. The Controller stores the current value in memory, and continues to make additional height measurements until the next PLC Select signal (Figure 16 on page 7) is received.

More detailed timing information and additional properties of the inputs/outputs can be found in the section called Technical Data: Controller (see page 11).

Communication Duration

The controller and the PLC determine the time required to transmit a value that is saved in memory. A typical value for a light array with 32 beams or less (6-bit transmission) lies between 30...60 ms. For a light array with 32 beams or more, the communication takes place in an 8-bit + parity bit pattern. A typical transmission time for such a case lies between 45...90 ms.

The mentioned transmission times are a minimum time. If the Controller does not receive an answer (Ack), within a programmed time (Time Out), it terminates the transmission, and waits for the next transmission (see the flowchart in Figure 16 on page 7).

Speed of Measurement

When developing the Laser Array family of products, special attention was paid to confirm a fast speed of measurement for the system. Because of high scan rates, the heights of even small objects are reliably detected. For instance, a light array with 30 beams is able to detect an object with 5 mm (0.2 in.) diameter. This detection occurs even when the object moves through the light array at a speed of 0.5 m/s.

The speed of measurement (T) can be roughly calculated using the number of beams (N), the scan speed per beam (tS) and the analysis speed (tA):

\[ T = N \times tS + tA \]

For, tS and tA, we can assume the following approximate values:

\[ tS = 65 \mu s/beam \]
\[ tA = 230 \mu s \]

For more detailed information about speed of measurement, contact your nearest sales office.

Information for Initial Installation

Controller

Plug-in terminal blocks allow a fast and user-friendly connection process. This type of block allows you to connect the individual wires.

Figure 20 - Both Sides of a Terminal Block

During the initial installation of the controller, the following precautions must be observed:

- Supply voltage must be +24V DC
- If a jumper is present: control the jumper setting
- Make the DIP switch setting
- To reduce the danger of electromagnetic disturbances, carefully confirm that the connecting cables are not lying next to the high-power circuit cables.
Light Indicators

The light arrays also feature an intensity indicator. If one of the green lights near the cable input of the emitter/receiver, and the green D1 light on the controller blink, then the intensity is in a critical area.

**IMPORTANT** Evaluation of the intensity can only be performed when no object is interrupting the light array. The evaluation of the intensity only happens during the interval between power-up and the first Select signal from the PLC. Once the first Select signal is detected, the intensity is no longer evaluated. The result of the measurement before detecting the first Select signal remains stored. This condition means that a machine, which communicates after power-up, only displays the intensity level that was detected immediately (if the light array is uninterrupted).

During the initial exploitation of the 4SMFA-F light array, observe the following precautions:

- Do not swap the emitter and receiver cables
- Select cable lengths not longer than 10 m (32.8 ft)
- Do not pinch or mechanically stress the cables
- Do not mechanically stress the light arrays (torsion or bend)
- Pay attention to intensity diodes only until the first PLC transmission
- Make sure that the connecting cables are not lying next to the high-power circuit cables

**ATTENTION:** To minimize ESD damage, ground or shunt the controller and use static control packaging and material handling products. Dissipate and neutralize by grounding, ionization, and the use of conductive and dissipative static control materials.
# Diagnostics and Solutions

<table>
<thead>
<tr>
<th>Problem</th>
<th>Reason</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>No function, no indicator diodes active in controller</td>
<td>No supply voltage</td>
<td>Check the power supply</td>
</tr>
<tr>
<td>No indicator light active in light array emitter or receiver</td>
<td>No cable connection to emitter or receiver</td>
<td>Check the cable connection to emitter or receiver Replace cables if necessary</td>
</tr>
<tr>
<td>Indicator in the light array is always red although the light array is not interrupted</td>
<td>Emitter and receiver are misaligned by 180°</td>
<td>Turn emitter or receiver 180°</td>
</tr>
<tr>
<td>System insufficiently aligned</td>
<td>Correct alignment</td>
<td></td>
</tr>
<tr>
<td>Lens that is blocked or dirty</td>
<td>Clear optical path</td>
<td></td>
</tr>
<tr>
<td>Special Lean Lift (for example, with roll door)</td>
<td>When the roll door is closed, the light array is always interrupted</td>
<td></td>
</tr>
<tr>
<td>Defective element</td>
<td>First remove the light array emitter and receiver, and position them against each other. If the indicator in the emitter and receiver remains red, then a misalignment can be ruled out. If so, replace emitter and receiver. If necessary, replace cables.</td>
<td></td>
</tr>
<tr>
<td>Defective controller</td>
<td>Replace controller</td>
<td></td>
</tr>
<tr>
<td>Indicator D2 red, blinking (system disturbance)</td>
<td>Emitter and/or receiver light array incorrectly connected</td>
<td>Is the red indicator in the emitter and receiver also blinking? If not, test the light array connection. If yes, then the emitter and receiver light arrays can possibly have been switched.</td>
</tr>
<tr>
<td>Defective emitter or receiver light array</td>
<td>First replace the emitter light array. If the problem persists, replace the receiver light array. If necessary, replace cables.</td>
<td></td>
</tr>
<tr>
<td>Defective controller</td>
<td>Replace controller</td>
<td></td>
</tr>
<tr>
<td>Indicator D1 green, blinking (intensity)</td>
<td>Emitter and receiver are poorly aligned to each other</td>
<td>Power up the controller and correct the alignment (see the 45MLA-F Indicator Diodes section)</td>
</tr>
<tr>
<td>Incorrect values are transmitted</td>
<td>DIP switch setting does not correspond to the desired pitch</td>
<td>Correct the DIP switch setting (see the DIP Switch Settings on page 6)</td>
</tr>
<tr>
<td>Incorrect light array pitch</td>
<td>Replace light array with correct pitch light array</td>
<td></td>
</tr>
<tr>
<td>Light array cables longer than 10 m (32.8 ft)</td>
<td>Shorten the cables</td>
<td></td>
</tr>
<tr>
<td>Poor or no ground connection</td>
<td>Improve the ground connection</td>
<td></td>
</tr>
<tr>
<td>Incorrect jumper setting in controller</td>
<td>Correct the jumper setting (see the DIP Switch Settings on page 6)</td>
<td></td>
</tr>
<tr>
<td>Defective controller</td>
<td>Replace controller</td>
<td></td>
</tr>
<tr>
<td>Object not detected</td>
<td>Reflections (shiny surface parallel to light beam)</td>
<td>Minimize shiny surface (for example, paint black)</td>
</tr>
<tr>
<td>Defective controller</td>
<td>Replace controller</td>
<td></td>
</tr>
<tr>
<td>Incorrect jumper setting in controller</td>
<td>Correct the jumper setting (see the 45MLA-CTRL-100F Controller on page 11)</td>
<td></td>
</tr>
<tr>
<td>Incorrect interface wiring</td>
<td>Correct wiring</td>
<td></td>
</tr>
<tr>
<td>Spontaneous faulty switching</td>
<td>Foreign light courses or other optical sensors</td>
<td>Cover or remove foreign light sources</td>
</tr>
<tr>
<td>Poor or no ground connection</td>
<td>Improve the ground connection</td>
<td></td>
</tr>
<tr>
<td>Loose contact</td>
<td>Replace cable, controller and/or light array</td>
<td></td>
</tr>
</tbody>
</table>

## Accessories

The following replacement accessories are available:

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>Description</th>
</tr>
</thead>
</table>
| 445L-AC8RJ | M12/8-pin...RJ45 connection cable

* 1 = 1 m (3.28 ft), 2 = 2 m (6.56 ft), 3 = 3 m (9.84 ft), 5 = 5 m (16.4 ft), and 8 = 8 m (26.25 ft) |
| 445L-AC8PC | M12/8-pin...M12/8-pin connection cable

* 1 = 1 m (3.28 ft), 3 = 3 m (9.84 ft) |
| 45MLA-CTRL-100F | Control unit |

**ATTENTION:** The ground connection of the light array and controller systems can be made either at the light arrays or the controller. Do not ground both the arrays and the controller as that can create ground loops.
## Technical Data

### 45MLA-CTRL-100F Controller

#### General Data
- **Nominal working mode**: Continuous
- **Net weight**: 360 g (12.7 oz)
- **Equipment dimensions**: 200 x 126 x 48 mm (7.87 x 4.96 x 1.89 in.)
- **Mounting position**: No restrictions
- **Temperature range**: Operation: 0…55 °C (32…131 °F)
  - Storage / transport: -25…+70 °C (-13…+158 °F)
- **Enclosure rating according to EN 60529**: Housing: IP54
  - Terminal strip: IP20
  - Housing material: ABS (FR) UL94-V0
  - Conductor connection: 8-pin terminal strip (plug-in)
  - Wire cross-section: 2.5 mm² (0.10 in.²) max
  - Wire clamped
- **Quick mounting**: DIN rail 35 m (114.83 ft) or mounting holes
- **Interface transmission rate**: 30…90 ms, dependent upon the reaction time of the Ack signal from the PLC, and the number of beams in the light array
- **Timing of the interface**:
  - **Time Out**: ca. 1 s
  - **T1**: 7.3 ms (maximum), depending on the number of light array beams
  - **T2**: 0.2 ms (maximum)
  - **T3**: 0.11 ms (maximum)
  - **T4**: 2.25 ms (maximum)

#### Weight and Packaging
- **Dispatch packaging**: 250 x 165 x 165 mm (9.8 x 6.49 x 6.49 in.)
- **Dispatch weight**: Net weight + 250 g (8.82 oz)

#### Inputs
- **Nominal voltage**: UN 24V DC (EN 60204-1)
- **Current consumption**: 100 mA, max. (Semiconductor outputs unloaded)
- **Internal fuse**: None
- **Max. power consumption**: 2.9 W @ 100 mA (at max. operating voltage)

#### Semiconductor Outputs
- **Terminals**: Data (861), [Out1]; Ready (862), [Out2]
- **Type**: PNP / NPN (short circuit proof, Pull up)
- **Voltage**: Nominal voltage UN
- **Current consumption**: Each PNP: max. 200 mA (24V), Each NPN: 100 mA (24V)
- **Logic**: 0V “Low” — +24V “High”

#### Semiconductor Inputs
- **Terminals**: Select (864), [In1]; Ack (863), [In2]
- **Type**: PNP or NPN dependent on jumper J1 and J2 (short circuit proof)
- **Switching level Low**: PNP: 0…7V DC, NPN: 21…24V DC
- **Switching level High**: PNP: 18…24V DC, NPN: 0…20V DC
- **Current consumption**: PNP: 6 mA (24V), NPN: 6 mA (28V) @24 V
- **Input**: Minimal current 3 mA

### 45MLA-CTRL-100F Light Array System

#### General Data
- **Weight**: Depends on length of system and cable length
- **Mounting**: Flanged profile with two (each side) recessed mounting holes. Made for M5 screws with pan head washers
- **Light array cross section**: Without flange:
  - **Width**: 16 mm (0.63 in.) ± 0.3 mm (0.012 in.)
  - **Depth**: 20.8 mm (0.82 in.) ± 0.3 mm (0.012 in.)
  - **With flange**: See Figure 6 on page 3
- **Housing material**: Aluminum
- **Housing surface**: Powder coated (RAL 3002 red)
- **Light array length**: Max. 4,000 mm (55.12 in.) (≤ 0.2 mm [0.008 in.])
  - Min. 50 mm (1.97 in.) (≤ 0.2 mm [0.008 in.])
- **Module length**: 50 mm (1.97 in.)
- **Number of beams**: 255 max.
- **Enclosure rating**: IP50
- **Type of connector**: M12/8-pin
- **Maximum cable length**: Transmitter: 10 m (32.8 ft)
  - Receiver: 10 m (32.8 ft)
- **Temperature range**: Operation: -20…+60 °C (-4…+140 °F) noncondensing
  - Storage: -20…+60 °C (-4…+140 °F)
- **Humidity**: 15…95% (noncondensing)
- **Pitch**: 10, 25, 37.5 mm (0.39, 0.98, 1.48 in.) or a multiple thereof via software (DIP switch)
- **Minimum distance from middle of the first active beam and the end of the profile**: 7 mm (0.27 in.) ± 0.1 mm (0.0039 in.)
- **Access protection**: Silicon free; Cascade system possible
- **Aperture geometry**:
  - 37.5 mm (1.48 in.) pitch: 8 x 3.1 mm (0.31 x 0.12 in.) (h x b)
  - 25 mm (0.98 in.) pitch: 8 x 3.1 mm (0.31 x 0.12 in.) (h x b)
  - 10 mm (0.39 in.) pitch: 8 x 2.8 mm (0.31 x 0.11 in.) (h x b)
- **Emitter / receiver optical angle**: ca. ± 2.5° 3 m (9.8 ft) and beyond
- **Foreign light suppression**: Up to 50,000 Lux
- **Operating range (emitter to receiver separation)**: 0 mm min. 4,000 mm (157.48 in.) max.
- **Further data**: Silicon free; Cascade system possible
- **Connection cable length**: 1, 2, 3, 5, and 8 m (3.28, 6.56, 9.8, 16.4, and 26.25 ft)
- **Extension cable length**: 1 m and 3 m (3.28 ft and 9.8 ft)

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**ATTENTION**: These devices are intended for object recognition only and can not be used for protection of humans (access protection).
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Publication 45MLA-IN004A-EN-P - May 2017 10002965916 Ver 00
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