Installation Instructions

Original Instructions

Allen-Bradley
by ROCKWELL AUTOMATION

45MLA Controller

Catalog Number 45MLA-CTRL-ALG, 45MLA-CTRL-BSC, 45MLA-CTRL, 45MLA-CTRL-485, 45MLA-CTRL-CAN

Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes. Translated versions are not always available for each revision.

Topic	Page
Added French translation to Attention table	1
Added French translation to Important table	2

Description

The 45MLA Light Array Controller drives the photoelectric elements in the light arrays, which are essentially a series of transmitted beam pairs. Five versions of the controller are available, each offering a different communications platform that can be selected to function with a range of programmable logic controllers (PLCs).

Model	Cat. No.
Analog Model Controller	45MLA-CTRL-ALG
Basic Model Controller	45MLA-CTRL-BSC
I/O Model Controller	45MLA-CTRL
RS-485 Controller	45MLA-CTRL-485
CAN Controller	45MLA-CTRL-CAN

The controller includes numerous application features, which allows for customization to the many applications. For instance, the I/O module can be used to configure up to four separate sensing zones with independent outputs and overhang/over-height detection. The basic model has an on/off output for use in discrete applications. The analog output model offers either a 4...20 mA current or 0...10V output proportional to target height, width, or position. The network communication models (RS-485 and CAN) can be used to communicate precise height readings and individual beam status.

Features

- External controller for 45MLA measuring light arrays
- Height measuring capability
- Fast reaction time and measurement speed
- Configurable over-height and overhang outputs
- Analog model offers either 4...20 mA or 0...10V output proportional to target height, width, or position
- Basic models offer single discrete output for use in on/off applications
- I/O model features Teach button for configuring four height zones with individual outputs
- RS-485 and CAN communication models provide extra functionality, including:
  - Connection to RS-485 or CAN networks (by model)
  - Detailed height information
  - Individual beam status

Specifications

Environmental	
Certifications	c-UL-us and CE Marked for all applicable directives
Operating environment	• Housing: IP54 • Terminal strip: IP20
Operating temperature	0...55 °C (32...131 °F)
Storage temperature	-25...+70 °C (-13...+158 °F)
Relative humidity	15...95%
Optical	
Status indicators	Alignment, target present, outputs, inputs, power
Electrical	
Voltage	24V DC ±15% (20.4...27.6V), max (Class 2) ripple = 5%
Current consumption	<300 mA with maximum number of beams to controller, outputs not connected
Sensor protection	EN 61000-4-2, EN 61000-4-4, and EN 61000-4-5; short circuit (SCP), reverse polarity, and overload
Outputs	
Response time	See Response Time on page 2
Output type	NPN and PNP (push-pull output)
Output mode	Dark operate (when connected as PNP)
Output current	150 mA max each
Input type	Sinking or sourcing (jumper selectable, default is for connection to PNP output)
Mechanical	
Connection types	• Spring loaded removable terminal strips • 2 x RJ45 (connection to light arrays only) • CAN model only: Two additional RJ45 connectors for CAN comms
Material	
Housing	ABS (FR) UL94-V0
Cover	Polycarbonate
Accessories	
Required accessories	45MLA light arrays (Cat. No. 45MLA-xxxxx0Pxx). See Accessories on page 11.

ATTENTION:
- These devices are intended for object recognition only and may not be used for protection of humans (access protection).
  Ces appareils sont uniquement destinés à la reconnaissance d'objets et ne peuvent pas être utilisés pour la protection des humains (protection d'accès).
- Maximum ambient temperature: 55 °C (131 °F)
  Température ambiante maximale: 55 °C (131 °F)

ATTENTION: The cables must be mounted using the provided grommets to maintain IP54 standards.
Do not allow the cables to be pinched or mechanically stressed in the mounted environment.

Rockwell Automation

IMPORTANT For use in NFPA 79 applications only.
Pour utilisation dans les applications NFPA 79 uniquement.

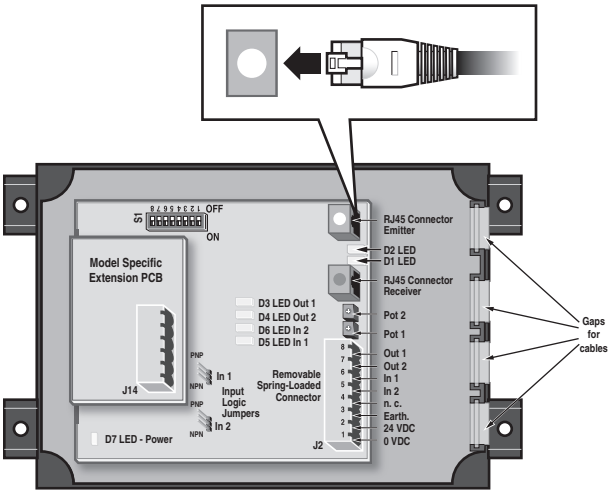
Mounting Instructions

This unit can be mounted on a DIN rail either with the mounting brackets on the back or four screws through the holes on the tabs that extend from the corners of the housing. To reduce the influences of electromagnetic disturbances, verify that none of the connecting cables are lying next to high power or high frequency circuit cables.

Electrical Configuration

The controller unit contains a main PCB that controls light array electronics, and an extension PCB for additional I/O or communication functionality (model dependent). The emitter and receiver light arrays must be connected to the controller through their respective RJ45 connectors on the main PCB. The grommets (provided) should be installed in the gaps on the side of the controller around the electrical cables. After you connect the cable and place the grommets, mount the clear plastic cover with the screws provided.

Figure 1 - Controller



This main board has two digital inputs, two digital outputs, and power connections on the terminal connector. The pin descriptions for this connector are listed in Table 1. Any additional connections to be made to the extension PCB are detailed in the model-specific sections of this document.

Table 1 - Controller Terminal Connector Pin Allocation

Pin	Signal	Description
1	0V DC	Power
2	+24V DC	Power
3	Ground	Ground
4	Not connected	Not connected
5	In 2	Model-specific descriptions
6	In 1	
7	Out 2	
8	Out 1	

Functional Description — All Models

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):

$$T = t_A + n \times t_S$$

n = number of optical beams

For t_S and t_A the approximate values in Table 2 can be assumed:

Table 2 - Response Time Details

Model	t_A (ms) ± 5%	t_S (ms) ± 5%
45MLA-CTRL-ALG single scan mode (default)	4.1	0.13
45MLA-CTRL-ALG double scan mode (1)	4.1	0.25
45MLA-CTRL-BSC single scan mode (default)	0.6	0.14
45MLA-CTRL-BSC double scan mode (1)	0.8	0.25
45MLA-CTRL	5.3	0.275
45MLA-CTRL-485	2.1	0.275
45MLA-CTRL-CAN	1.0	0.275

(1) Double-scan mode can be set with the DIP switches on these models.

For example, for a 600 mm array with a 10 mm beam spacing with the I/O model controller, the response time is calculated as follows:

$$T = 5.3 + 60 \times 0.275 = 21.8 \text{ ms}$$

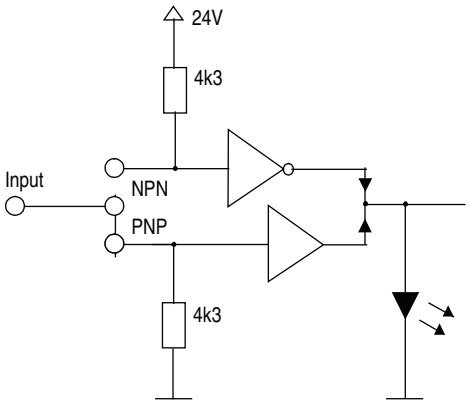
Input Logic

The controller inputs can accept either NPN or PNP outputs. The default setting is configured as a sinking input to connect to a PNP sourcing output. To connect the input to an NPN output the jumpers In1 and In2, on the main PCB, must be adjusted as described in Table 3 and Figure 2.

Table 3 - Input Logic as Described by Jumper Settings

Jumper	Connect to PNP Output (Default)	Connect to NPN Output
In1	Input IN1 active 'high' (+24V)	Input IN1 active 'low' (0V)
In2	Input IN2 active 'high' (+24V)	Input IN2 active 'low' (0V)

Figure 2 - Input Logic Sinking/Sourcing Is Defined by the Jumper Setting



Output Logic

The 45MLA controller uses push-pull outputs that can be connected to either sinking or sourcing input cards. Additionally, the output logic can be inverted using DIP switch S1:5. The procedure is detailed in the model-specific sections.

Status Indicators

Figure 4 shows the meaning of each status indicator on the main PCB of the controller.

Table 4 - Controller Main Board Status Indicators

Status Indicator	Description	Color	Meaning
D1	Light array OK	Off	Target present or light arrays not aligned
		Green	Target not present and light arrays aligned
		Green flashing	Low margin/light intensity inadequate
D2	Light array status	Off	Target not present
		Red	Target present
		Red flashing	System
D3	Out1	Off	Output 1 inactive
		Green	Output 1 active
D4	Out2	Off	Output 2 inactive
		Green	Output 2 active
D5	In1	Off	Input 1 inactive
		Green	Input 1 active
D6	In2	Off	Input 2 inactive
		Green	Input 2 active
D7	Power	Off	Power off
		Green	Power on

DIP Switches

DIP switch settings and descriptions are detailed in model-specific sections in this document. Change DIP switch settings only when the controller power is off.

Potentiometer Settings

The time settings of outputs Out1 and Out2, overhang duration (t_ot) and minimum output duration (t_out), can be adjusted using the corresponding potentiometers, as described in Table 5.

Table 5 - Controller Main PCB Potentiometer Adjustments

Pot	Description	Direction	Limit Value
Pot 1 (1)	Allowed overhand detection (2) or scan interruption ignore time (3)	Counterclockwise	t_ot = 0 s
		Clockwise	t_ot = 3.3 s
Pot2	Minimum output duration	Counterclockwise	t_out = 0 s
		Clockwise	t_out = 3.3 s

(1) Potentiometer 1 is not used on the analog controller model.
(2) I/O, RS-485 and CAN controllers.
(3) Basic controller (only when double-scan mode is selected, for example, via DIP switch 4).

Additionally, the CAN and RS-485 controller models offer the flexibility of adjusting these settings through use of specified commands over the serial interface.

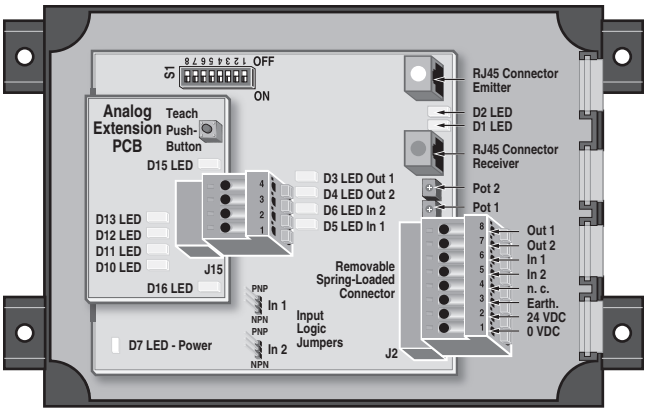
Reset Default Parameter Settings

All controllers are shipped with default parameter values that can be changed through the teach process for the I/O model and through serial commands for the RS-485 and CAN models. The default parameters can be reset in all models by following this procedure:

1. Turn off controller power.
2. Set switch 8 on DIP switch array S1 to ON.
3. Turn on controller power.
4. Set switch eight on DIP switch array S1 to OFF.
5. Default settings should now be restored.

Functional Description – Analog Model

Figure 3 - Analog Model



The analog controller model offers either 4...20 mA or 0...10V (current or voltage selectable via DIP switch) output proportional to target height, width, or position. The output is automatically scaled to the length of the connected arrays, so most applications do not require additional adjustments. A Teach button is available for applications that require customized scaling of the output.

Pin Listings

Table 6 shows the allocation of pins on the main connector, J2.

Table 6 - J2 Pin Listings

Pin	Signal	Description	Remarks
1	0V DC	Power	–
2	+24V DC	Power	–
3	Ground	Ground	–
4	Not connected	Not connected	–
5	In 2	Not used	–
6	In 1	Not used	DIP switch S1 (3) = 0
		Remote teach	DIP switch S1 (3) = 1
7	Out 2	Error	0V DC = error 24V DC = no error
8	Out 1	Light array interrupted	0V DC = interrupted 24V DC = not interrupted

Table 7 shows the allocation of pins on the I/O extension PCB.

Table 7 - J15 Pin Listings

Pin	Signal	Minimum	Maximum
1	I Out	4 mA	20 mA
2	0V DC		
3	V Out	0V	10V
4	0V DC		

Status Indicators

Table 8 shows the meaning of status indicators D15 and D16 on the extension PCB.

Table 8 - Analog Board Status Indicators

Status Indicator	Description	Status	Meaning
D15	Teach Indicator	Off	Teach inactive
		Flashing	Teach active
		Orange	Last step of teach process
D16	Analog Output Status	Off	V_out = OFF (0V)
		Flashing	Start up (ignore output), over current, or error
		Green	Brightness proportional to analog output

DIP Switch Settings

DIP switches 1...6 on the S1 DIP switch array are configured for the various applications that are described in Table 9. If no information is otherwise provided, these DIP switches should remain in the OFF position.

DIP switch 8 is used to reset default configuration.

IMPORTANT Once changed, DIP switch settings are only recognized after a power cycle.

The following table details DIP switch settings for the I/O board. See Publication 10000071139 for further information on the listed functions.

Table 9 - Analog Model DIP Switch Settings

Function	DIP Switch S1 (0: OFF, 1: ON, X: not relevant)							
	8	7	6	5	4	3	2	1
Default setting	0	0	0	0	0	0	0	0
Current output	x	x	x	x	x	x	x	0
Voltage output	x	x	x	x	x	x	x	1
Absolute mode (position)	x	x	x	x	x	x	0	x
Relative mode (size)	x	x	x	x	x	x	1	x
Enable remote teach	0	x	x	x	x	1	x	x
Enable double scan filter	0	x	x	x	1	x	x	x
Output logic Light Operate = 24V (PNP L.O.) Dark Operate = 0V (NPN D.O.)	0	x	x	0	x	x	x	x
Output logic Light Operate = 0V (NPN L.O.) Dark Operate = 24V (PNP D.O.)	0	x	x	1	x	x	x	x
Standard beam counting direction	0	x	0	x	x	x	x	x
Reverse beam counting direction	0	x	1	x	x	x	x	x
Normal operation	0	x	x	x	x	x	x	x
Set default	1	x	x	x	x	x	x	x

It is possible to configure the analog controller to ignore short beam interruptions, such as those caused by small particles that pass through the detection area. The double scan mode is enabled by turning DIP switch 4 ON. In this mode, every beam is evaluated twice (instead of once) and only beams that are interrupted during both evaluations are recognized. This configuration allows brief beam interruptions to be ignored. When using double scan mode, the response time is increased.

Teach Instructions

The analog output is automatically scaled to the length of the connected arrays. If no beams are interrupted, the analog output is at the minimum (4 mA or 0V); if the top (last) beam is interrupted (in absolute/position mode) or all beams are interrupted (in relative/size mode), the analog output is at the maximum (20 mA or 10V) with a straight-line slope for conditions in between those states. This means that most applications do not require teaching the device. For applications that do require customized scaling of the output use the following teach steps.

ATTENTION: Help 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 dissipative static control materials.

The Teach button on the extension PCB and the remote teach input (Input 1) both use the same teach procedure. Set DIP switch S1:3 to ON (and cycle power) to enable the remote teach input. When using the remote teach, if the instructions indicate "Press and hold the Teach button for 5 seconds" the input must be turned ON for at least 5 seconds.

1. Start teach
   Press and hold the Teach button for approximately 5 seconds until status indicator D15 begins flashing once every 3 seconds, which indicates that the unit is in teach mode.
2. Teach minimum analog output (4 mA or 0V)
   Place the object that is to be represented by the minimum analog output within the arrays. Press and release the Teach button. Status indicator D15 now flashes twice every 3 seconds, which indicates that any interrupted beams have been recognized. If no beams are interrupted, the minimum analog output value (4 mA or 0V) in Run mode indicates that no beams are interrupted.
3. Teach maximum analog output (20 mA or 10V)
   Place the object that is to be represented by the maximum analog output within the arrays. Press and release the teach button. Status indicator D15 now flashes three times every 3 seconds, which indicates that any interrupted beams have been recognized. If no beams are interrupted, the maximum analog output value (20 mA or 10V) in Run mode indicates that no beams are interrupted.
4. Complete teach
   To complete the teach process, press and hold the Teach button until the status indicator D15 turns off (approximately 5 seconds), which signals the end of the teach process. The taught values are saved to non-volatile (flash) memory. Alternatively, briefly pressing the Teach button can discard the newly taught values. Status indicator D15 turns off (which indicates the end of the teach process) and the previous values are restored.

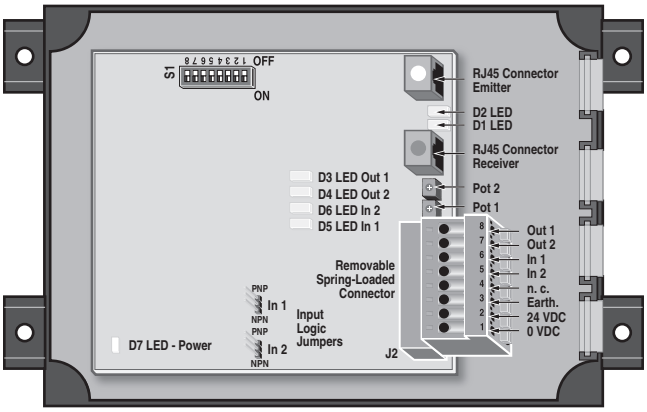
Notes on the teach process:

- If the controller is set in absolute/position mode (DIP switch S1:2 = OFF), the discrete output (Out 1) changes state only when a beam within the taught area is interrupted. For example, if the minimum analog output is set for beam 10 and the maximum analog output is set for beam 30, blocking only beam 5 or beam 40 does not change the state of the discrete output, while interrupting beam 20 would change the state of the discrete output. The discrete output changes state if both beam 40 AND beam 20 are blocked. If the controller is set in relative/size mode (DIP switch S1:2 = ON), the discrete output (Out 1) changes state if any beam is interrupted.
- Instead of using the actual object to be detected for the teach process, the appropriate beams may be interrupted by other means during the teach process, such as a metal flag.

- Turning off power at any time during the teach process cancels the process. The previously stored values remain valid.
- The analog output is active during the teach process and the output value represents the actual state based on the current interrupted beams and the values that are taught during the current teach process.
- Default values (analog output scaled to full length of connected light arrays) can be reset by setting DIP switch 1:8 to ON and cycling power.
- Connecting a different length light array pair to the controller results in the analog output being scaled to the full length of the array, thus overwriting any taught values for minimum and maximum analog output value.
- The slope of the analog output can be made positive or negative by changing the order in which the two different sized objects are presented during the teach process. For example, presenting the taller object in step 2 and the shorter object in step 3 results in a negative slope in the analog output.

Functional Description — Basic Model

Figure 4 - Basic Model



This controller model provides a basic discrete (on/off) output that indicates the overall state of the arrays.

Pin Listings

Table 10 shows the allocation of pins on the main connector, J2.

Table 10 - J2 Pin Listings

Pin	Signal	Description	Remarks
1	0V DC	Power	–
2	+24V DC	Power	–
3	Ground	Ground	–
4	Not connected	Not connected	–
5	In 2	Not used	–
6	In 1	Not used	DIP switch S1 (3) = 0
		Remote teach	DIP switch S1 (3) = 1
7	Out 2	Error	0V DC = Error
8	Out 1	Light array interrupted	0V DC = interrupted 24V DC = not interrupted

DIP Switch Settings

DIP switches 1…6 on the S1 DIP switch array are configured for the various applications that are described in Table 11. If no information is otherwise provided these DIP switches should remain in the OFF position.

DIP switch 8 is used to reset default configuration. Once changed, DIP switch settings are only recognized after a power cycle.

Table 11 details DIP switch settings for the I/O board. See Publication 10000071139 for further information on the listed functions.

Table 11 - Basic Model DIP Switch Settings

Function	DIP Switch S1 (0: OFF, 1: ON, X: not relevant)							
	8	7	6	5	4	3	2	1
Default setting	0	0	0	0	0	0	0	0
Maximum emitter power (100%)	0	x	x	x	x	x	0	0
Reduce emitter power (75% of max)	0	x	x	x	x	x	0	1
Reduce emitter power (60% of max)	0	x	x	x	x	x	1	0
Reduce emitter power (15% of max)	0	x	x	x	x	x	1	1
Enable remote teach	0	x	x	x	x	1	x	x
Enable double scan filter	0	x	x	x	1	x	x	x
Output logic Light Operate = 24V (PNP L.O.) Dark Operate = 0V (NPN D.O.)	0	x	x	0	x	x	x	x
Output logic Light Operate = 0V (NPN L.O.) Dark Operate = 24V (PNP D.O.)	0	x	x	1	x	x	x	x
Standard beam counting direction	0	x	0	x	x	x	x	x
Reverse beam counting direction	0	x	1	x	x	x	x	x
Normal operation	0	x	x	x	x	x	x	x
Set default	1	x	x	x	x	x	x	x

The 45MLA controller is designed to work with a range of at least 4 m (13.1 ft). As a result some translucent targets may not block enough light to be properly detected, especially if the emitter and receiver arrays are placed closer together. With the Basic Controller model, it is possible to use DIP switches to decrease the emitter intensity, therefore making it easier to detect translucent objects. The emitter intensity may be set to full power (default setting), 75% of full intensity power, 60%, or 15% by using a combination of DIP switches 1 and 2 according to Table 11.

It is possible to configure the Basic Controller to ignore short beam interruptions, such as those caused by small particles that pass through the detection area. The double-scan mode can be enabled by turning on DIP switch 4 (and cycling power). In this mode, every beam is evaluated twice (instead of once) and only beams that are interrupted during both evaluations are recognized. This allows brief beam interruptions to be ignored. The response time is increased. When the double-scan mode is enabled, the minimum duration of detection can be made even longer with the use of potentiometer one. This additional time delay can range from 0…3.3 seconds.

Teach Instructions

The Basic Controller offers the ability to teach blanked zones that are not evaluated during operation. You can either configure blanked zones at one or both ends of the array (for example if the arrays are too long for the application); OR one blanked zone in the middle of the array (if an area in the middle is too be ignored).

To activate the teach capability DIP switch 3 must be turned ON (and controller power cycled) to enable the remote teach. Once the remote teach is enabled, the teach process is initiated by turning the discrete input IN 1 ON. Interrupt the beams/zones that are to be ignored and turn the input IN 1 OFF. The beams that are interrupted while IN 1 changes from ON to OFF determine the blanked zones.

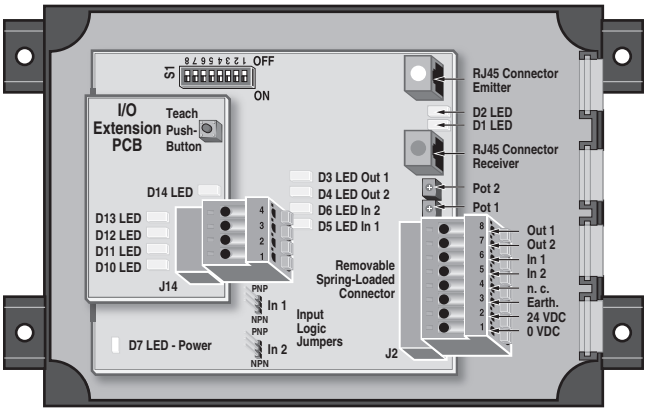
The blanked zones can be reset with DIP switch 8 or by doing the teach process again.

Notes on the teach process:

- There cannot be any holes in a single blanked zone—all beams must be interrupted to define the zone.
- The first blanked zone is defined from the first interrupted beam to one less than the first beam that is not blocked. (DIP switch 6 determines beam counting direction, with the default standard beam counting starting from the cable end of the array.) If (and only if) the first blanked zone starts with Beam 1, a second blanked zone can also be created. The zone is defined as starting with the next interrupted beam (after the first uninterrupted beam) all the way to the end of the array, regardless of which other beams are interrupted.
- For best results, confirm that all beams in the blanked zone are completely blocked. Also, if two blanked zones are being created, confirm that the first zone includes beam 1 (based on the beam counting direction that DIP switch 6 determines).

Functional Description — I/O Model

Figure 5 - I/O Model



This model of the controller extends the functionality of the 45MLA controller to offer four additional output signals and a teach function. These outputs can be allocated to specific zones or single beams on the light array.

Pin Listings

Table 12 shows the allocation of pins on the main connector, J2.

Table 12 - J2 Pin Listings

Pin	Signal	Description	Remarks
1	0V DC	Power	–
2	+24V DC	Power	–
3	Ground	Ground	–
4	Not connected	Not connected	–
5	In 2	Trigger and hold	DIP switch S1 (7) = 0
		Overhang back sensor	DIP switch S1 (7) = 1
6	In 1	Not used	DIP switch S1 (7) = 0
		Overhang front sensor	DIP switch S1 (7) = 1
7	Out 2	Light array interrupted (1)	0V DC = interrupted 24V DC = not interrupted
8	Out 1	Overhang	0V DC = overhang 24V DC = no overhang

(1) Or over-height (special function)

Table 13 shows the allocation of pins on the I/O extension PCB.

Table 13 - J14 Pin Listings

Pin	Signal	0V DC	+24V DC
1	Out 3	Zone Z1 interrupted	Zone Z1 not interrupted
2	Out 4	Zone Z2 interrupted	Zone Z2 not interrupted
3	Out 5	Zone Z3 interrupted	Zone Z3 not interrupted
4	Out 6	Zone Z4 interrupted	Zone Z4 not interrupted

Status Indicators

Table 14 shows the meaning of status indicators D10...D14 on the I/O extension PCB.

Table 14 - I/O Board Status Indicators

Status Indicator	Description	Status	Meaning
D10	Zone 1	Off	Out 3 = OFF (0V DC)
		Green	Out 3 = ON (24V DC)
D11	Zone 2	Off	Out 4 = OFF (0V DC)
		Green	Out 4 = ON (24V DC)
D12	Zone 3	Off	Out 5 = OFF (0V DC)
		Green	Out 5 = ON (24V DC)
D13	Zone 4	Off	Out 6 = OFF (0V DC)
		Green	Out 6 = ON (24V DC)
D14	Teach	Off	Teach inactive
		Flashing	Teach in progress
		Orange	Last teach step

DIP Switch Settings

DIP switches 1...6 on the S1 DIP switch array are configured for the various applications that are described in Table 15. If no information is otherwise provided, these DIP switches should remain in the OFF position.

DIP switch 7 is used to configure the overhang mode (see Publication 10000071139 for further information) and DIP switch 8 is used to reset default configuration. Once changed, DIP switch settings are only recognized after a power cycle.

Table 15 details DIP switch settings for the I/O board. See the Programming Guide for further information on the listed functions.

Table 15 - I/O Board DIP Switch Settings

Function	DIP Switch S1 (0: OFF, 1: ON, X: not relevant)							
	8	7	6	5	4	3	2	1
Default setting	0	0	0	0	0	0	0	0
Standard beam counting direction	0	X	0	X	0	0	0	0
Reverse beam counting direction	0	X	1	X	0	0	0	0
Output logic (default) active low	X	X	X	0	X	X	X	
Output logic active high	X	X	X	1	X	X	X	
Overhang monitoring with time delay	0	0	X	X	0	0	0	0
Overhang monitoring with trigger sensor	0	1	X	X	0	0	0	0
Set Default	1	X	X	X	X	X	X	X

Default Parameters

Table 16 lists the default values for each of the parameters that are previously discussed, that can be reset by use of switch 8 on DIP switch array S1, followed by a power cycle.

Table 16 - Default Parameters for I/O Model

Parameter	Default value (beam no.)
zc – Carrier zone 1	1
oh – Over-height 1	1
z1L – Zone 1 Lowest beam 1	1
z1H – Zone 1 Highest beam n/4 (1)	n/4
z2L – Zone 2 Lowest beam z1H+1	z1H+1
z2H – Zone 2 Highest beam 2n/4	2n/4
z3L – Zone 3 Lowest beam z2H+1	z2H+1
z3H – Zone 3 Highest beam 3n/4	3n/4
z4L – Zone 4 Lowest beam z3H+1	z3H+1
z4H – Zone 4 Highest beam n	n
Beam counting mode	0 = first beam cable side

(1) n = total number of beams in the light array

Teach Process

The teach function allows you 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, and the steps associated with this procedure.

ATTENTION: Help 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 dissipative static control materials.

Before beginning this process:

- Verify that the light array is mounted as it is in the target application.
- Turning off the power during any stage of the teach process cancels the process and restores previously stored values.
- Previous values can also be restored by pressing the Teach button repeatedly until the teach process is completed and status indicator 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.

Step-by-Step Teach Function Guide

1. Start teach
   Press and hold the Teach button for approximately 5 seconds until status indicator D14 begins flashing once every 3 seconds, which indicates 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 status indicator D14 now flashes twice approximately every 3 seconds, which indicates 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 configure a blanked area below the application detection area.)
3. Carrier zone
   Place the carrier (pallet, crate, and so on) in the field of the light array and briefly press the Teach button again. Status indicator D14 should now flash three times approximately every 3 seconds, which indicates that the carrier that interrupts all beams 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) are defined as the carrier zone.

IMPORTANT Setting the carrier zone is only required for applications that use over-hang detection. For other applications, press the Teach button to skip this step.

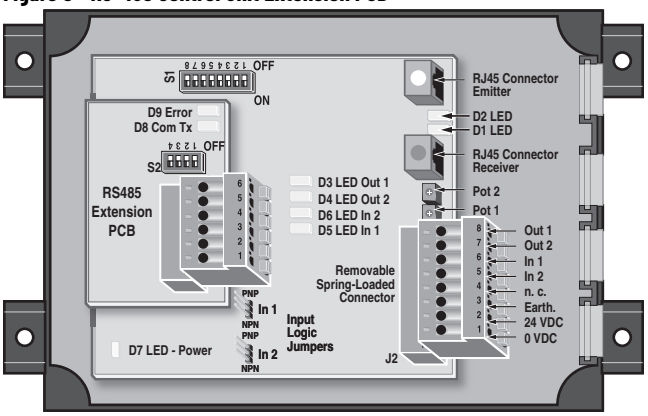
4. Over-height
   The over-height output (Out 2) is a discrete on-off output that is activated by default when any beam is interrupted. (Default Beam oh = Beam 1)

   To teach the over-height level, place the highest allowed object in the range of the light array and then briefly press the Teach button. Status indicator D14 should now remain on, which indicates that the highest allowed object beam has now been set. The next uninterrupted beam is 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) is activated.
5. Configure zones
   If you do not wish to configure specific zones at this point, press and hold the Teach button until status indicator D14 turns off (approximately 5 seconds), which signals 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 these steps:
   a. Zone 1: When you enter the zone setup, status indicators D10 and D14 flash, which indicates that zone 1 is ready to be taught. Place an object that represents the size of zone 1 into the range of the light array. Now press the Teach button to establish the highest and lowest interrupted beams, which define zone 1.
   b. Zone 2: Status indicators D11 and D14 flash after step a, which indicates that zone 2 can be taught. As in step a, place an object that represents the size of zone 2 into the range of the light array and then press the Teach button.
   c. Zone 3: Status indicators D12 and D14 flash after step b, which indicates that zone 3 can be taught. Again, place an object into the range of the light array to represent the size of zone 3 and press the Teach button.
   d. Zone 4: Status indicators D13 and D14 flash, which indicates that zone 4 can be taught. Place an object into the range of the light array to represent the size of zone 4 and press the Teach button. Status indicator D14 now remains on, which acknowledges 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 status indicator D14 turns off (approximately 5 seconds), which signals the end of the teach process.

IMPORTANT If you want to delete the new settings (to restore previously stored values), instead of pressing and holding the Teach button, briefly press the Teach button. Status indicator D14 turns off (which indicates the end of the teach process) and the previous values are restored.

Functional Description – RS-485 Comm. Model

Figure 6 - RS-485 Control Unit Extension PCB



Pin Listings

The allocation of pins on the main connector, J2, for use with the RS-485 controller model is described in Table 17.

Table 17 - J2 Pin Listings

Pin	Signal	Description	Remarks
1	0V DC	Power	–
2	+24V DC	Power	–
3	Ground	Ground	–
4	Not connected	Not connected	–
5	In 2	Trigger and hold	See Publication 10000071139
6	In 1	Not used	Not used
7	Out 2	Light array interrupted (1)	0V DC = interrupted 24V DC = not interrupted
8	Out 1	Overhang	24V DC = no overhang

(1) Or over-height (special function)

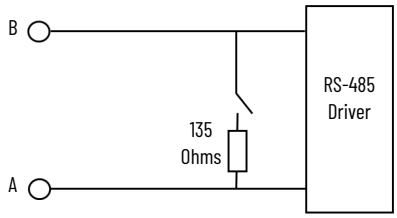
Table 18 describes the connectivity of connector J16, the RS-485 connection, which is located on the extension PCB.

Table 18 - J16 Pin Listings

Pin	2 Wire	4 Wire
1	0V DC	0V DC
2	-	Rx+
3	Shielding	Shielding
4	-	Rx-
5	B	Tx+
6	A	Tx-

Figure 7 provides additional information on the impedances that are associated with each of the RS-485 inputs.

Figure 7 - Input Schematic of the RS-485 Terminal



Status Indicators

Table 19 shows the meaning of status indicators D8 and D9 on the RS-485 extension PCB.

Table 19 - RS-485 Controller Status Indicators

Status Indicator	Description	Color	Meaning
D8	Data communication	Off	No communication
		Green flashing	Communication active
D9	RS-485 Error	Off	No RS-485 error
		Red	RS-485 error

DIP Switch Settings

Table 20 and Table 21 describe settings for DIP switch arrays S1 and S2. Changes made to these settings take effect only after a power cycle.

Table 20 - DIP Switch Array S1 Settings on the Main PCB

Function	DIP switch array S1 (0: OFF, 1: ON, X: not relevant)							
	8	7	6	5	4	3	2	1
Default	0	0	0	0	0	0	0	0
Offset to address: 0 (00 Hex)	X	X	X	X	0	0	0	0
Offset to address: 1 (01 Hex)	X	X	X	X	0	0	0	1
Offset to address: 2 (02 Hex)	X	X	X	X	0	0	1	0
Offset to address: 3 (03 Hex)	X	X	X	X	0	0	1	1
Offset to address: 4 (04 Hex)	X	X	X	X	0	1	0	0
Offset to address: 5 (05 Hex)	X	X	X	X	0	1	0	1
Offset to address: 6 (06 Hex)	X	X	X	X	0	1	1	0
Offset to address: 7 (07 Hex)	X	X	X	X	0	1	1	1
Offset to address: 8 (08 Hex)	X	X	X	X	1	0	0	0
Offset to address: 9 (09 Hex)	X	X	X	X	1	0	0	1
Offset to address: 10 (0A Hex)	X	X	X	X	1	0	1	0
Offset to address: 11 (0B Hex)	X	X	X	X	1	0	1	1
Offset to address: 12 (0C Hex)	X	X	X	X	1	1	0	0
Offset to address: 13 (0D Hex)	X	X	X	X	1	1	0	1
Offset to address: 14 (0E Hex)	X	X	X	X	1	1	1	0
Offset to address: 15 (0F Hex)	X	X	X	X	1	1	1	1
Communication rate 19,200 Baud	X	X	0	0	X	X	X	X
Communication rate 2400 Baud	X	X	0	1	X	X	X	X
Communication rate 9600 Baud	X	X	1	0	X	X	X	X
Communication rate 57,600 Baud	X	X	1	1	X	X	X	X
Reset to default	1	X	X	X	X	X	X	X

Table 21 - DIP Switch Array S2 Settings for 2-Wire (default)/4-Wire Communication (on extension PCB)

Function	DIP switch array S2			
	4	3	2	1
Default	0	1	0	0
Terminating resistor (135 W) OFF	X	X	X	0
Terminating resistor (135 W) ON	X	X	X	1
Terminating resistor 4-wire OFF	X	X	0	0
Terminating resistor 4-wire ON	X	X	1	1
Rx 2-wire	0	1	0	X
Rx 4-wire	1	0	X	X

Functional Description – CAN Model

Figure 8 - CAN Board with Pin Locations, Teach Button

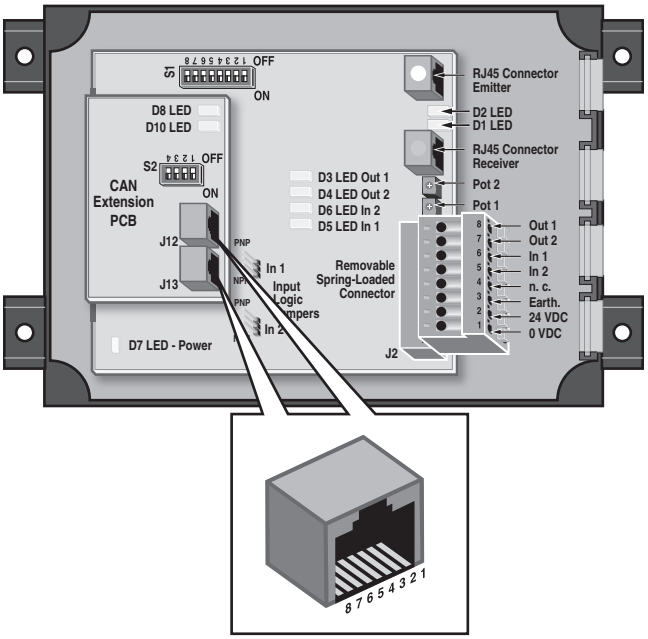


Table 22 shows the allocation of pins on the main connector, J2, for use with the CAN controller model.

Table 22 - J2 Pin Listings

Pin	Signal	Description	Remarks
1	0V DC	Power	–
2	+24V DC	Power	–
3	Ground	Ground	–
4	Not connected	Not connected	–
5	In 2	Trigger and hold	See Publication 10000071139
6	In 1	Not used	Not used
7	Out 2	Light array interrupted (1)	0V DC = interrupted 24V DC = not interrupted
8	Out 1	Overhang	0V DC = overhang 24V DC = no overhang

(1) Or over-height (special function)

This extension PCB is equipped with two RJ45 connectors, J12 and J13, for the CAN interface. Table 23 describes pin functions.

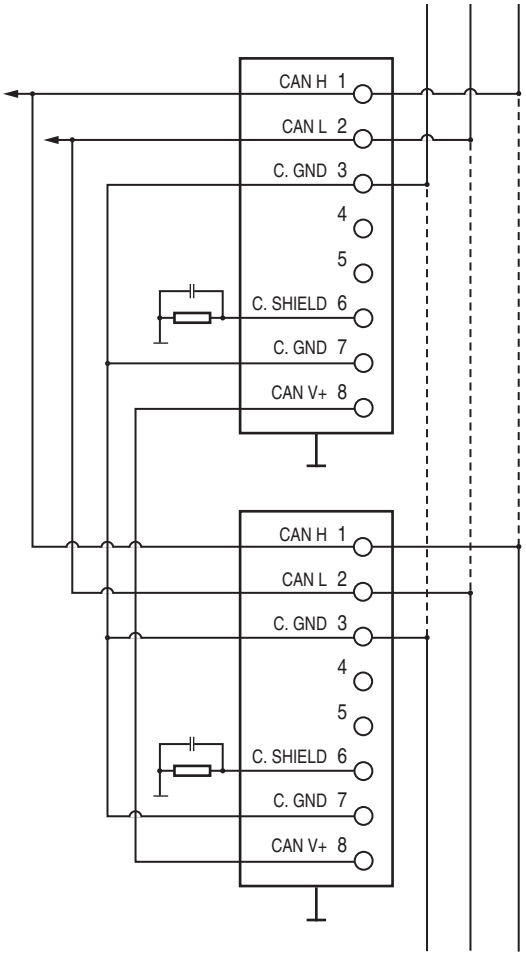
Table 23 - CAN Standard RJ45 Connection for J12 and J13

Pin	Signal
1	CAN H
2	CAN L
3	0V DC
4	Not connected
5	Not connected
6	Shield (optional)
7	CAN GND (optional)
8	CAN V+ (optional)

Electrical Connection

The individual pins from J12 and J13 are connected to each other in series (Figure 9) and are identical. Two CAN cables can be connected to the two plugs separately, or connected to just one plug. The CAN module is powered internally. The CAN power supply (connector J12 and 13, Pin 7 and 8) is not used, but connected in series.

Figure 9 - CAN Model Pinout



Status Indicators

Table 24 shows the meaning of status indicators D8 and D10 on the CAN extension PCB.

Table 24 - CAN Controller Status Indicators

Status Indicator	Description	Color	Meaning
D8	CAN Error	Off	No CAN error
		Red	CAN error – invalid message
D10	CAN Communication	Off	No communication
		Green flashing	Controller communicating over CAN

DIP Switch Settings

Table 25 and Table 26 describe DIP switch settings for the CAN model. DIP switch array S2 (1...4), on the extension PCB, sets the address offset, affecting all basic addresses from the CAN standard mode and extended CAN mode. DIP switch setting changes only take effect after a power cycle.

Table 25 - DIP Switch Array S1 Setting

Function	DIP switch number on array S1 (1)							
	8	7	6	5	4	3	2	1
Default	0	0	0	0	0	0	0	0
Offset to address: 0 (00 Hex)	0	X	X	X	0	0	0	0
Offset to address: 1 (01 Hex)	0	X	X	X	0	0	0	1
Offset to address: 2 (02 Hex)	0	X	X	X	0	0	1	0
Offset to address: 3 (03 Hex)	0	X	X	X	0	0	1	1
Offset to address: 4 (04 Hex)	0	X	X	X	0	1	0	0
Offset to address: 5 (05 Hex)	0	X	X	X	0	1	0	1
Offset to address: 6 (06 Hex)	0	X	X	X	0	1	1	0
Offset to address: 7 (07 Hex)	0	X	X	X	0	1	1	1
Offset to address: 8 (08 Hex)	0	X	X	X	1	0	0	0
Offset to address: 9 (09 Hex)	0	X	X	X	1	0	0	1
Offset to address: 10 (0A Hex)	0	X	X	X	1	0	1	0
Offset to address: 11 (0B Hex)	0	X	X	X	1	0	1	1
Offset to address: 12 (0C Hex)	0	X	X	X	1	1	0	0
Offset to address: 13 (0D Hex)	0	X	X	X	1	1	0	1
Offset to address: 14 (0E Hex)	0	X	X	X	1	1	1	0
Offset to address: 15 (0F Hex)	0	X	X	X	1	1	1	1
Communication rate CAN: 125k	0	X	0	0	X	X	X	X
Communication rate CAN: 250k	0	X	0	1	X	X	X	X
Communication rate CAN: 500k	0	X	1	0	X	X	X	X
Communication rate CAN: 1M	0	X	1	1	X	X	X	X
Standard CAN mode	0	0	X	X	X	X	X	X
Extended CAN mode	0	1	X	X	X	X	X	X
Set default configuration	1	X	X	X	X	X	X	X

(1) (0: OFF, 1: ON, X: not relevant), DIP 2...4 not used

Table 26 - DIP Switch Array S2 Settings (extension PCB)

Function	DIP switch number on array S2 (1)			
	4	3	2	1
Default	0	0	0	0
Terminating resistor (135 W) OFF	X	X	X	0
Terminating resistor (135 W) ON	X	X	X	1

(1) (0: OFF, 1: ON, X: not relevant), DIP 2...4 not used

Default Parameters

The termination resistor must be set according to the CAN architecture in each application and can be switched on through use of switch 1 on DIP switch array S2. The communication rate and address offset can be set with DIP switch array S1 (on the main PCB).

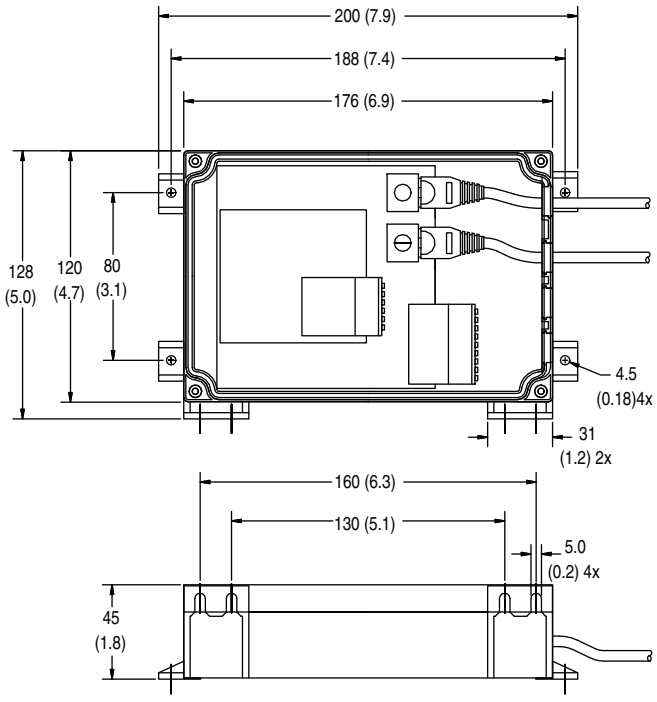
Table 27 lists the default values for additional parameters that are previously discussed (for both RJ485 and CAN models), which can be reset by use of switch 8 on DIP switch array S1, followed by a power cycle.

Table 27 - Default Parameter Settings for CAN model

Parameter	Setting	Default
Beam counting mode	Command 1C (Hex), Par 46	0 = First beam cable side
Pitch factor	Command 1C (Hex), Par 45	1
Blanked Beams	Command 1C (Hex), Par 43 and 44	0
Output logic overhang	Command 1C (Hex), Par 24	0 = Active "Low"
Over-height	Command 1C (Hex), Par 25	1
Output logic over-height	Command 1C (Hex), Par 26	0 = Active "Low"
Overhang carrier zone	Command 1C (Hex), Par 23	1
Overhang trigger mode	Command 1C (Hex), Par 49	0 = time delay mode
Delay times	Command 1C (Hex), Par 63, 64, and 65	0

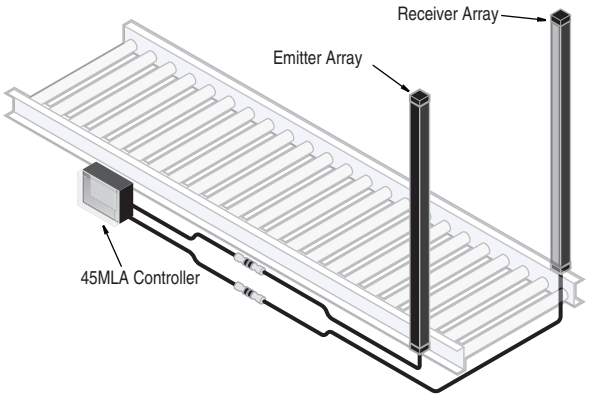
Approximate Dimensions

Dimensions shown in mm (in.).



Accessories

Light arrays from the 45MLA family (Cat. No. 45MLA-xxxxx0Pxx) are sold as transmitted beam pairs.



Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental information on its website at rok.auto/pec.

Your comments help us serve your documentation needs better. If you have any suggestions on how to improve our content, complete the form at rok.auto/docfeedback.
For technical support, visit rok.auto/support.

Rockwell Otomasyon Ticaret A.Ş. Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenkÖy, İstanbul, Tel: +90 (216) 5698400 EEE YÖnetmeliğine Uygundur

Connect with us.

rockwellautomation.com — expanding **human possibility**™

AMERICAS: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
EUROPE/MIDDLE EAST/AFRICA: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
ASIA PACIFIC: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 45MLA-IN002C-EN-P - August 2020 | Supersedes Publication 45MLA-IN002B-EN-P-July 2013

95302518
10000110164 Ver 02