# User manual

LD140-M7 + SM25
LD141-M7-R-...
LD142-M7-R-...

Description
This manual describes the LD14x battery display series and the sensors of the SM25 series. The purpose of this system is to display linear or angular displacements on industrial machines and on automation systems. The measurement system includes a battery powered LCD display, magnetic tape and a magnetic sensor. As the sensor is moved along the magnetic tape, it detects the displacement which is shown on the display. The flexibility of the tape allows it to be used for both linear and angular applications.
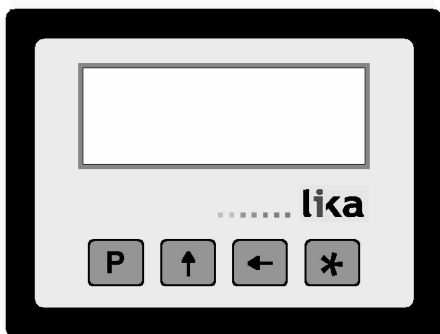
Chapters

1 – Safety summary
We strongly recommend carefully reading this user manual and following the installation guidelines:

- Sensor head should be installed as close as possible to the display.

- Avoid running the sensor cable near high voltage power cables (e.g. drive cables).
- Avoid mounting sensor head near capacitive or inductive noise sources such as relays, motors, and switching power supplies.

Connect according to chapter 5.

2 – Identification
The display and sensor can be identified by the label's data (ordering code, serial number). This information is listed in the delivery document. For technical features please refer to the product catalogue.

3 – Installation
Install the product according to the protection level provided.
Protect the system against knocks, friction, solvents, temperatures under –0°C (32°F) and over +60°C (+140°F).
Be sure that the system is mounted where hard or sharp objects (e.g. metal chips) do not come into contact with the magnetic scale and the bottom of the sensor head. If these conditions cannot be avoided provide a wiper or pressurized air.

4 – Mounting recommendations
4.1 Display
Push the display into the cut-out without panel clips.
Install panel clips on the display's housing and screw until fixed and stable.
Power supply by 1.5V commercial battery type **C** (or AM2 / BABY / LR14 / MN1400 / SP/HP11).

4.2 Magnetic tape
See manual supplied with the magnetic tape.

4.3 Sensor mounting
4.3.1 Sensor SM25–R (rectangular)
Sensor can be fixed by means of two M3 screws over the buttonholes. Make sure that the gap between sensor and tape is in respect with (fig. 1) along the total measuring length. Avoid contact between the parts. You can check planarity and parallelism between sensor and magnetic tape using a feeler gauge.
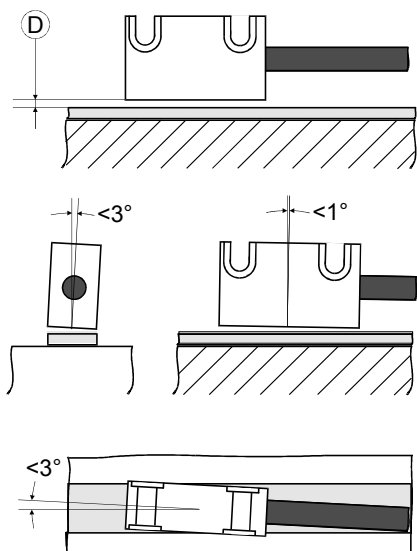
figure 1

D = 0,1 mm - 1,0 mm

4.3.2 Sensor SM25-C (circular)

The sensor can be fixed in a corresponding mounting hole by means of the two nuts. Make sure that the gap between sensor and tape is in respect with (fig. 2) along the total measuring length. **Observe the correct alignment of the marker on the tape.** Avoid contact between the parts. You can check planarity and parallelism between sensor and magnetic tape using a feeler gauge.
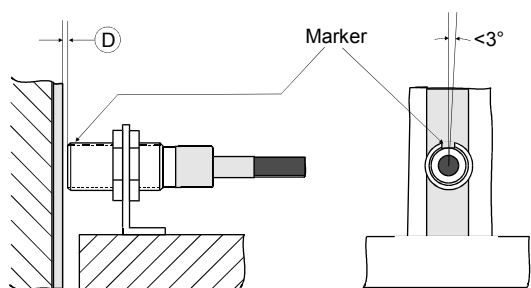

figure 2

D = 0,1 mm - 1,0 mm

5 – Electrical connections

5.1 SM25 sensor (only LD140)

Plug in the sensor's Mini-DIN connector (circular) on backside of the display.

5.2 RS232 serial interface (only with option I1)

Connect PC to LD14x with NULL MODEM COMPUTER AT CROSS OVER cable (9 pin female - 9 pin female) available in commerce.

Electrical cable connection:

Pin PC	Function	Pin LD14x
1		
2	Rx	3
3	Tx	2
4	DTR	6 *
5	GND	5
6	DSR	
7	RTS	8 *
8	CTS	
9		

* Power supply has to be provided to RS232 interface to avoid battery consummation. If not connect to the PC provide power supply (8-15Vdc) to pin 6 or 8. External supply isn't needed if using a Modem computer cable!

6 – Setup

6.1 Key's function

↑ : UP (select value)

← : Shift links (select digit)

* : Save (save data)

P : Program (programming/change parameter)

6.2 Key combinations / Quick functions

6.2.1 Set datum (reference)

Push * key for 3 sec. to access reset function ("**rESEt**" will be displayed).

Push **P** key to exit function (no reset).

Push * key twice to confirm datum value ("**donE**" will be displayed).

Display value = rEF + OFS1 + OFSx (where OFSx is the actually set Offset value).

This function is enabled only if **"F_rSt"** parameter is set **"yES"**.

6.2.2 Incremental measurement

Push **P** and * key simultaneously to switch from absolute measurement to incremental.

Zero setting in incremental modes (see 6.2.1) does not change absolute value in the background.

The function is enabled only if **"F_rEL"** parameter is set **"yES"**.

6.2.3 Mm/inch display modes

Mm/inch display modus can be changed by pushing ← key for 3 s. The function is enabled only if **"F_mml"** parameter is set **"yES"**.

6.2.4 Offset value modification

Push **P** and ← keys simultaneously to display 1. Offset value (OFS1). Use ← and ↑ keys to change value and save with * key. Further Offset values OFS2 and OFS3 can be changed only in setup menu.

Offset function is enable if **"F_oFS"** parameter is set **"yES"**.

← key allows to scroll OFS1, OFS2 and OFS3 values.

OFS1 = actual value + OFS1 + rEF

OFS2 = actual value + OFS1 + OFS2 + rEF

OFS3 = actual value + OFS1 + OFS3 + rEF

6.2.4.1 Fractional offset display

The fractional inch display mode allows to set offset values (OFS) in the following way:

- 1st digit blinking → increases $1/64$" pushing ↑ key.
- 2nd digit blinking → increases $1/32$" pushing ↑ key.
- 3rd digit blinking → increases $1/16$" pushing ↑ key.
- 4th digit blinking → increases $1/8$" pushing ↑ key.
- 5th digit blinking → increases 1" pushing ↑ key.
- 6th digit blinking → increases 10" pushing ↑ key.

6.2.5 Datum modification

Push simultaneously **P** and ↑ keys to display datum value **rEF**. Use ← and ↑ keys to change value and save with * key.

This function is enabled only if **"F_rEF"** parameter is set **"yES"**.

6.3 Setup / Parameter setting

Push **P** key for 3 s to enter setup and **"SEtUP"** is displayed.

Push ↑ key to enter **MENU 1** (parameters)

Push * key to enter **MENU 2** (RS232 serial interface)

Push **P** key to access the next Parameter and Parameter setting.

Push **P** key for 3 s to exit the setup at any point.

6.3.1 Default parameters (factory settings)

All default values are written in **BOLD** characters.

The display can be reset to default parameters with the following procedure:

- take out battery and wait for 10 s.
- while putting in the battery push * key (**"dEFPar"** is displayed)

6.3.2 Parameter list MENUE 1

Unit Measurement unit [dEC, FrEE, dG1, dG2, IdEC, Ifrct]

Sets the measurement unit and the display mode.

dEC = linear measurement display (decimal)

FrEE = display with conversion factor

dG1 = angular display (-∞..-0,1°..0,0°..+0,1°..+∞)

dG2 = angular display (..359,9°..0,0°..359,9°..0,0°..)

IdEC = inch display mode

Ifrct = fractional inch mode (eg. 12.31.64 = 12" $31/64$)

* = save, **P** = next parameter, **P** for 3 s. = exit

COn only with Unit = FrEE, dG1, dG2
Allows to set a free conversion factor to display non-metric units or angles.
Valeu range:
FrEE = 0,00001 - **1,00000**
dG1, dG2 = 0,00001 - 9,99999

Example 1:
Want to display a 90° angle (from 0° to 90°) with 0,1° resolution on a round table with 785,4 mm circumference.
The measurement length on 360° is 785,4 mm, though on 90.0° it is 785,4 / 4 = 196.35.
COn = 900 : 19635 = 0,045836

Example 2:
Want to display angles on a magnetic ring with diameter 114,5 mm.
The circumference is 114.5 * 3.14 = 359.53 mm
COn = 3600 : 35953 = 0,10013
* = save, **P** = next parameter, **P** for 3 s. = exit

rES Resolution
(only with Unit = dEC, FrEE, dG1, dG2, IdEC)
Sets the resolution to be displayed.
Unit = dEC, FrEE, dG1, dG2 = 0.001, 0.005, **0.01**, 0.05, 0.1, 0.5, 1
Unit = IdEC = 0.0001, 0.0005, **0.001**, 0.005, 0.01, 0.05, 0.1
* = save, **P** = next parameter, **P** for 3 s. = exit

dIr Counting direction [uP, dn]
uP = up (standard direction)
dn = down (inverted direction)
* = save, **P** = next parameter, **P** for 3 s. = exit

6.3.3 Additional function of MENUE 1
F_mmI mm/inch function [yES, no]
Enables the mm/inch function (by pushing ← key)
yES = enabled
no = disabled
* = save, **P** = next parameter, **P** for 3 s. = exit

F_rEL Incremental measurement function [yES, no]
Enables incremental measurement function (by pushing **P** and ***** keys).
yES = enabled
no = disabled
* = save, **P** = next parameter, **P** for 3 s. = exit

F_rSt Datum function [yES, no]
Enables datum function (by pushing ***** key).
yES = enabled
no = disabled
* = save, **P** = next parameter, **P** for 3 s. = exit

F_rEF Datum modification function [yES, no]
Enables reference modification function (by pushing **P** and ↑ key).
yES = enabled
no = disabled
* = save, **P** = next parameter, **P** for 3 s. = exit

F_oFS Offset modification function [yES, no]
Enables offset modification function (by pushing **P** and ← keys).
yES = enabled
no = disabled
* = save, **P** = next parameter, **P** for 3 s. = exit

rEF Datum value [-999999, 999999]
Absolute reference value for the measuring system. This value is displayed by pushing ***** key for 3 s. (displayed value includes previously set offset values).
* = save, **P** = next parameter, **P** for 3 s. = exit

OFS1 Offset1 value [-999999, 999999]
First offset value (e.g. tool correction). This value is added to actual value (see 6.2.3.)
* = save, **P** = next parameter, **P** for 3 s. = exit

OFS2 Offset2 value [-999999, 999999]
Second Offset value. This value is added to actual value and OFS1.
* = save, **P** = next parameter, **P** for 3 s. = exit

OFS3 Offset3 value [-999999, 999999]
Third Offset value. This value is added to actual value, OFS1 and OFS2.
* = save, **P** = next parameter, **P** for 3 s. = exit

When the setup is completed the display shows "**rESEt**"
Push ***** key twice to reset the display and quit the setup. **"donE"** will be displayed.
Push **P** key quit the setup without resetting the display. **"no rSt"** will be displayed.

6.3.4 Parameter list MENUE 2
Ad xx Device address [01, 31]
Setting of device address (only if ordered with serial interface (option I1).
For setting use ← and ↑ keys.
* = save, **P** = next parameter

H_cntr Hour meter (1/10 h)
Elapsed time indication (display connected to battery). Resolution is 1/10 hour (6 minutes).
* = save, **P** = next parameter

7 – RS232 serial interface (option I1)
If the display is provided with RS232 serial interface, the following commands can be used.

7.1 RS232 parameters
9600 Baud, 8Bit, no Parity, 1 Stop bit, Xon/Xoff

7.2 Serial commands
Serial commands must have the following structure:

│ A D C M N D = X
where:
│: PC keyboard symbol
AD: device address (00 to 31) 2 digit
CMND: command (see command list)
X: value range (see command list)

Upon receipt of a wrong command the display will answer with the same command + **?** and checksum (e.g. sent command: │02azs → answer │02azs?EF)
Any common terminal program can be used for communication with LD140 (e.g. Hyperterminal). Commands will be send after confirmation by ENTER key (carriage return).

Answers are structured as follows:

ADCMND:SXXXXXXXXCK
where:
AD: device address
CMND: command
XXXXXXX: value
CHKS: checksum

The checksum is equal to the least significant byte of the summing the hex values of all characters transmitted.

Example:
The displayed position is 8,29. The position of device with address 01 is read by means of the │01TPOS command.
The answer is: 01TPOS:+000008299**F**
The sum of hex values of all characters is the following:
30+31+54+50+4F+53+3A+2B+30+30+30+30+30+38+32+39 = 39F
The least significant byte of 39F is **9F** which is the checksum.

7.2.1 Command list
(below the device address is indicated with **AD**)

Zeroing of device address
|**00**RSET
Address of all connected devices is set to zero (0).

Device address [1, 31]
|**00**INIT=X
Sets address of all connected devices to value X.

Display device address
|**00**DADR
Displays device address until **P** key is pushed.

Change device address [1, 31]
|**AD**RADR=X
Changes actual device address AD to X.
Answer : ADTADR:+XCHKS (CHKS is checksum and X is value).

Read actual position
|**AD**TPOS
Reads actual position of device **AD** (resolution of value is 0,01mm or 0,001 inch depending on settings).

Change counting direction [0, 1]
|**AD**RDIR=X
Sets counting direction.
X=0 → uP = standard direction
X=1→ dn = inverted direction
Answer: ADTDIR:+0000000XCHKS

Read counting direction
|**AD**TDIR
Reads the actual counting direction.
X=0→uP , X=1→dn
Answer: ADTDIR:+0000000XCHKS

Measurement unit [0, 5]
|**AD**RUNI=X
Sets the measurement unit and display mode.
X=0→ dEC = decimal mode
X=1→ FrEE = display with conversion factor
X=2→ dG1 = angular (-∞..-0,1°..0,0°..+0,1°..+∞)
X=3→ dG2 = angular (..359,9°..0,0°..359,9°..0,0°..)
X=4→ IdEc = decimal inch display mode
X=5→ Ifrct = fractional (es. 12.31.64 = 12" $^{31}/_{64}$)
Answer: ADTUNI:+0000000XCHKS

Read measurement unit
|**AD**TUNI
Reads the status of measurement unit.
Answer: ADTUNI:+0000000XCHKS

Resolution [1, 5, 10, 50, 100, 500, 1000]
|**AD**RRES=X
Sets linear resolution in mm or *inch*.
X=1→ 0.001/*0.0001*, X=5→ 0.005/*0.0005*,
X=10→ 0.01/*0.001*, X=50→ 0.05/*0.005*,
X=100→ 0.1/*0.01*, X=500→ 0.5/*0.05*,
X=1000→ 1/*0.1*
Answer: ADTRES:+XCHKS

Read resolution
|**AD**TRES
Reads value of actual resolution (see values above).
Answer: ADTRES:+XCHKS

Free conversion factor COn
[with FrEE 0,00001 - 1,00000 / with dG1, dG2 0,00001 - 9,99999]
|**AD**RFRE=X
Sets free conversion factor COn (see chapter 6.3.1).
Answer: ADTFCO:+XCHKS

Read COn conversion factor
|**AD**TFCO
Reads value of actual COn factor.
Answer: ADTFCO:+00X.XXXXCHKS

Display mm/inch display mode [0, 1]
|**AD**RMMI=X
Changes display mode from mm to inch.
X=0→ mm, X=1→inch
Answer: ADTMMI:+0000000XCHKS

Read mm/inch display mode
|**AD**TMMI
Reads status of mm/inch display mode.
X=0→ mm, X=1→ inch
Answer: ADTMMI:+0000000XCHKS

Incremental measurement function [0, 1]
|**AD**RRLA=X
Enables incremental measurement function (key combination **P** and **✱**).
X=0→ oFF , X=1→ on
Answer: ADTRAE:+0000000XCHKS

Read incremental measurement
|**AD**TRAE
Reads status of incremental measurement function.
X=0→ oFF, X=1→ on
Answer: ADTRAE:+0000000XCHKS

Incremental measurement [0, 1]
|**AD**RRLA=X
Sets from absolute display mode to incremental (relative).
X=0→ oFF, X=1→ on
Answer: ADTRAE:+0000000XCHKS

Read incremental measurement
|**AD**TRLA
Reads status of absolute/incremental display mode.
X=0→ oFF, X=1→ on
Answer: ADTRLA:+0000000XCHKS

Datum function [0, 1]
|**AD**RRSE=X
Enables Datum function (by pushing **✱** key).
X=0→ oFF, X=1→ on
Answer: ADTRSE:+0000000XCHKS

Read Datum function
|**AD**TRSE
Reads status of Datum function.
X=0→ oFF, X=1→ on
Answer: ADTRSE:+0000000XCHKS

Datum value modification [0, 1]
|**AD**RRFE=X
Enables Datum value modification (by key combination **P** and **↑**).
X=0→ oFF, X=1→ on
Answer: ADTRFE:+0000000XCHKS

Read Datum value modification
|**AD**TRFE
Reads status of Datum value modification.
X=0→ oFF, X=1→ on
Answer: ADTRFE:+0000000XCHKS

Offset function [0, 1]
|**AD**ROFE=X
Enables Offset function (by key combination **P** and **←**)
X=0→ oFF, X=1→ on
Answer: ADTOFE:+0000000XCHKS

Read Offset function
|**AD**TOFE
Reads status of Offset function.
X=0→ oFF, X=1→ on
Answer: ADTOFE:+0000000XCHKS

Datum value [-999999, 999999]
|**AD**RREF=X
Absolute Reference value for the measurement system. (the value has resolution 0,01mm or 0,001 inch depending on the display settings).
Answer: ADRREF:XCHKS

Read Datum value
|**AD**TREF
Reads actual Datum value.
Answer: ADTREF:XCHKS

Offset1 value [-999999, 999999]
|**AD**ROF1=X
Sets Offset1 (OFS1) value (the value has resolution 0,01).
Answer: ADROF1:XCHKS

Read Offset1 value
|**AD**TOF1
Reads actual Offset1 value.
Answer: ADTOF1:XCHKS

Offset2 value [-999999, 999999]

|**AD**ROF2=X

Sets Offset2 (OFS2) value (the value has resolution 0,01).

Answer: ADROF2:XCHKS

Read Offset2 value

|**AD**TOF2

Reads actual Offset2 value.

Answer: ADTOF2:XCHKS

Offset3 value [-999999, 999999]

|**AD**ROF3=X

Sets Offset3 (OFS3) value (the value has resolution 0,01).

Answer: ADROF3:XCHKS

Read Offset3 value

|**AD**TOF3

Reads actual Offset3 value.

Answer: ADTOF3:XCHKS

8 – Cut-out

8.1 LD140 and LD142

Provide a 94 x 68 mm (w x h) cut-out.

8.2 LD141

Check details on product catalogue.

Rev.	Man.Vers.	Description
0	1.0	1ˆ issue
	4.1	SW + Manual update
3	4.2	Chap.5 correction
4	4.3	Reset function correction (chap. 6.2.1)

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