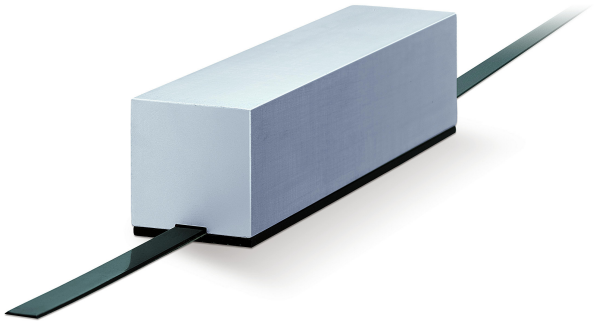
User manual

SMAL-I4-...
(RS485)

Description

This manual describes the products of SMAL series.
The purpose of this system is to measure linear displacements on lift system and on automation systems. The device is composed by a sensor with an integrated conversion electronic that moving along the magnetic tape, generates a signal equivalent to an absolute encoder.
The sensor has to be matched with MTAL magnetic tape.



Chapters

1 - Safety summary

Safety

- observe the professional safety and accident prevention regulations applicable to your country during device installation and operation;
- installation has to be carried out by qualified personnel only, without power supply and stationary mechanics parts;
- the device must be used only for the purpose appropriate to its design;
- high current, voltage and rotating parts can cause serious or fatal injury.

Electrical safety

- switch OFF the voltage before connecting the device;
- connect according to instructions of "Electrical connections";
- according to the 89/336/CEE norm on electromagnetic compatibility, following precautions must be taken:

  - before handling and installing, discharge electrical charge from your body and tools which may come in touch with the device;
  - power supply must be stable without noise, install EMC filters on device power supply if needed;
  - always use shielded and twisted cables if possible;
  - avoid cables runs longer than necessary;
  - avoid running the signal cable near high voltage power cables;
  - mount the device as far as possible from any capacitive or inductive noise source, shield the device from noise source if needed;
  - minimize noise by connecting shield or connector housing to ground (GND). Make sure that ground (GND) is not affected by noise. The shield connection point to ground can be situated both on the device side and on user's side. The best solution to minimize the interference must be carried out by the user.

Mechanical safety

- install according to the section "Mounting instructions" with stationary mechanics parts;
- do not disassemble the device;
- do not tool the device;
- do not subject the device to knocks or shocks;
- protect the system against solvents and substances damaging it;
- respect the environmental characteristics of the product;
- be sure that the system is mounted where hard or sharp objects (e.g. metal chips) do not come into contact with the magnetic tape and the bottom of the sensor head. If these conditions cannot be avoided provide a wiper or pressurized air.

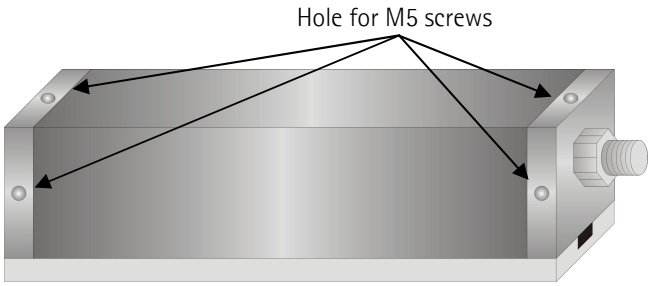
2 - Identification

The device can be identified by the label's data (ordering code, serial number). This information is listed in the delivery document. For technical features of the product, refer to the technical catalogue.

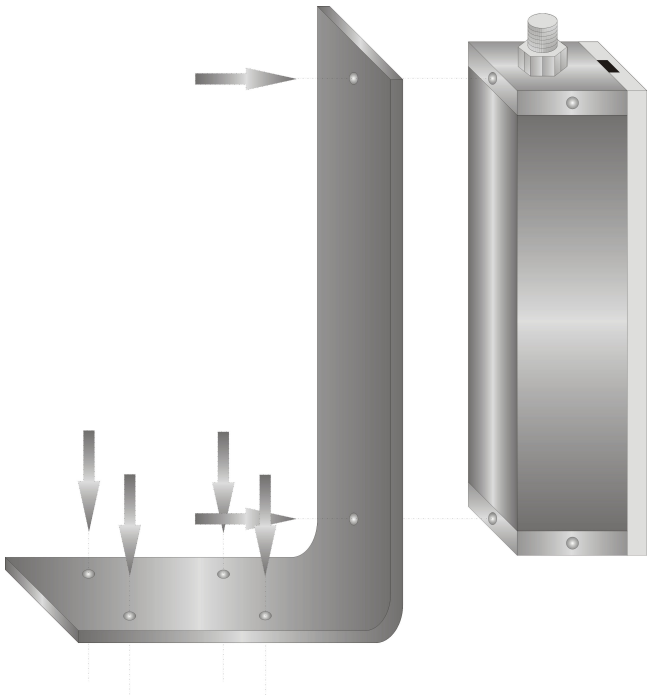
3 - Mounting instructions

3.1 Sensor mounting

Do not tool the device.



A - Fix the device to the square with M5 screws.
B - Connect the cable.
C - Put the square at the cabin roof adjusting the overhangs according to the desired working position and then fix it.

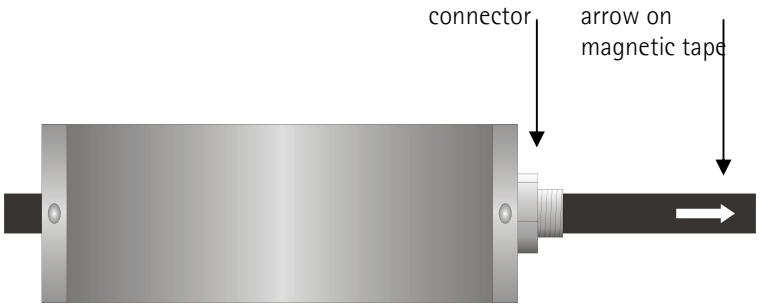


3.2 Magnetic tape

The magnetic tape must be insert on the device hole and fixed at the ends of the lift vane. The magnetic tape must be free to slide into device.

The active side of magnetic tape (black side), however installed, has to face the active part of magnetic sensor on electronic board

Install sensor and magnetic tape according to the above figure. The arrow shows positive counting direction.
The system doesn't work if mounted incorrectly.

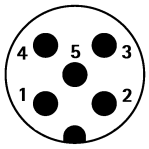


4 - Electrical connections

ATTENTION:
minimize noise by connecting shield or device body to ground (GND). Make sure that ground (GND) is not affected by noise. It's recommended to provide the ground connection as close as possible to the device.

M12	Colour	Description
1	Red	+10Vdc +30Vdc Supply voltage
2	Black	0 Vdc Supply voltage
3	Shield	Shield
4	White	A (RS485)
5	Blue	B (RS485)

M12 connector:
male, frontal side



4.1 LED indicator

Three LEDs show the status of the interface following the table below:

LED 1	LED 2	LED 3	Description
OFF	OFF	OFF	Power supply OFF
ON	OFF	OFF	Power supply ON, no error
ON	Blinking	Blinking	Flash memory error
ON	ON	Blinking	Parameter error

During device initialization an hardware test is made to check if LEDs work correctly.

4.3 Baud rate

The bit rate of RS485 is 115200 Kbits/s.

4.4 Node number

The node number can be set in software mode.
Permissible addresses lie between 0 and 99.
Default: Node-ID = 0

ATTENTION:
at first start up the node number of device has to be set through the Master. To avoid conflict between Slaves, this operation should be carried out with only one device connected to the network.

5 - RS485 interface

5.1 Technical data

Function	Data
Baud rate	115200 Kbits/s
Data bits	8
Parity bit	No
Stop bit	1
Flow control	No

5.2 Communication protocol

The communication protocol consists of messages with a fix length of 14 bytes. In every transmission a **Command** is sent by the PC, while the device answers with **Acknowledge** (except cyclic transmission).

5.2.1 Protocol structure

Byte	Field	Function
0	SOF	Start of Frame
1	ADD	Device address
2,3,4,5	CMD	Command
6	ACK	Acknowledge
7,8,9,10	DATA	Process data
11,12	CHK	Checksum
13	EOF	End of Frame

SOF Start of Frame
Start of message.
SOF = " | " (ASCII) = 7C (hex)

ADD Device address
Byte used to specify the device address. The value of ADD is hexadecimal.
eg. address 12: ADD = 0C (hex)

CMD Command
Byte used to specify the command (sent or received). CMD byte is ASCII coded (see. chap. 5.2.2 for possible values).

ACK Acknowledge
Acknowledge confirms correct transmission of data.
PC → SMAL: ACK = "Null" (00 Hex),
SMAL → PC: ACK = ":" (3A Hex)
Other values mean incorrect transmission:
SMAL → PC: ACK = "?" (3F Hex)

DATA Actual position and Process data
4 bytes used to transmit the actual position or parameter data/values to be set.
DATA byte content must be hexadecimal.
Bytes 7-10 are "signed integer 32 bits" with the following structure:

byte 7			...	byte 10		
MSBit			...			LSBit
2^31	...	2^24	...	2^7	...	2^0

CHK Checksum
2 bytes used to control the correct transmission of message. Value of CHK is the sum of bytes 0-10.
Bytes 11-12 are "unsigned integer 16 bits" with the following structure:

byte 11			byte 12		
MSBit					LSBit
2^15	...	2^8	2^7	...	2^0

Checksum overflow is ignored.

EOF End of Frame
End of message.
EOF = " ♦ " (ASCII) = 04 (hex)

5.2.2 Commands

Transmitted commands have the following meaning:

"T..." (transmit): means a command from PC to device to read a parameter value, the contents of DATA is negligible.
The device replies with the same CMD, ACK=":" and required value in the DATA field.

"R..." (receive): means a transmission from PC to device of a DATA value, the parameter value to transmit has to be set in the DATA field.
The device acquires the value and confirms sending the same CMD, ACK=":" and same DATA values.

Possible values of CMD are the following:

TPOS Transmit actual position [signed int 32bits]
Read the actual position from device. The device transmit the position in millimeters.

TREF Transmit Reference [signed int 32bits]
Read Reference value from device. The device transmit Reference in millimeters.

RREF Receive Reference [signed int 32bits]
Use this command to assign and set a value of Reference. Set the new value in millimeters in the DATA field.

TDIR Transmit measuring direction [bool]
Read actual measuring direction:
0 = increase position with standard direction
1 = increase position with inverted direction

RDIR Receive measuring direction [bool]
Enter the new measuring direction, set the new value in byte 10 of DATA field
0 = increase position with standard direction
1 = increase position with inverted direction

TADR Transmit device address [signed int 32bits]
Request for transmission of the address. This command is also seen by devices with different address from that shown in ADD.

ATTENTION: to avoid conflict between Slaves, this command should be carried out with only one device connected to the network.

RADR Receive device address [signed int 32bits]
Use this object to set a new address to the device.
The address must have a value between 0 and99.
The default address is 0.

ATTENTION: to avoid conflict between Slaves and to avoid to assign the same address to more Slaves, this command should be carried out with only one device connected to the network.

STAR Start cyclic mode [signed int 32bits]
This command enables the cyclic transmission of the actual position. Indicate in the DATA field the wait time between two successive transmissions.

"NULL" Cyclic transmissions of actual position [signed int 32bits]
This command is used only by the device to send the position during the cyclic mode. The position is transmitted in millimeters.

STOP Stop cyclic mode
Use this command to stop cyclic transmission of the position. The DATA field is negligible.

6 - Setup

The following page show examples of transmission between a Master and a Slave device.
In the examples we consider the slave address equal to "0".
All values are hexadecimal.

Set device address
(Previous address = 0, new address = 20 = 14h)

Master → SMAL CMD = RADR

SOF	ADD	CMD				ACK	DATA				CHK		EOF
7C	00	52	41	44	52	00	00	00	00	14	01	B9	04

SMAL → Master

SOF	ADD	CMD				ACK	DATA				CHK		EOF
7C	00	52	41	44	52	3A	00	00	00	14	02	07	04

Start cyclic mode (cycle time = 100 ms = 64h)

Master → SMAL CMD = STAR

SOF	ADD	CMD				ACK	DATA				CHK		EOF
7C	00	53	54	41	52	00	00	00	00	64	02	1A	04

SMAL → Master

SOF	ADD	CMD				ACK	DATA				CHK		EOF
7C	00	53	54	41	52	3A	00	00	00	64	02	54	04

Read actual position cyclically

SMAL → Master

SOF	ADD	CMD				ACK	DATA				CHK		EOF
7C	00	00	00	00	00	3A	00	00	03	E8	01	A1	04

Position = 00 00 03 E8 h = 1000mm

Stop cyclic mode

Master → SMAL CMD = STOP

SOF	ADD	CMD				ACK	DATA				CHK		EOF
7C	00	53	54	4F	50	00	00	00	00	00	01	C2	04

SMAL → Master

SOF	ADD	CMD				ACK	DATA				CHK		EOF
7C	00	53	54	4F	50	3A	00	00	00	00	01	FC	04

Man.Vers.	Description
1.0	1st issue
1.1	General revision
1.2	General revision
1.3	Revision chap.4

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