Measuring Light Array Controller

USER MANUAL

45MLA

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Rockwell Automation publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley sales office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

WARNING	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequences.
SHOCK HAZARD	Labels may be on or inside the equipment (for example, drive or motor) to alert people that dangerous voltage may be present.
BURN HAZARD	Labels may be on or inside the equipment (for example, drive or motor) to alert people that surfaces may reach dangerous temperatures.

It is recommend that you save this user manual for future use.

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1 Introduction

The Allen-Bradley 45MLA controller drives the photoelectric elements in the 45MLA transmitted beam array pairs. Three versions of the controller are available, each offering a different communications platform that can be selected to function with a range of PLCs.

- 45MLA controller I/O Model, Catalog Number: 45MLA-CTRL
- 45MLA controller RS45, Catalog Number: 45MLA-CTRL-485
- 45MLA controller CAN, Catalog Number: 45MLA-CTRL-CAN

This controller includes numerous application features, allowing for customization to many applications. All controller types are equipped with two digital outputs, indicating light array interrupted or over-height (i.e. object is too tall) and overhang. The I/O version of the 45MLA controller offers four additional outputs to monitor single beams or groups of beams (zones). In addition, the RS485 and CAN controllers are able to communicate the state of each beam to a PLC.

This user manual describes advanced features and the communication protocols of the controller. The basic information on wiring, DIP switch settings, and LED indicators can be found in the 45MLA Controller Installation Instructions. That document also contains additional information on setting the baud rate, setting the address, and the network topology.

1.1 Advanced Functions

Applications like height measurement require information regarding individual beam status as well as the exact beam positions. This is only possible if the light array itself is clearly defined. This chapter defines the light array and reference beams, specific measurement modes as well as various functions to obtain information from the 45MLAs.

1.1.1 Beam counting direction

In order to gather meaningful information from beam status about an object interrupting the light array, the individual beams must be identified through a standardized numbering system. This system depends on the orientation of the light array and is explained in Figure 1.

There are two ways to number the beams in the 45MLA:

- Standard beam counting direction: Beam 1 (first beam) is located at the connector end of the light array.
- Reverse beam counting direction: Beam 1 (first beam) is located at the other end (the nonconnector end) of the light array (inverted).

Note that blanked beams are not counted, and beam counting begins at the beam after the designated First Beam Offset (fb_offset).

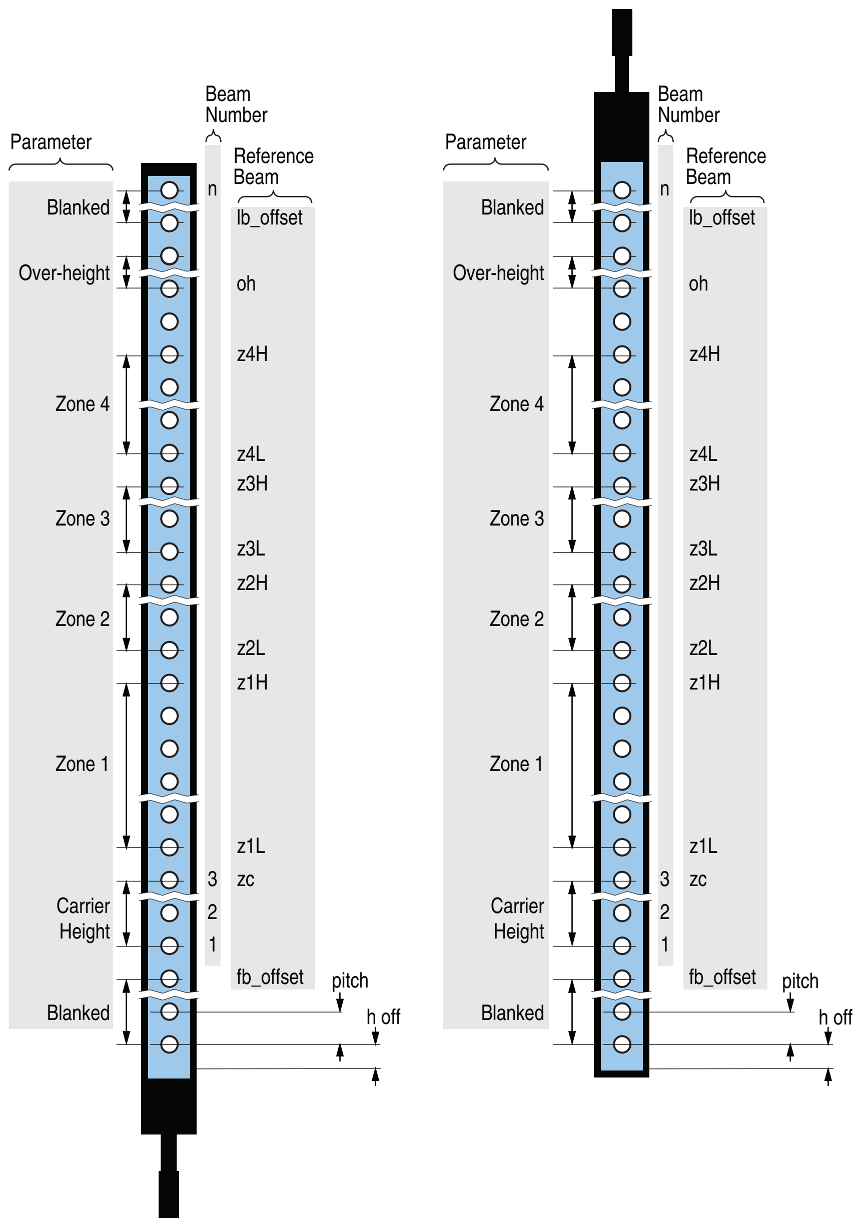

Figure 1: 45MLA beam definitions and beam counting direction

Parameter	Description	Reference Beam	Explanation
Blanked	These beams will be ignored, and not used in any evaluation process, and are not counted in beam numbering	“fb_offset”	Number of blanked beams from the beginning of the array (cable end for standard beam counting direction; opposite end for reverse beam counting direction)
		“lb_offset”	Number of blanked beams from the opposite end of the array
Over-height	Beams which when interrupted, cause the Over-height output to be activated	“oh”	Lowest beam of the Over-height zone (incl.)
Zone 1…4	Beams which when interrupted, cause the corresponding zone output to be activated	Z1L	Zone 1 low beam (incl.)
		Z1H	Zone 1 high beam (incl.)
Carrier height	Beams representing the carrier zone. This information is important for Overhang monitoring (see section 1.1.10)	“zc”	Top beam carrier zone (incl.)

Table 1: Reference to Figure 1

1.1.2 Measurement reference point

All measurements are made from the reference point to the respective beam numbers. For the standard beam counting direction this reference point is at the cable end of the light array. For the reverse beam counting direction this point is the opposite end of the light array housing. The reference point is defined as the end of the black light array housing (see Figure 2…5).

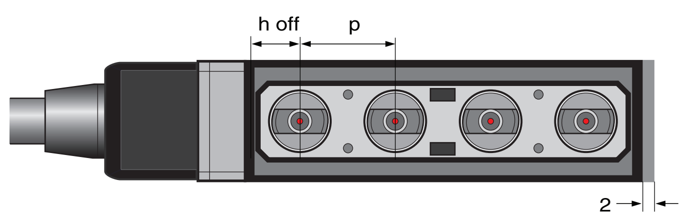

Figure 2: Standard beam counting direction, 10 mm pitch

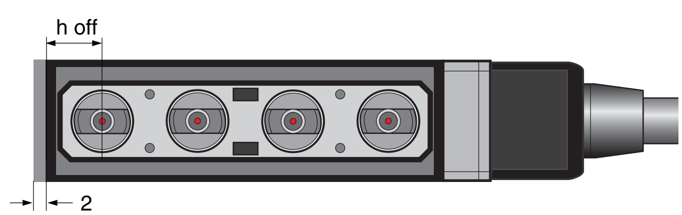

Figure 3: Reverse beam counting direction, 10 mm pitch

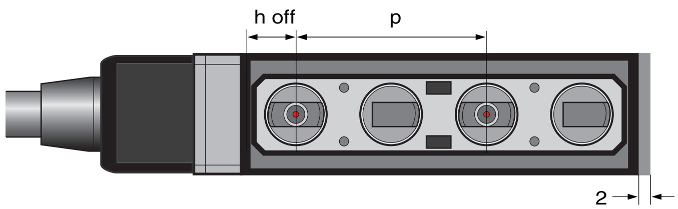

Figure 4: Standard beam counting direction, 25 mm pitch

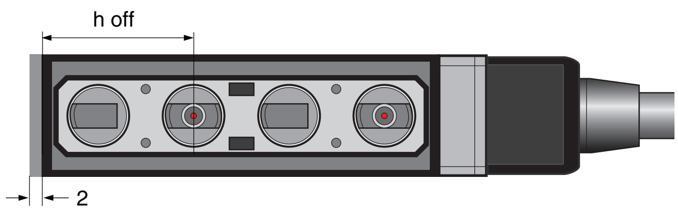

Figure 5: Reverse beam counting direction, 25 mm pitch

Note: p=Pitch, h_{off} = Beam offset

Note: While a 45MLA with a 10 mm pitch has a photoelectric element behind each lens, in the 25 mm pitch models, only every second physical lens is “active” (has a photoelectric element behind it).

1.1.3 Pitch and height measurement

The light array is designed with an active beam pitch of 10 mm (0.4 in.) or 25 mm (1.0 in.). In either case, the lens closest to the connector end of the light array will always contain an active beam. The beam positions are a function of the beam number and can be calculated as follows:

$h = h_{off} + (n-1) \times p$	h	Active beam position with respect to the reference point at the end of the light array housing
	h_{off}	Beam offset
	n	Beam number
	p	Pitch

Examples:

45MLA with pitch = 10 mm (Standard beam counting direction)

h_{off} = 5 mm (0.2 in.)	n	1	2	3	4	5	6	7	...	
p = 10 mm (0.4 in.)	h	5	15	25	35	45	55	65	...	[mm]
		0.2	0.6	1.0	1.4	1.8	2.2	2.6		[in.]

45MLA with pitch = 10 mm (Reverse beam counting direction)

h_{off} = 5 mm (0.2 in.)	n	1	2	3	4	5	6	7	...	
p = 10 mm (0.4 in.)	h	5	15	25	35	45	55	65	...	[mm]
		0.2	0.6	1.0	1.4	1.8	2.2	2.6		[in.]

45MLA with pitch = 25 mm (Standard beam counting direction)

h_{off} = 6 mm (0.2 in.)	n	1	2	3	4	5	6	7	...	
p = 25 mm (1.0 in.)	h	6	31	56	81	106	131	156	...	[mm]
		0.2	1.2	2.2	3.2	4.2	5.2	6.1		[in.]

45MLA with pitch = 25 mm (Reverse beam counting direction)

h_{off} = 19 mm (0.7 in.)	n	1	2	3	4	5	6	7	...	
p = 25 mm (1.0 in.)	h	19	44	69	94	119	144	169	...	[mm]
		0.7	1.7	2.7	3.7	4.7	5.7	6.7		[in.]

1.1.4 Measurement accuracy

It is possible for an object to be detected by an individual light beam even if only a small part of the aperture area is covered; however, for the object to be properly detected by an individual light beam, the aperture area of that light beam must be completely blocked. The aperture measures 8 mm (0.3 in.) in the longitudinal axis (parallel to array housing) and 3 mm (0.12 in.) in the diagonal axis (perpendicular to array housing) of the light array.

If the light beam state signals that it is interrupted, the following tolerance for a measurement is considered:

$h_{min} = h - b/2$

$h_{max} = h + p + b/2$

h	Position of the actual beam in mm to the reference point. (see section 1.1.3)
h_{min}	Minimal position of the object
h_{max}	Max. position of the object (before the next beam state is active)
b	Height of the aperture = 8 mm (0.3 in.)
p	Pitch (10 or 25 mm, 0.4 or 1.0 in.)

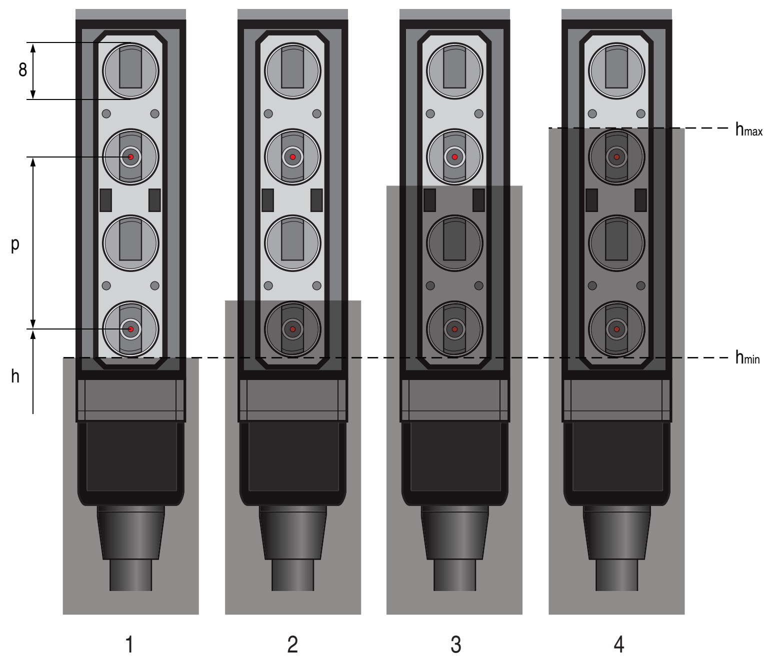

Figure 6:
If the beam at position h is detecting an object and beam h+1 is not detecting an object (pitch 25 mm — only every other lens has an active beam), h_min is the shortest and h_max is the tallest that the object may actually be

1. Object is not detected by the beam at position h
2. Object is properly detected by the beam at position h
3. Highest object that will not be detected by the beam at position h+1
4. Shortest object that will be properly detected by the beam at position h+1

1.1.5 Response time

The measurement or response time (T) can be roughly calculated from the number of beams (n), the scan time per beam (t_S) and the analysis time (t_A):

$T = t_A + n \times t_S$

For, t_S and t_A the following approximate values can be assumed:

- n = number of optical beams

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	45MLA Controller IO	45MLA Controller RS 485	45MLA Controller 100 CAN
tA [ms] (± 5%)	5.3	2.1	1.0
tS [ms] (± 5%)	0.275	0.275	0.275

Table 2: Response time details

For example for a 600 mm array with a 10 mm pitch utilizing the IO model controller, the response time is calculated as follows :

T = 5.3 + 60 x 0.275 = 21.8 ms

1.1.6 Measurement velocity

The allowed maximum speed an object can pass through the monitoring field of the light array depends on the size of the object, the optical aperture geometry and the light array length. An aperture of a 45MLA is rectangular and measures 8 mm (0.3 in.) in the longitudinal axis (parallel to array housing) and 3 mm (0.12 in.) in the diagonal axis (perpendicular to array housing).

So that an object is detected properly, the aperture has to be covered fully for the minimum measurement time t_m. The minimum measurement time depends on the light array length, i.e. the number of optical elements.

$t_m = t_A + n \times t_s$

t_m	Minimum measurement time
t_A	Evaluation time = (per Table 2 above)
n	Number of light array elements
t_s	Scan time per beam ≈ (per Table 2 above)

The minimum size of the object to be detected depends on the velocity as follows:

$v_{max} = (L – b) / t_m$
or
$L = (v_{max} * t_m) + b$

v_{max}	Maximum velocity of the object
L	Length of the object
b	Width of the aperture = 3 mm
t_m	Minimum measurement time

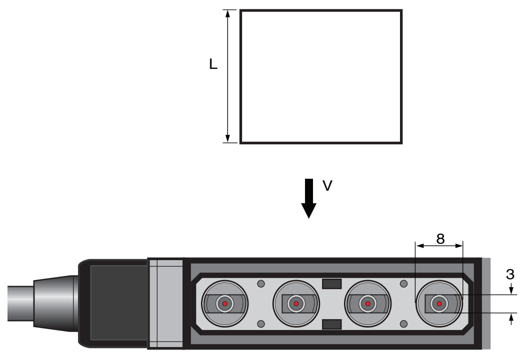


Figure 7: An object with length L is detected by optical beams from the 3 x 8 mm (0.3 x 0.12 in.) apertures.

Example:

An object with a 50 mm (2.0 in.) width passes through the monitoring field across the light array axis. The light array has a sensing height of 900 mm (35.4 in.) and a pitch of 25 mm (1 in.). This means the light array consists of 36 beams. The minimum measurement calculates to:

t_m = 5.3 ms + 36 x 0.275 ms = 15.2 ms
v_{max} = (50 mm – 3 mm) / 15.2 ms
= 3.1 m/s

1.1.7 Blanked beams

This functionality accounts for the fact that the 45MLA can be mounted so that the top or bottom extend beyond the application space, for example on a conveyor belt, where the top and/or bottom beams are physically blocked. By defining the first beam offset (“fb_offset”) and last beam offset (lb_offset), the beams in the zones from beam number 1 to “fb_offset” and (n -“lb_offset” + 1) to the last beam will be ignored, where ‘n’ represents the total number of beams in the array. This sets the active zone in which objects are detected.

The first beam offset (“fb_offset”) refers to the number of blanked beams from the cable end of the light array, and the last beam offset (“lb_offset”) refers to the number of blanked beams from the noncable end of the light array. Note that in cases where the reverse beam counting direction is being used, the first beam offset and last beam offset instead refer to beams counting from the noncable end and cable end of the arrays, respectively.

1.1.8 Zone monitoring

This option allows for object sorting based on the location of beams interrupted by the object. This height sorting function allows for an efficient use of the storage area, as pallets can be stored in an area optimally suited to their height.

In the I/O controller model, four digital outputs are available, each representing the status of one of four zones. While specific outputs are not allocated to zones in the RS485 and CAN versions of the controller, individual beam information can be determined using the communication procedures detailed in sections 4 and 4.1.1, respectively.

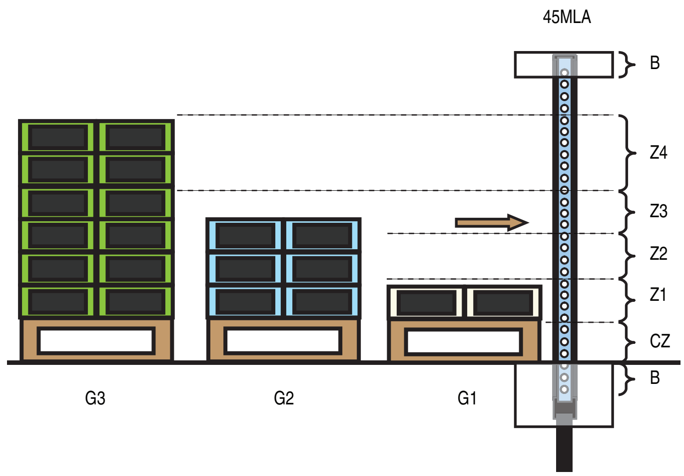


Figure 8: Example of pallets being sorted according to height:

Goods G1 to Zone Z1 — B Blanked beams
Goods G2 to Zone Z3 — CZ Carrier zone
Goods G3 to Zone Z4

Zone Status				Product (goods) height
Z4	Z3	Z2	Z1	
0	0	0	0	No goods (or carrier only)
0	0	0	1	Goods up to height 1
0	0	1	1	Goods up to height 2
0	1	1	1	Goods up to height 3
1	1	1	1	Goods up to height 4

Table 3: Example for an evaluation for a pallet transport storage system

Zones can be defined as overlapping, and may contain as few as one beam or as many as all beams. A zone is defined by specifying two beams, a low and a high beam. For example, zone three in the left side of Figure 9 is defined by z3L = 13 and z3H = 19.

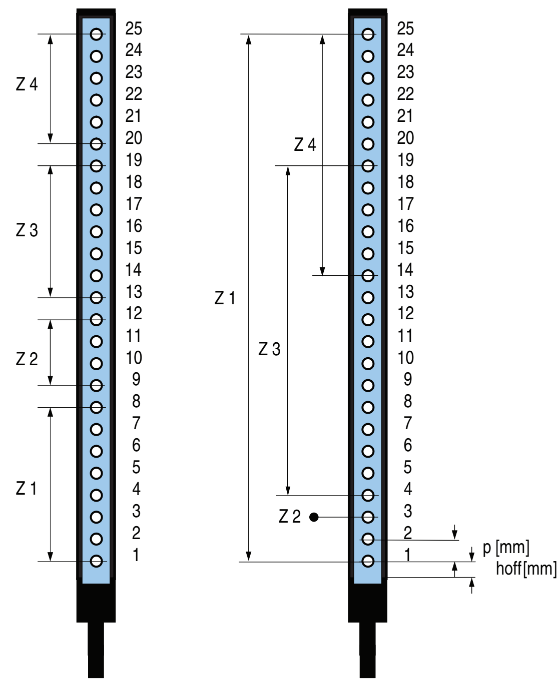


Figure 9: Two 10 mm pitch light arrays with defined zones.

An object that is detected by any beam in a defined zone will result in that zone output changing state. In other words, if one beam in a zone is interrupted, that zone is considered to be interrupted.

1.1.9 Over-height

This function provides an output signal when objects passing through the light array exceed an expected height, defined by a taught over-height beam, “oh,” as illustrated in Figure 10.

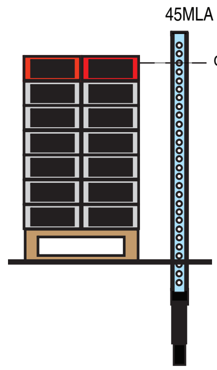


Figure 10: 45MLA detects goods with an overheight.

1.1.10 Overhang

This allows the user to identify any unexpected horizontal protrusions on the front or back of an object, such as a pallet or carrier, passing through the light array. The basic regions relevant to overhang detection are illustrated in Figure 11.

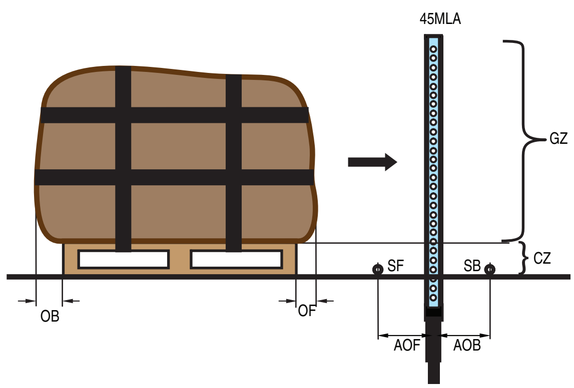


Figure 11: Overhang monitoring

OB	Overhang Back	CZ	Carrier Zone
OF	Overhang Front	GZ	Goods Zone
AOF	Allowed Overhang Front	SF	Sensor Front (optional)
AOB	Allowed Overhang Back	SB	Sensor Back (optional)
zc	Top beam carrier zone		

1.1.10.1 Overhang monitoring with time delay

This mode does not require front (SF) or back (SB) sensors. By defining a “zc” beam the light array is divided (configured) into a carrier zone (CZ) and goods zone (GZ). When a beam in the goods zone is interrupted, at least one beam from the carrier zone must also be interrupted, otherwise the overhang output will be activated.

If a certain amount of overhang is to be allowed, then a time difference between a goods zone interruption and a carrier zone interruption is allowed.

Note: In the 45MLA controller I/O model, the allowed time difference, overhang time “t_ot,” can be adjusted with Pot 1 and depends on the transport speed. The minimum overhang output signal duration “t_out” may also be adjusted, with the aid of Pot 2.

Note: The timing diagrams below utilize low true logic (object present = 0, object not present = 1) and the pallet loads are moving to the right.

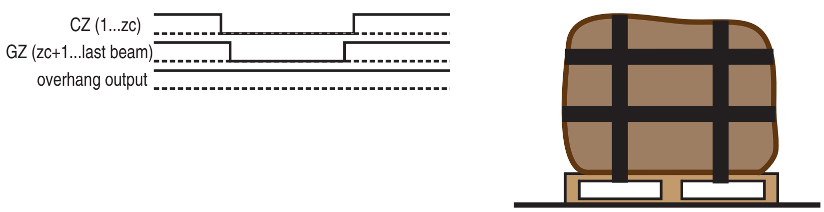


Figure 12: Example no overhang

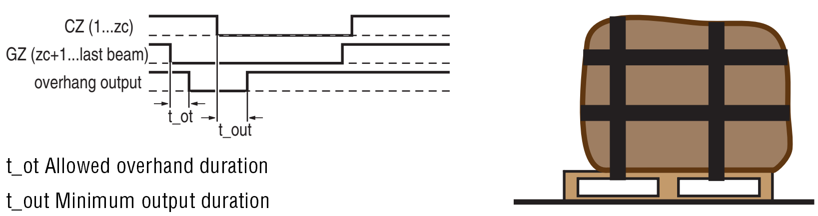


Figure 13: Example overhang front side

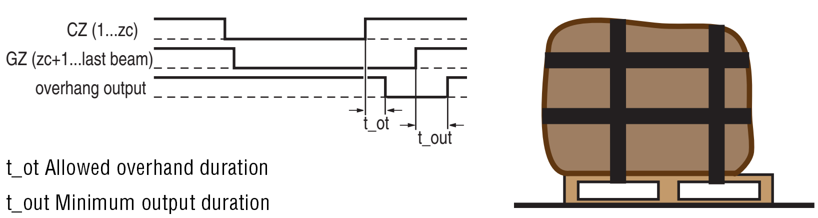


Figure 14: Example overhang back side

Notes: At least one of the carrier zone beams has to detect the carrier at all time during transit through the light array. Special attention needs to be paid to carriers with openings, e.g. pallets.

45MLA controller I/O: switch (7) in DIP switch array S1has to be turned "OFF" (= 0)

Output logic can be inverted, default = active "Low" (can be changed with DIP switch 5 on S1; see 45MLA Controller Installation Instructions)

1.1.10.2 Overhang monitoring with external sensors

A second way to monitor an overhang is by using a front and a back sensor, mounted in the carrier zone "zc" (Figure 15). The amount of overhang allowed is adjusted by simply altering the front and back sensors' physical distance to the light array.

When the carrier interrupts the front sensor, the sensor sends a negative slope signal (turns its output OFF) to the 45MLA controller. If a light beam in the goods zone (GZ) is interrupted before this signal, an overhang error is detected and the corresponding output is triggered. The duration of this output signal state can be adjusted with Pot 2.

After the carrier leaves the light array it passes through the back sensor. When the carrier no longer interrupts this sensor it must send a positive slope signal (turns its output ON) to the 45MLA controller. From then on, if any 45MLA goods zone (GZ) beam is interrupted the overhang output will be activated.

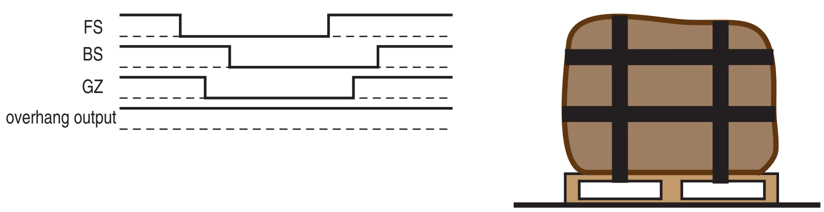
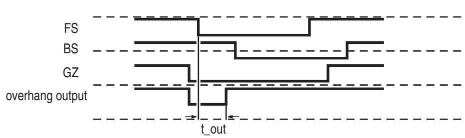
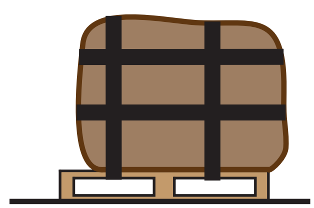


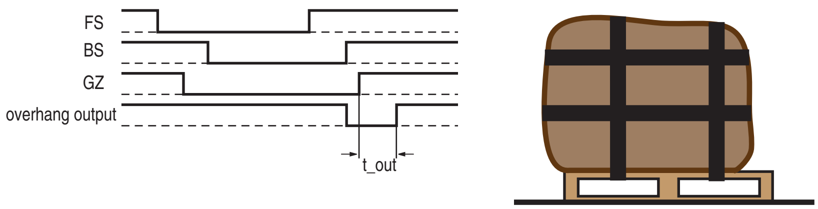
Figure 15: Example no overhang





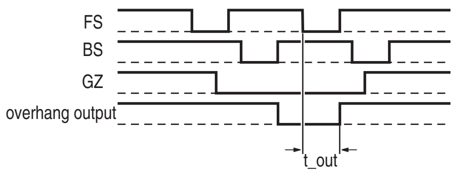
t_out Minimum output duration

Figure 16: Example overhang front side



t_out
Minimum
output
duration

Figure 17: Example overhang back side



t_out   Minimum output duration

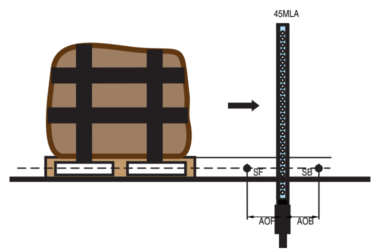


Figure 18: Example overhang error due to invalid carrier zone (i.e. external sensors positioned too low)

Note: The front and back sensors have to detect the carrier all the time during transit through the individual sensors. Special attention needs to be paid in cases of carriers with openings, e.g. pallets.

Overhang monitoring with external sensors is only available with the I/O version of the 45MLA controller.

Switch 7 on DIP switch array S1 must be ON (= 1).

The controller accepts PNP sensor outputs by default from the front and back sensors. This setting can be modified to accept NPN sensor outputs through use of jumpers on the controller (see 45MLA controller installation instructions).

Output logic can also be inverted, and the default is set to be active when “Low.”

1.1.11 Trigger and hold

Depending on the hardware and the configuration, the 45MLA controller provides a function whereby the outputs (Out 1 and Out 2 (J12)), will be held regardless of the status of the light array. This function is called trigger and hold, and is active depending on the signal at In2 (J2).

When the trigger and hold input (In 2) is low (0 V), the status of the output Out 1 and Out 2 change according to the status of the light array. When the trigger and hold input is high (24 V), the output status is frozen. This means that the outputs do not change their status until the trigger and hold signal is set back to low.

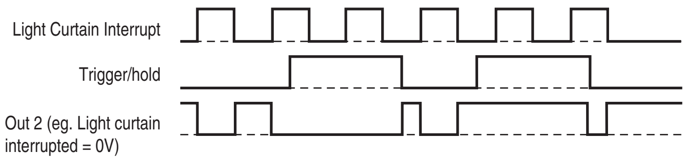


Figure 19: Example of trigger and hold function

1.2 45MLA controller default settings

Parameter values can be set with command “set parameter (28 [1C hex])” on communication model controllers and via the teach process on the I/O controller model. The default parameters are listed in Table 23. The default values can be reset with switch 8 in DIP switch array S1 on the main PCB.

DIP Switch S2	Remarks
0 = “OFF” (DIP 1…4)	See Chapter 6.4 in Operation Manual

Table 3: DIP switch S2 default setting

2 Controller I/O Model

2.1 Teach Process

The teach function allows the user to configure the parameters for a number of functions by use of a push button on the I/O extension PCB. The following sections detail the parameters that can be taught to the sensor, as well as the steps associated with this procedure.

ATTENTION	Protect the controller from ESD with proper grounding or shunting and the use of static control packaging and materials handling products. Dissipate and neutralize by grounding, ionization, and the use of conductive and dissapative static control materials.

Before beginning this process:

- Verify that the light array is mounted as it will be in the target application.
- Turning the power OFF during any stage of the teach cancels the process, restoring previously stored values.

- Previous values can also be restored by pressing the teach button repeatedly until the teach process is completed and LED D14 turns off (and is not flashing).
- Default parameters can be reset through use of switch eight on DIP switch array S1.
- By default, each zone is configured as 1/4 of the number of beams in the light array.

2.2 Step-by-Step Teach Function Guide

1. **Start teach:** Press and hold the teach button for approximately five seconds until LED D14 begins flashing once every three seconds, indicating that the unit is in teach mode.
2. **Blanked beams:** Check to confirm that any beams that will normally be interrupted (blanked) in the application are being interrupted. Briefly press the teach button again — the LED D14 now flashes twice approximately every three seconds, indicating that any interrupted (blanked) beams are recognized.

   Blanked beams are ALWAYS ignored. No other beams or zones can be defined in the blanked beam areas. It is only possible to define blanked beams above and below the detection area — it is not possible to define blanked beams in between sensing zones. The blanked area below the application (towards Beam 1) must include Beam 1 and is defined as Beam 1 to fb_offset. (Beam 1 must be blocked to set up a blanked area below the application detection area.)
3. **Carrier zone:** Place the carrier (pallet, crate, etc) in the light array's field and briefly press the teach button again. The LED D14 should now flash three times approximately every three seconds, indicating that all beams interrupted by the carrier have now been recognized.

   The highest of these beams is set as the "zc" beam (top beam carrier zone). At the conclusion of this teach process all beams between the "fb_offset" (exclusive) and the "zc" beam (inclusive) will be defined as the carrier zone.

Note: Setting the carrier zone is only required for applications utilizing over-hang detection. For other applications, press the teach button to skip this step.

4. **Over-height:** The over-height output (Out 2) is a discrete on-off output that is by default activated when any beam is interrupted. (Default Beam oh = Beam 1)

   In order to teach the over-height level, place the highest allowed object in the light array's range and then briefly press the teach button. The LED D14 should now remain on, indicating that the highest allowed object beam has now been set. The next uninterrupted beam will be set as the "oh" beam. At the conclusion of this teach process if any beam starting with "oh" and higher is interrupted, the over-height output (Out 2) will be activated.

5. **Setting up zones:** If you do not wish to configure specific zones at this point, press and hold the teach button until LED D14 turns off (approximately five seconds), signaling the end of the teach process. If you wish to configure sensing zones (corresponding to Outputs 3…6), press the teach button briefly to enter the zone setup and follow the steps below.

   i. **Zone 1:** When you enter the zone setup, LED D10 and D14 will flash, indicating that zone 1 is ready to be taught. Place an object that represents the size of zone 1 into the light array's range. Now press the teach button to establish the highest and lowest interrupted beams, which will define zone 1.

   ii. **Zone 2:** LED D11 and D14 will be flashing after step i, indicating that zone 2 may now be taught. As in step i, place an object that represents the size of zone 2 into the light array's range and then press the teach button.

   iii. **Zone 3:** LED D12 and D14 will be flashing after step ii, indicating that zone 3 may now be taught. Again, place an object into the light array's range to represent the size of zone 3 and press the teach button.

   iv. **Zone 4:** LED D13 and D14 will be flashing, indicating that zone 4 may now be taught. Place an object into the light array's range to represents the size of zone 4 and press the teach button. The LED D14 now remains on, acknowledging that all parameters for the zones have been stored temporarily in memory.

6. **Complete teach:** To complete the teach process, press and hold the teach button until LED D14 turns off (approximately five seconds), signaling the end of the teach process.

   Note: If it is desired to delete the new settings (thereby restoring previously stored values), instead of pressing and holding the teach button, briefly press the teach button. LED D14 turns off (indicating the end of the teach process) and the previous values are restored.

3 Serial Communications

3.1 Introduction

The serial communication enabled models of the controller are capable of communicating individual beam status and other information to a PLC. The following sections describe in detail the operation and commands associated with these models.

Principally, the PLC/master controller will send a command to the 45MLA and will then receive a response from the 45MLA (corresponding to the command request). The commands and responses are structured as eight byte strings, where bytes one and two correspond to the high and low bytes of the command or response number and bytes three to eight contain the data. For most commands bytes three to eight will contain zeroes. The response number (bytes one and two) is typically the corresponding command number plus one.

3.1.1 RS485 protocol structure

The following tables describe the structure of RS485 commands from the 45MLA controller to a PLC, and responses from a PLC to the 45MLA controller. Commands discussed in the following sections must be formatted in this manner to communicate with the controller.

Direction			Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8	
Master (PLC) to 45MLA controller	STX (02)	Address (DIP switch)	Command High byte	Command Low byte	Data (typically zeroes)						ETX (03)
45MLA controller to Master (PLC)	ACK (06)	Inverted (Address)	Command High byte	Command Low byte	Data						ETX (03)

Table 4: RS485 protocol architecture (hex)

Direction			Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8	
Master (PLC) to 45MLA controller	02	00	00	14	00	00	00	00	00	00	03
45MLA controller to Master (PLC)	06	FF	00	15	05	13	0F	0F	00	00	03

Table 5: RS485 command example (hex)
Trigger (1 Standard Scan), interrupted beams: 05…19, total interrupted beams: 15 (Dec), pitch factor = 1

3.1.2 CAN telegram structure

A CAN telegram consists of a string of bytes beginning with an address, followed by one byte that contains the number of data-bytes that will follow (DLC). The telegram then finishes with these data-bytes (in this instance eight bytes). The 45MLA controller typically uses eight data-bytes. Not used data-bytes have to be filled up with 00hex.

The 45MLA controller data-bytes are composed of two command bytes and six parameter bytes. The 45MLA CAN controller type supports the CAN standard 2.0A (standard frame). Note that response telegrams one [01 hex], 65 [41 hex] and 67 [43 hex], are exceptions to the master-slave rule and will be transmitted spontaneously.

Address	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Address	[08 hex]	Command High byte	Command Low byte	Data	Data	Data	Data	Data	Data

Table 6: CAN protocol architecture

Address	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0220	08	00	14	00	00	00	00	00	00

Table 7: CAN command example (hex) (standard mode)
Trigger (1 Standard Scan)

Address	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
01A0	08	00	15	05	13	0F	32	00	00

Table 8: CAN response example (hex)
Answer 15 (hex): Interrupted beams: 05…13 (hex), total interrupted beams: 0F (hex)

3.2 Serial Commands and Responses

The following tables provide an overview of the serial communication commands associated with both the RS485 and CAN models of the controller. Details on each command can be found in the following sections. Please note that the CAN model supports additional commands which are discussed in the CAN specific section of this document.

		Command		
Command	Byte 1+ 2	2	02 hex	Pseudo command – Can be used to check controller connectivity to bus system (controller will send an empty answer).
		4	04 hex	Get controller status – Can be used to check what parameters are set on the controller through use of command 28 dec/1C hex
		6	06 hex	Test light array function
		8	08 hex	Get light array status – This command responds the status information from the last scan. No start command has to be sent. (This command is very similar to 20dec /14hex trigger.)
		18	12 hex	Get number of active (unblanked) beams
		20	14 hex	Trigger (1 Standard-scan) – carries out one single height measurement scan
		22	16 hex	Start permanent scan standard – starts the height measurement until the stop command is sent from the PLC.
		24	18 hex	Stop permanent scan standard – stops the height measurement and the different height information are sent to the PLC.
		26	1A hex	Get scan counter – check how many scans have been done between the last Start and Stop commands.
		28	1C hex	Set parameters
		30	1E hex	Set default parameters – resets all configurations to defaults
		32	20 hex	Start permanent scan with overhang monitoring
		34	22 hex	Stop permanent scan with overhang monitoring
		36	24 hex	Get scan counter with overhang
		38	26 hex	Get beam status – bit information for up to 48 beams
		40	28 hex	Get zone status – similar to 20dec/14hex, but specific to one zone
		42	2A hex	Get parameters – reports values set with command 28dec/1Chex
		44	2C hex	Reset
Data	Byte 3…8	Data associated with command (zeroes if no data is required)		

Table 9: 45MLA controller CAN and RS485 commands

		Response		
(Command number + 1)	Byte 1+ 2	Response “n+1” to command “n.”		
		1	01 hex	Light array status (spontaneous response – CAN model only)
		3	03 hex	Pseudo response
		5	05 hex	Get controller status
		7	07 hex	Values for test function
		9	09 hex	Get light array status
		19	13 hex	Get number of beams
		21	15 hex	Height measurement values
		23	17 hex	Empty
		25	19 hex	Height measurement value
		27	1B hex	Number of measurements
		29	1D hex	Parameters
		31	1F hex	Empty
		33	21 hex	Evaluated first beam and last beam
		35	23 hex	Measurement values and overhang status
		37	25 hex	Number of overhang measurements
		39	27 hex	Beam status
		41	29 hex	Get zone status
		43	2B hex	Get parameters
		45	2D hex	Reset
Data	Byte 3…8	Response data specific to command (described in following sections)		

Table 10: 45MLA controller CAN and RS485 response messages

3.2.1 Light array status (spontaneous response) (01 [01 hex])

Note: This response is only available through the 45MLA CAN controller.

The light array status is sent whenever a status change is detected in the light array. The telegram is sent spontaneously. The trigger condition can be changed with parameter 62 (command 28 set parameter).

Response 1 [01 hex]			
Byte #	**Bit**	**Value**	**Description**
Byte 1 + 2		1 Dec 01 hex	Response number
Byte 3	0	0 1	Light array free Light array interrupted
	1	0 1	Light array state not changed Light array state changed to the last measurement
	2	0 1	No light array error Emitter and receiver have different beam numbers or no light array connected
	3	0 1	No over-height Over-height detected
	4…5	00 01 10 11	No overhang Front overhang Back overhang Front and back overhang
	6	0 1	Permanent scan standard not active Permanent scan standard active
	7	0 1	Permanent scan w. overhang not active Permanent scan w. overhang active
Byte 4	1…2	00 01 10 11	No overhang Front overhang Back overhang Front and back overhang
Byte 5	1	0 1	No over-height Over-height detected
Byte 6	0	0	Not used
Byte 7	0	0	Not used
Byte 8	0	0	Not used

Table 11: Spontaneous response 01

3.2.2 Pseudo-command (02 [02 hex])

The pseudo-command serves merely to allow the controller to respond to the PLC as a means to check controller connectivity to the bus system. The controller responds with an empty answer, allowing us to verify baud rate and address.

Response 3 [03 hex]			
Byte #	**Bit**	**Value**	**Description**
Byte 1 + 2		3 Dec 03 hex	Response number
Byte 3 – 8	0…7	0	(Not used)

Table 12: Response to command 02

3.2.3 Get status controller (04 [04 hex])

With this command, the status of a controller will be sampled. The parameters can be set with command 28.

Response 5 [05 hex]				
Byte #	**Bit**	**Value**	**Description**	
Byte 1 + 2		5 Dec 05 hex	Response number	
Byte 3	0…7	0…254 255	Physical length (number elements) Error	
Byte 4	0…7	0…254	Effective length (according to setting of “fb_offset” to “lb_offset” and pitch factor)	
Byte 5	0…7	0…254	Pitch factor (only for special applications)	
Byte 6	1	0 1	Beam no. 1 on cable end side Beam no. 1 on opposite end to cable (inverted)	
Byte 7	0…1		**CAN**	**RS485**
		0	125 kBit/s	19,200 Bit/s
		1	250 kBit/s	2,400 Bit/s
		2	500 kBit/s	9,600 Bit/s
		3	1 Mbit/s	57,600 Bit/s
Byte 8	0…7	0…255	Software version	

Table 13: Response to command 04

3.2.4 Test function light array (06 [06 hex])

With this command every beam of the attached light array will be tested.

Response 7 [07 hex]			
Byte #	**Bit**	**Value**	**Description**
Byte 1 + 2		7 Dec 07 hex	Response number
Byte 3	0…7	0 1	Light array okay Light array defective
Byte 4…8	0…7	0	(Not used)

Table 14: Response to command 06

3.2.5 Get light array status (08 [08 hex])

This command responds with the status information from the last scan. The scan runs permanently and does not have to be specifically started.

Response 9 [09 hex]			
Byte #	**Bit**	**Value**	**Description**
Byte 1 + 2		9 Dec 09 hex	Response number
Byte 3	0	0 1	Light array free Light array interrupted
	1	0 1	Light array state not changed Light array state changed to the last measurement
	2	0 1	No light array error Emitter and receiver have different beam numbers or no light array connected
	3	0 1	No Target detected (or no over-height) Target detected (or over-height)
	4…5	00 01 10 11	No overhang Front overhang Back overhang Front and back overhang
	6	0 1	Permanent scan standard not active Permanent scan standard active
	7	0 1	Permanent scan w. overhang not active Permanent scan w. overhang active
Byte 4…8	00	00	Not used

Table 15: Response to command 08

3.2.6 Get number of beams (18 [12 hex])

This command indicates the number of active beams in the attached light array, based on the blanked beam settings as determined by the first beam offset and the last beam offset (“lb_offset” and “fb_offset”). Additional information on this is available in the section specific to beam blanking under Advanced Functions.

Response 19 [13 hex]			
Byte #	**Bit**	**Value**	**Description**
Byte 1 + 2		19 Dec 13 hex	Response number
Byte 3	0…7	0…254	Number of evaluated beams
Byte 4	0…7	0…254	Number of physical beams
Byte 5…8	00	00	Not used

Table 16: Response to command 12

3.2.7 Trigger (1 standard scan) (20 [14 hex])

When a standard scan is triggered, the object height will be measured by monitoring the condition of the entire light array. Only one scan will be carried out, and the beam information will automatically be sent enclosed in response 21.

Response 21 [15 hex]			
	Bit	Value	Description
Byte 1 + 2		21 Dec 15 hex	Response number
Byte 3	0…7	0 1…254	No beam interrupted First interrupted beam 1)
Byte 4	0…7	0 1…254	No beam interrupted Last interrupted beam 1)
Byte 5	0…7	0 1…254	No beam interrupted Total number of interrupted beams
Byte 6	0…7	1…254	Number of used beams 1)
Byte 7	0…1	0	No over-height
		1	Over-height
Byte 8	0…1	00 01 10 11	No overhang Front overhang Back overhang Front and back overhang

Table 17: Command 20

Note: Blanked beams (set by parameters “fb_offset” and “lb_offset) are ignored and not counted.

3.2.8 Start continuous standard scan (22 [16 hex])

In the event of a standard height measurement (standard scan) the object height will be ascertained by monitoring the condition of the entire light array. Continuous scans will be executed and the lowest and highest interrupted beams will be ascertained until the ‘stop’ command is received. This command lends itself well for measuring various object types, even those that do not start at beam one or those with open spaces.

Sending command 22 a second time, before sending command 24 will reset the scan counter and reset the status values noted in command 24.

Response 23 [17 hex]			
Byte#	Bit	Value	Description
Byte 1 + 2		23 Dec 17 hex	Response number
Byte 3…8	0…7	0	Not used

Table 18: Response to command 16

3.2.9 Stop continuous standard scan (24 [18 hex])

This command stops the standard height measurement and sends the beam information.

Command 24 [18 hex]			
Byte#	Bit	Value	Description
Byte 1 + 2		24 Dec 18 hex	Command number
Byte 3	0…7	0 1	Stop scan after sending results Start new continuous scan after sending results (additional stop commands can be sent without new start command)
Byte 4…8		0	Not used

Table 19: Command 24

Response 25 [19 hex]			
Byte#	Bit	Value	Description
Byte 1 + 2		25 Dec 19 hex	Response number
Byte 3	0…7	0 1…254	No beam interrupted First interrupted beam 1)
Byte 4	0…7	0 1…254	No beam interrupted Last interrupted beam 1)
Byte 5	0…7	0 1…254	No beam interrupted Total number of effective beams beams interrupted at any point during scan
Byte 6	0…7	0 1…254	No beam interrupted First beam interrupted at last scan last scan
Byte 7	0…7	0 1…254	No beam interrupted Last beam interrupted during last scan last scan
Byte 8	0…1	0 1	No over-height Over-height

Table 20: Response to command 24

Note: Blanked beams are ignored.

The command 'stop continuous standard scan' must first be preceded by the 'start continuous standard scan' command. No response will be sent if a continuous scan has not been started.

3.2.10 Get scan counter (26 [1A hex])

The responses to this command contains the number of light array scans that have been made since the last command "start permanent scan" (command 22). The scan counter is stopped with the command "stop permanent scan." The value counts up to 2.2E12 (four byte) and then starts at zero again (overflow).

Response 27 [1B hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		27 Dec 1B hex	Response number
Byte 3	0…7	0…255	Number of scans (LSB)
Byte 4	0…7	0…255	Number of scans
Byte 5	0…7	0…255	Number of scans
Byte 6	0…7	0…255	Number of scans (MSB)
Byte 7…8	0…7	0	Not used

Table 21: Response to command 26

3.2.11 Set parameter (28 [1C hex])

This command is used to set the various parameters shown in Table 24. Using command 30 (1E hex) = 1, all parameters may be reset to the default values.

Command 28 [1C hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		28 Dec 1C hex	Command number
Byte 3	0…7	23…65	Parameter
Byte 4	0…7	0…255	Value
Byte 5…8	0…7	0	Not used

Table 22: Command 28

Response 29 [1D hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		29 Dec 1D hex	Response number
Byte 3	0…7	0…255	Value
Byte 4…8	0…7	0	Not used

Table 23: Response 29

Parameter		Description	Beam identifier	Default Value	Value	Description	Remarks
23	[17 hex]	Top element of carrier zone (inclusive)	“zc”	1	0…255		Section 1.1.10 Figure 1
24	[18 hex]	Output logic Out 1		0	0 1	Active “Low” (= 0 V) Active “High” (= 24 V)	
25	[19 hex]	Over-height monitoring (inclusive)	“oh”	1	0…254		Section 1.1.9 Figure 1
26	[1A hex]	Output logic Out 2		0	0 1	Active “Low” (= 0V) Active “High” (= 24V)	
43	[2B hex]	First beam offset	“fb_offset”	0	0…254	Number of blanked beams at cable end of array (or opposite end if reverse beam counting)	Section 1.1.1
44	[2C hex]	Last beam offset	“lb_offset”	0	0…254	Number of blanked beams at opposite end of array	Section 1.1.1
45	[2D hex]	Pitch factor		1	(only for special applications)		
46	[2E hex]	Beam counting mode		0	0 1	First beam at cable end First beam at opposite end to cable	Section 1.1.1 Mode affects the whole light array definition!
62	[3E hex]	Status message		1	0 1 2	No message telegram Message at change of light array state Message at change of light beam state	CAN model only See 3.2.1 1)
63	[3F hex]	Inputs depend on DIP switch and potentiometer settings or parameters		0	00…03 Bit 0=0 Bit 0=1 Bit 1=0 Bit 1=1	hex Output duration from Pot 2 Output duration from Par 65 Overhang t. time from Pot 1 Overhang t. time from Par 64	2)
64	[40 hex]	Overhang tolerance time (Pot 1)		0	0…255	t ≈ n x 13.1 ms (± 10 ms)	Activated by parameter 63
65	[41 hex]	Output duration (Pot 2)		0	0…255	t ≈ n x 13.1 ms (± 10 ms)	

Table 24: Parameter list

1 This mode may cause a high message frequency and may cause problems with the bus communications.
2 Select if potentiometer is active or values set by parameters 64 and 65.

3.2.12 Set default configuration (30 [1E hex])

All parameters revert to default condition. It is the same effect as DIP Switch S1 (eight). Command 44 [2C hex] *Reboot* should be sent afterwards.

Response 31 [1F hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		31 Dec 1F hex	Response number
Byte 3…8	0…7	0	Not used

Table 25: Response to Command 30

3.2.13 Start continuous scan with overhang monitoring (32 [20 hex])

This measurement will be repeated in approximately 10 ms cycles for a 30 beam light array. Overhang monitoring is performed at the same time. After the measurement is completed, the result may be repeatedly read out by reentering the command 32 [20 hex].

Sending command 32 a second time before sending command 34 will reset the scan counter and reset the status values noted in command 35.

Response 33 [21 hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		33 Dec 21 hex	Response number
Byte 3…8	0…7	0	Not used

Table 26: Response to command 32

3.2.14 Stop continuous scan with overhang monitoring (34 [22 hex])

Command 34 [22 hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		34 Dec 22 hex	Command number
Byte 3	0…7	0 1	Stop scan after sending results Start new continuous scan after sending results (additional stop commands can be sent without new start command)
Byte 4…8		0	Not used

Table 27: Command 34

Response 35 [23 hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		35 Dec 23 hex	Response number
Byte 3	0…7	0 1…254	No beam interrupted First interrupted beam 1)
Byte 4	0…7	0 1…254	No beam interrupted Last interrupted beam 1)
Byte 5	0…7	0	No beam interrupted
		1…254	Total number of effective beams ever interrupted
Byte 6	0…7	0 1…254	No beam interrupted First beam interrupted at last scan
Byte 7	0…7	0 1…254	No beam interrupted Last beam interrupted at last scan
Byte 8	0…7	0 1 2 3	No overhang detected Overhang front detected 2) Overhang back detected 3) Overhang front and back detected

Table 28: Response to Command 34

Note: Blanked beams are ignored.

Overhang front means that an overhang is detected as the carrier or pallet is pulled into the light array area.

Overhang back means that an overhang is detected as the carrier or pallet is pulled out of the light array area.

The command ‘stop continuous scan with overhang monitoring’ must first be preceded by the ‘start continuous scan with over-hang monitoring’ command. No response will be sent if a continuous scan with over-hang has not been started.

Get overhang scan counter (36 [24 hex])

The response to this command contains the number of light array scans which have been made since the last command permanent scan with overhang monitoring (command 32). The scan counter is stopped with the command stop permanent scan with overhang monitoring. The value counts up to 2.2E12 (4 bytes) and starts at 0 again (overflow).

Response 37 [25 hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		37 Dec 25 hex	Response number
Byte 3	0…7	0…255	Number of scans (LSB)
Byte 4	0…7	0…255	Number of scans
Byte 5	0…7	0…255	Number of scans
Byte 6	0…7	0…255	Number of scans (MSB)
Byte 7…8	0…7	0	Not used

Table 29: Response to command 36

3.2.15 Get beam status (38 [26 hex])

Return the bit-information of 48 beams, considering beam offset x. To determine beam status in arrays with more than 48 beams, this command can be repeated while changing the beam offset x. For example, send the command with beam offset x (byte 3) = 1 on the first pass to get the status of beams 1…48, and then with beam offset x = 49 on the second pass to get the status of beams 49…96.

Command 38 [26 hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		38 Dec 26 hex	Command number
Byte 3	0…7	1…254	Beam offset x (the first beam to be evaluated)
Byte 4…8	0…7	0	Not used

Table 30: Command 38

Note: Beam counting starts with one. A beam offset of zero will result in an error.

Blanked beams are not counted – beam counting starts from the designated fb_offset (fb_offset default = the first beam).

Response 39 [27 hex])			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		39 Dec 27 hex	Response number
Byte 3	0 1 : 7	Beam x+0 Beam x+1 : Beam x+7	0: Beam not interrupted 1: Beam interrupted
Byte 4	0 : 7	Beam x+8 : Beam x+15	0: Beam not interrupted 1: Beam interrupted
Byte 5	0 : 7	Beam x+16 : Beam x+23	0: Beam not interrupted 1: Beam interrupted
Byte 6	0 : 7	Beam x+24 : Beam x+31	0: Beam not interrupted 1: Beam interrupted
Byte 7	0 : 7	Beam x+32 : Beam x+39	0: Beam not interrupted 1: Beam interrupted
Byte 8	0 : 7	Beam x+40 : Beam x+47	0: Beam not interrupted 1: Beam interrupted

Table 31: Response to command 38

Note: Status and errors cannot be communicated with this command.

3.2.16 Get zone status (40 [28 hex])

This command is a simple way to get the status of a certain zone. The zone can be defined by setting a first beam and last beam (inclusive).

Command 40 [28 hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		40 Dec 28 hex	Command number
Byte 3	0…7	1…254	First beam defining zone
Byte 4	0…7	1…254	Last beam defining zone
Byte 5…8	0…7	00	Not used

Table 32: Command 40

Note: Beam numbers for a zone are inclusive.

Blanked beams are not counted – beam counting starts after the fb_offset.

Response 41 [29 hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		41 Dec 29 hex	Response number
Byte 3	0…7	0 1	Zone not interrupted Zone interrupted
Byte 4…8	0…7	00	Not used

Table 33: Response to command 40

3.2.17 Get parameter value (42 [2A hex])

The command is used to read out a parameter from the 45MLA controller. The parameter can be set with command 28.

Command 42 [2A hex]‘			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		42 Dec 2A hex	Command number
Byte 3	0…7	23…65	Parameter - see Table 22: Command 28
Byte 4…8	0…7	00	Not used

Table 34: Command 42

Response 43 [2B hex]‘			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		43 Dec 2B hex	Response number
Byte 3	0…7	0…255	Parameter value - see Table 22: Command 28
Byte 4…8	0…7	00	Not used

Table 35: Response to command 42

3.2.18 Reboot (44 [2C hex])

This command restarts the controller. It has the same effect as a power up of the 45MLA controller.

Response 45 [2D hex]			
Byte#	**Bit**	**Value**	**Description**
Byte 1 + 2		43 Dec 2B hex	Response number
Byte 3…8	0…7	0	Not used

Table 36: Response to command 44

4 RS485 Controller Model

4.1 Introduction

This system works according to the master-slave principle, where each 45MLA controller (slave) is addressed and receives a command from a PC or PLC (master). The addressed 45MLA controller processes the command and responds with the required data. Only one 45MLA controller may be communicated with at any given time.

See the 45MLA Controller Installation Instructions for information on how to set the baud rate, set the address, and utilize the integrated terminating resistor via the DIP switches.

4.1.1 RS485 commands and responses

The command list for the RS485 model is shared with that for the CAN, and described in section 3.2.

4.1.2 RS485 communication example 1

Get the number of active beams for the light array with Address 1. The PLC sends command 18 (=12 hex):

Byte	Description	Value	Byte structure
	STX	02 hex	0000 0010
	Address (DIP switch)	01	0000 0001
Byte 1	Command	00	0000 0000
Byte 2	Command	12 hex	0001 0010
Byte 3	Data	00	0000 0000
Byte 4	Data	00	0000 0000
Byte 5	Data	00	0000 0000
Byte 6	Data	00	0000 0000
Byte 7	Data	00	0000 0000
Byte 8	Data	00	0000 0000
	ETX	03 hex	0000 0011

Table 37: Command examples

The responses to be expected from a 45MLA controller RS485 system with a light array counting 30 beams (=1E hex), and no offset beams, are as follows:

Byte	Description	Value	Byte structure
	ACK	06 hex	0000 0110
	Inv. Address (DIP switch)	= 255-1 = 254 (FE hex)	1111 1110
Byte 1	Command	00	0000 0000
Byte 2	Command	13 hex	0001 0010
Byte 3	Data	1E hex	0001 1110
Byte 4	Data	1E hex	0001 1110
Byte 5	Data	00	0000 0000
Byte 6	Data	00	0000 0000
Byte 7	Data	00	0000 0000
Byte 8	Data	00	0000 0000
	ETX	03 hex	0000 0011

Table 38: Response examples

4.1.3 Timing RS485

Example for a baud rate of 19,200 baud and 1 stop bit:

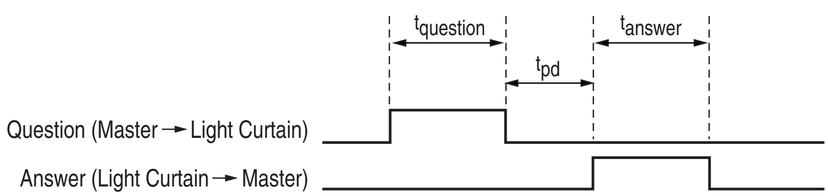


Figure 21: Timing of RS485 communication

Baud rate 19200 1 Bit = 52.08 µs.
1 start bit + 8 data bits + 1 parity bit + 1 stop bits = 11 bits = 572.92 µs

$t_{question}$	11 bytes = 4.583 ms
t_{pd}	This time window is dependent on the command number. As a minimum it lasts approx. t_{pd} = 5 ms. When using a light array with 254 beams and the command ‘trigger standard scan,’ the time will increase to approx. t_{pd} = 55 ms.
$T_{response}$	11 bytes = 4.583 ms

4.2 Master Programming

When using a 45MLA controller RS485 controller, the following process should be followed in order to avoid data collision:

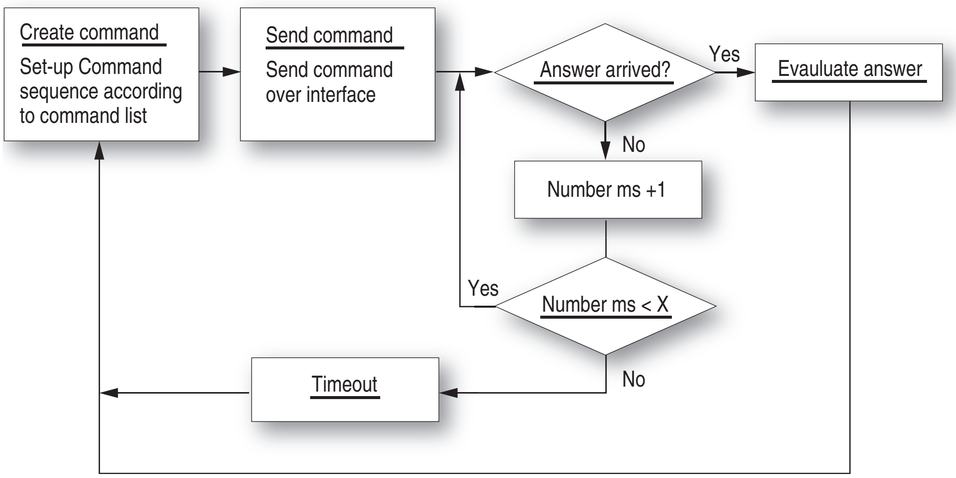


Figure 22: Recommended RS485 communication procedure

4.3 Technical Data

Maximum cable length (twisted pair/shielded)	100 meter	
Short circuit protected	Yes	
Number of addresses	0…15	
Parity	None	
Protocol	None	
Stop bits	1	
Baud rates	2,400 9,600 19,200 57,600	Baud Baud Baud Baud

Table 39: RS485 technical data

5 CAN Controller Model

5.1 Introduction

CAN communication can also be used for obtaining individual beam status information on the light arrays. This information then allows us to determine, for example, the size of an object.

The 45MLA controller offers two CAN modes. The CAN standard mode (section 5.2) offers, beside commands for beam states, the functionality of overhang and over-height detection. This mode typically operates as a master/slave communication with the exception of response telegram 01 (which, when active, is generated by the 45MLA controller upon a change of state of the light array). For all other communication, the master sends a command to the 45MLA controller (slave) and gets a response.

This mode is similar to the operation of the 45MLA controller RS485 and can be selected with DIP switch S1 (7) = "OFF."

The CAN interface can be used with restrictions in a CAN open network.

5.2 CAN Standard Mode

5.2.1 Spontaneous telegram

The state telegram 1 [01 hex] (Table 11: Spontaneous response 01) will be transmitted as soon as the state of the light array changes. The status telegram has its own address (Table 40: CAN addresses). This status command can be activated or deactivated with command 28 [1C hex], Parameter 62 [3E hex] (Table 24). The parameter determines if a status telegram 1 [01 hex] is sent if:

1. The light array status changes (interrupted/not interrupted) – a telegram is sent if all beams are uninterrupted or a light beam is interrupted.
2. Change of light beam status – a telegram is sent if the state of at least one beam changes.

Note: This mode can lead to a high communication rate.

This mode of communication is unavailable on the RS485 controller model.

5.2.2 Baud rate

The baud rate can be selected through use of a DIP switch, as described in the 45MLA controller installation instructions. The default baud rate is set to 125 k.

5.2.3 CAN address

The CAN address is defined as follows. The CAN sub-address can be selected using the DIP switch S1 (see installation instructions). Therefore up to 16 45MLA controller units can be used in a CAN network.

Address for receiving telegram for 45MLA controller	[0220 hex] + sub-address (= 0220, 0221, …, 022F hex)
Address for sending telegram for 45MLA controller in response to receiving telegram	[01A0 hex] + sub-address (= 01A0, 01A1, …, 01AF hex)
Address for spontaneous sending telegram for 45MLA controller	[02A0 hex] + sub-address (= 02A0, 02A1, …, 02AF hex)

Table 40: CAN addresses

Receiving and sending of telegrams are related to the control unit 45MLA controller.

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5 CAN Controller Model

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