Installation Manual

E24R Digital SDi-12 Encoder

For models E24R-150 and E24R-155

SDI-12 Version: 1.4

Issue: 01 Ref:

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Description:

The E24R-150 series Rotary Encoder has been developed for applications that use traditional encoders but with additional functionality to be used with data logger and telemetry systems that require connected sensors to connect with digital signals. The E24R-150 in particular has embedded electronics and a microprocessor which enables communications via the SDI-12 protocol.

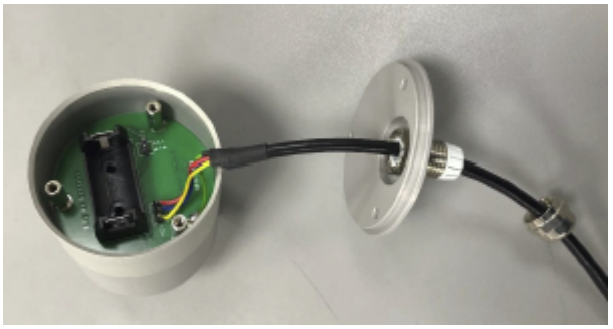
In addition to the digital communications the E24R-150 has an internal battery backup in case of power shortages on site, the encoder will remember its position without the need of resetting the position of the encoder.

This manual will give you instructions to install and replace the battery, a complete list of SDI-12 commands and the wiring instructions.

Installation:

1. Fit Encoder (24R-150 or 24R-155) to your desired mounting bracket to give better control of the following actions.

2. Remove the back cover of the Encoder by unscrewing the three screws on the back cover (ensure cable gland is loose to allow the cable to be pushed/pulled through the gland). *NOTE: DO NOT APPLY EXCESSIVE FORCE OR PULL ON THE CABLE FROM THE ENCODER!*



3. Fit your selected Pulley to the Encoder shaft (400mm circumference is standard, others available on the datasheet).

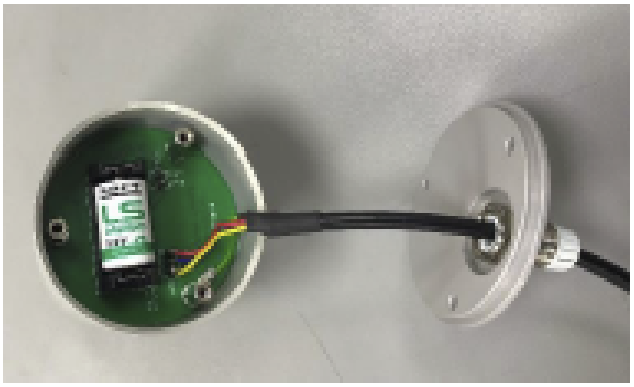
4. Hang the selected float and counterweight assembly over the pulley and allow it to settle gently on the water surface.

5. Connect the cable wires to your data logger or outstation and apply the power (7-16V dc, Current Consumption Typical 1.1mA @ 12V dc).

Wiring:

Cable Wire Colour	Function
Yellow	Output SDi-12
Red	+ve supply
Blue	0V supply
Screen	Encoder Body

6. Fit the supplied battery (Recommended Type LS14250, details shown below) and the battery retaining clip back in place.



7. Check the E24R Encoder communicates with the rest of the SDI-12 system its connected to with the commands, default settings shown below and a comprehensive list of commands is in the annex:

Default Settings:

Command / Settings	Default Setting
Encoder Address:	**0**
Pulse Counts per revolution:	E24R-150: **200**
	E24R-155: **100**
Pulley Circumference:	**400**
Rotational Direction:	**1** (Clockwise)
Measurement Units:	**0** (meters)

8. Fit the back cover to the encoder once you have completed some simple commands and know the device is working. You can tighten up the screws on the back cover and then ensure you tighten the cable gland up sufficiently so there is no movement on the cable in the gland.

9. Setup the E24R Encoder to the site specific details for complete accuracy and functionality, refer to the full commands list in the Annex.

10. Lastly, ensure the logger or interface is set to take readings at the required interval time.

Battery Specification:

Primary lithium battery
LS 14250

3.6 V Primary lithium-thionyl chloride (Li-$SOCl_2$)
High energy density
½ AA-size bobbin cell

Cell size references	½ R6 – ½ AA

Electrical characteristics

(typical values relative to cells stored for one year or less at +30°C max.) Nominal capacity *(at 1 mA +20°C 2.0 V cut-off. The capacity restored by the cell varies according to current drain, temperature and cut-off)*		1.20 Ah
Open circuit voltage	(at +20°C)	3.67 V
Nominal voltage	(at 0.1 mA +20°C)	3.6 V
Nominal energy		4.32 Wh
Pulse capability: Typically up to 100 mA *(100 mA/0.1 second pulses, drained every 2 mn at +20°C from undischarged cells with 10 µA base current, yield voltage readings above 3.0 V. The readings may vary according to the pulse characteristics, the temperature, and the cell's previous history. Fitting the cell with a capacitor may be recommended in severe conditions. Consult Saft)*		
Maximum recommended continuous current *(Higher currents are possible, consult Saft)*		35 mA
Storage	(recommended) (for more severe conditions, consult Saft)	+30°C (+86°F) max
Operating temperature range *(Operation above ambient T may lead to reduced capacity and lower voltage readings at the beginning of pulses. Consult Saft)*		-60°C/+85°C (-76°F/+185°F)

Physical characteristics

Diameter (max)		14.55 mm (0.57 in)
Height (max)		25.15 mm (0.99 in)
Typical weight		8.9 g (0.3 oz)
Li metal content		approx. 0.3 g
Available termination suffix		
	CN, CNR	radial tabs
	2 PF, 3 PF, 3 PF RP, 4 PF	radial pins
	CNA (AX)	axial leads
	FL	flying leads...*etc.*

Standard SDI-12 Commands:

Acknowledge Active This command is used to check the presence of the sensor on the bus.	
Command:	a!
Response:	a<CR><LF>
Where:	
! =	Acknowledge Active command
a =	Sensor address

Address Query This command is used to check the address of the sensor on the bus.	
Command:	?!
Response:	a<CR><LF>
Where:	
?! =	Address query command
a =	Sensor address
Note: If there are multiple sensors on the bus there will be a bus contention and data returned will be invalid	

Change Address This command is used to change the address of the sensor on the bus.	
Command:	aAb!
Response:	a<CR><LF>
Where:	
A! =	Change address command
a =	Sensor address
b =	New sensor address

Continued…

Send Identification This command is used to query the identity of the sensor.	
Command:	aI!
Response:	a11cccccccmmmmmmvvvxxxxxx<CR><LF>
Where:	
I! =	Identification command
a =	Sensor address
11 =	Compliant SDI-12 version
cccccccc =	StorkSol (manufacturer ref)
mmmmmm =	Model number of sensor
vvv =	Sensor version
xxxxxx =	Serial Number

Start Measurement This command is used to tell the sensor to take a measurement.	
Command:	aM!
Response:	atttn<CR><LF>
Where:	
a =	Sensor address
M! =	Measurement command
MC! =	Measurement command with CRC enabled
ttt =	Number of seconds until the sensor will have the measurement ready
n =	Number of measurements the sensor will make available
Note: 1) A service request ‘a<CR><LF>’ must be sent by the sensor if the reading is available before the time specified by ttt otherwise the data recorder must wait time ttt before issuing a D0 command. 2) Additional Measurement Commands aM1! ….aM9! are not implemented and will return a0000<CR><LF>	

Continued…

Start a Concurrent Measurement This command is to tell the sensor to take a concurrent measurement	
Command:	aC!
Response:	atttnn<CR><LF>
Where:	
a =	Sensor address
C! =	Concurrent measurement command
CC! =	Concurrent measurement with CRC enabled
ttt =	Number of seconds until the encoder will have the measurement
nn =	Number of measurements to encoder will make available
Note: 1) A service request 'a<CR><LF>' must be sent by the sensor if the reading is available before the time specified by ttt otherwise the data recorder must wait time ttt before issuing a D0 command. 2) Additional Measurement Commands aM1! ….aM9! are not implemented and will return a0000<CR><LF>	

Send Data This command is used to obtain measurement data from the sensor and issued after the M and C commands.	
Command:	aD0!
Response:	a<value><CR><LF> a<value><CRC><CR><LF> (with CRC)
Where:	
a =	Sensor address
D0! =	Send data command
<value> =	The sensor measurement in the selected units
<CRC> =	CRC Value
nn =	Number of measurements to encoder will make available
Note: 1) Measurement value will be a maximum of 9 digits inclusive of both sign and decimal point. 2) The returned measurement value will be in the selected units configured using the extended command aXU. 3) Additional Send Data Commands aD1! ….aD9! are not implemented and will return a0000<CR><LF>	

Continuous Measurement This command is used to obtain measurement data from the sensor that is continuously measuring. The use of the M command is not required as measurement can be directly read.	
Command:	aR0! aRC0! (with CRC response)
Response:	a<value><CR><LF> a<value><CRC><CR><LF> (with CRC)
Where:	
a =	Sensor address
R0! =	Continuous measurement command
RC0! =	Continuous measurement command with CRC
<value> =	The sensor measurement in the selected units
<CRC> =	CRC Value
Note: 1) Measurement value will be a maximum of 9 digits inclusive of both sign and decimal point. 2) The returned measurement value will be in the selected units configured using the extended command aXU. 3) Additional Send Data Commands aR1! ….aR9! are not implemented and will return a<CR><LF>	

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Extended SDI-12 Commands:

Set/Read Serial Number This command is used to set/read the sensor serial number.	
Read command:	aXSN!
Response:	a<serial number><CR><LF>
Set command:	aXSN<serial number>!
Response:	aXSN<serial number><CR><LF>
Where:	
a =	Sensor address
XSN! =	Serial number set/read command
serial number =	6 digit unique identifier (default: 000000)

Set/Read Pulse counts per revolution This command is used to set/read the sensor pulse count per revolution.	
Read command:	aXPC!
Response:	a<pulse count><CR><LF>
Set command:	aXPC<pulse count>!
Response:	aXPC<pulse count><CR><LF>
Where:	
a =	Sensor address
XPC! =	Pulse count set/read command
pulse count =	3 digit value (default: 200 count per revolution)

Continued…

Set/Read Pulley Circumference This command is used to set/read the pulley diameter fixed to the sensor.	
Read command:	aXCP!
Response:	a<pulley circumference><CR><LF>
Set command:	aXCP<pulley circumference>!
Response:	aXCP<pulley circumference><CR><LF>
Where:	
a =	Sensor address
XCP! =	Pulley circumference set/read command
pulley circumference =	4 digit value in mm (default: 400)

Set/Read Pulley Rotational Direction This command is used to set/read the sensor rotational direction.	
Read command:	aXRD!
Response:	a<rotational direction><CR><LF>
Set command:	aXRD<rotational direction>!
Response:	aXRD<rotational direction><CR><LF>
Where:	
a =	Sensor address
XRD! =	Rotational Direction Set/Read command
rotational direction =	1 = CW for increasing level, 0 = ACW for decreasing level, (default value = 1)

Continued…

Set/Read Measurement Units This command is used to set/read the sensor measurement units.	
Read command:	aXMU!
Response:	a<measurement units><CR><LF>
Set command:	aXMU<measurement units>!
Response:	aXMU<measurement units><CR><LF>
Where:	
a =	Sensor address
XMU! =	Measurement units set/read command
measurement units =	0 = m, 1 = mm, 2 = inches, 3 = feet (default: 0)

Set to Zero This command is used to set the current measurement to zero.	
Set command:	aXZE!
Response:	aXZE<CR><LF>
Where:	
a =	Sensor address
XZE! =	Set Zero Command

Continued…

Set Current Value This command is used to set the current measurement to value entered.	
Read command:	aXCV!
Response:	aXCV<current value><CR><LF>
Set command:	aXCV<current value>!
Response:	aXCV<current value><CR><LF>
Where:	
a =	Sensor address
XCV! =	Current value command
current value =	9 digit value in configured measurement units (default: 0)

Read Firmware Version This command is used to read the sensor firmware version.	
Read command:	aXFV!
Response:	aXFV<firmware version><CR><LF>
Where:	
a =	Sensor address
XFV! =	Read firmware version command
firmware version =	6 digit number in the format xx.xxx

If you are ever unsure, please get in touch!