# ECTDS10 Isolated Conductivity Transmitter (SDI-12 Interface) User Manual



- 1 -



## Index

1	Customer Support
2	Introduction
3	Wiring diagrams
	3.1 SDI-12 Interface
4	Dimension and Ordering Infomation
	4.1 Dimension64.2 Ordering Information7
5	Safety ,Care and Installation
	5.1 Installation   8     5.2 Maintenance   8
6	SDI-12 Communication
	6.1 SDI-12 Interface and Protocol   13     6.1.1 SDI-12 Interface   13     6.1.2 Protocol   13
7	Calibration
	7.1 Calibrated by electrode constant K
Ap	pendix A SDI-12 Sensor Testing and Settings
	A.1 Testing SDI-12 Sensors with SDI12ELF20 Converter
Co	pyright and Trademark
Ve	rsion Control



## **1** Customer Support

Thank you very much for your order. Our success comes from the continuous faith in the excellence of our products and services, something we are committed to and would never sacrifice. Our customer service, especially in the after sales phase, guarantees the satisfaction of our clients. In line with this strategy, we appreciate that you can share with us your feedback at any time for our improvement, be it positive or negative, so if we can serve you better in anyway, please do inform us.

### Website

http://www.infwin.com

### **E-Mail**

infwin@163.com

### Telephone

+86-411-66831953, +86-4000-511-521

### Fax

+86-411-66831953



## 2 Introduction

ECTDS10 isolated measures Conductivity, Salinity, TDS with temperature compensation. It is applicable for industrial, water processing, sewerage system, irrigation, smart agriculture etc.

The SDI-12 output provides universal compatibility with any SDI-12-enabled data logger and low power applications.

#### **Features:**

- Conductivity, Salinity and TDS measurement with temperature compensation
- Isolated Sensor Input
- Optional ABS or Stainless steel electrode
- SDI-12 Output Interface with low power design
- High accuracy with excellent stability
- Reverse power protection and Built-in TVS/ESD protection

Specifications			
Output Interface Optional: SDI-12, V1.3			
Power Supply	4.5-28V/DC		
Power Consumption	Quiescent Current : <10uA		
	Measuring Current : <20mA @ 12V DC		
Conductivity	Range: 20000us/cm (20ms/ccm)		
Measurement	Resolution: 1us/cm (0.001ms/cm)		
	Accuracy (calibrated by standard solution): 100us/cm±3% (Range: 0-10000us/cm);		
	±5%(Range: 10000-20000us/cm)		
EC temperature	0-50°C		
compensation			
Temperature	Range: -40~80°C, Resolution: 0.1°C, Accuracy: +/-0.5°C		
Measurement			
IP Ratings	Electrode: IP68; Transmitter: IP65		
Operating	Temperature: -40~80°C, Humidity: 0-100%		
Cable Length	Power and Signal Cable: 2 meters or Customize		
Dimension	Electrode: 1/2"NPT screw threads, Refer to dimension diagram.		
	Transmitter: 140mm*65mm*50mm (L*W*H)		



## **3** Wiring diagrams

## 3.1 SDI-12 Interface





## **4** Dimension and Ordering Infomation

### 4.1 Dimension





- 6 -



## 4.2 Ordering Information

Parameters	Code	Comments	
Code 1:	ECTDS10	ECTDS10 conductivity transmitter	
Product Series			
Code 2:	А	Conductivity, Salinity and TDS	
Measuring			
Parameters			
Code 3:	А	Platinum black electrode (K=1.0, ABS plastic housing, built-in NTC	
Electrode Selection		10K/3950 temperature sensor, cable length 5 meters)	
	В	Platinum black electrode (K=1.0, ABS plastic & Stainless steel housing,	
		built-in NTC 10K/3950 temperature sensor, cable length 10 meters)	
	С	Customize	
	D	Transmitter Only (No electrode)	
Code 4:	А	0-20000us/cm (20ms/cm)	
EC Range	Е	Customize	
Code 5:	С	4.5-28V DC	
Power Supply			
Code 6: F		SDI-12	
Output Interface			
Code 7:	002	Power and Signal Cable: 2 meters	
Cable Length	XXX	Power and Signal Cable: xxx meters	
Ordering Code Example: ECTDS10 ADACE002			

Ordering Code Example: ECTDS10- ABACF002

ECTDS10: Conductivity transmitter;

A: Conductivity, Salinity and TDS

B: Platinum black electrode (K=1.0, ABS plastic & Stainless steel housing, built-in NTC 10K/3950 temperature sensor, cable length 10 meters)

A: 0-20000us/cm (20ms/cm)

C: Power Supply 4.5-28V DC

F: Output Interface SDI-12

002: Electrode Cable:10 meters, Power and Signal Cable:2 meters

## 5 Safety ,Care and Installation

## 5.1 Installation

(1) Install the sensor so that the electrodes are completely immersed in the process liquid.

(2) Avoid installing the sensor in places where air bubbles are likely to get trapped or sedi ment is likely to accumulate on the electrodes.

(3) Generally, mounting the sensor in a vertical pipe run is best. If the sensor must be installed in a horizontal pipe, place the sensor in the 3 o'clock position.

(4) Keep at least 1.0 in. (25 mm) clearance between the end of the sensor and the opposite pipe wall.

(5) To keep response time as fast as possible, do not install the sensor in dead legs or areas where circulation is poor.

## 5.2 Maintenance

The accuracy of conductivity measurements and the working life of the cell will be severely compromised if the conductivity cell is not used and maintained correctly. The working life of a conductivity cell can be several years if correct care and maintenance is employed. The following guidelines are general recommendations only the cell manufacturer's instructions on care and maintenance should always be followed.

(1) Visually inspect the cell's electrodes and electrode housing on a regular basis and instigate cleaning if required.

(2) Mechanical cleaning should be avoided as scratching of the electrodes' surfaces may result.

(3) Oil and salt deposits may be removed by soaking in a mild non-ionic detergent, followed by repeated rinsing with purified water to remove all traces of the detergent.

(4) In extreme cases, deposits may be removed by soaking in a mild acid solution, followed by repeated rinsing with purified water to remove all traces of the acid.

(5) Platinum electrodes are coated in platinum black and they require regular re-platinizing to maintain the integrity of the platinum black coating. This should be done in accordance with the cell manufacturer's instructions.

(6) Cleaning may alter the cell constant and so calibration must be performed after any cleaning process.

(7) Cells can be stored in purified water for short-term storage; for long-term storage, they can be stored dry. Some cells may require re-conditioning after long-term storage by soaking in purified water for one hour before being used for measurements.

## 6 SDI-12 Communication

The sensor has SDI-12 interface and protocol. The description and terms used within this chapter are listed in table below:

Parameters	Unit	Description
±	-	Sign of the value
a	-	SDI-12 address
n	-	Number of measurements (fixed width of 1)
nn	-	Number of measurements with leading zero if necessary
		(fixed width of 2)
ttt	Seconds	Maximum measurement time (fixed width of 3)
tttt	Seconds	Maximum measurement time (fixed width of 4)
<tab></tab>	-	Tab character
<sapce></sapce>	-	Space character
<cr></cr>	-	Carriage return character
<lf></lf>	-	Line feed character
<checksum></checksum>	-	SUM Checksum
<crc_adi></crc_adi>		ADI protocol CRC Checksum
<crc></crc>	-	SDI-12 protocol CRC Checksum
<verify_status></verify_status>	-	Sensor Verification status
<==Temperature>	°C	Temperature Original, the value is output according to the
	°F	temperature unit setting. The value depends on the settings
		of <temperaturesensorselection>.</temperaturesensorselection>
<=TemperatureCalibed>	°C	Temperature Calibed, the value is output according to the
	°F	temperature unit setting. The value depends on the settings
		of <temperaturesensorselection>.</temperaturesensorselection>
<±TOffset>	°C	Temperature Offset, the value is output according to the
	°F	temperature unit setting.
		<±TemperatureCalibed> = <±Temperature> + <±TOffset>
<temperatureunit></temperatureunit>	-	Temperature Unit, Rnage:
-		C: ℃
		F: °F
<+ConductivityT25>	us/cm	Conductivity Value (Temperature Compensated)
	ms/cm	
<+ConductivityTx>	us/cm	Conductivity Value (Non Temperature Compensated)
	ms/cm	
<ecunit></ecunit>	-	Conductivity, Salinity, TDS Unit, Range:
		0: us/om mg/L (default)
		1. ms/cm, a/
		1: IIIS/CIR, g/L
<+Salinity>	mg/L	Salinity Value, The unit of this value is up to <ecuni< td=""></ecuni<>



#### http://www.infwin.com

	mg/L	t>
<+TDS>	mg/L	TDS Value, The unit of this value is up to <ecunit></ecunit>
	mg/L	
<+WarmUpTime>	Seconds	Warm Up Time, The sensor measurement circuit will be
		powered on for a period of time specified by
		<+WarmUpTime> upon receiving the measurement
		command, then make a measurement.
		Range:1-60 ( Seconds )
		Default:2 ( Seconds )
<ledenable></ledenable>	-	LED indicator on PCB, Range:
		0: Disabled, the indicator light will be off regardless of
		whether the transmitter is working or not.
		1: Enabled, the indicator will be off during sleep and on to
		indicate that the transmitter is working.
<±TManual>	°C	Manual input temperature, When < TemperatureSensorSel
	٩F	$ection \ge 1$ , This value is output as temperature value.
		Default : 25.00
<temperaturesensorselection></temperaturesensorselection>	-	Temperature Sensor Selection Range:
		0: External Temperature Sensor (NTC 10K 3950) -40
		if unconnected.
		1. Manual input temperature defined by <+TManual>:
		2: Onboard Temperature Sensor:
	%	
<conductivitytempcompcoe< td=""><td>/0</td><td>Conductivity temperature compensation coefficient</td></conductivitytempcompcoe<>	/0	Conductivity temperature compensation coefficient
f>		Range : 0.000~10.000(0.000%-10.000%)
		Default : 2.000(2.000%)
<salinitycoef></salinitycoef>	-	Salinity coefficient
		Range : 0.000~1.000
		Default : 0.550
<tdscoef></tdscoef>	-	TDS coefficient
		Range : 0.000~1.000
		Default : 0.500
<eccalibmethod></eccalibmethod>	-	EC Calibration Method :
		0: Calibrated by electrode constant K
		1: Calibrated by conductivity standard solution
<electrodeconstant></electrodeconstant>	-	Electrode Cell Constant

- 11 -



		Range : 0.500~1.500
		Default : 1.000
<+ECRawADT25>	-	Raw AD of Conductivity(with temperature compensatio n)
<+ECRawADTx>	-	Raw AD of Conductivity(without temperature compens ation)

The following error value will be responded as measurement value when there is error:

Error Value	Description
-9999	Sensor Broken
-9996	Not supported value (Invalid Value)



## 6.1 SDI-12 Interface and Protocol

### 6.1.1 SDI-12 Interface

Please refer to SDI-12 standard user manual V1.3.

### 6.1.2 Protocol

Request	Response	Comment
a!	a <cr><lf></lf></cr>	Acknowledge Active
		a: Sensor address
		Example:
		Request: 0!
		Response: 0 <cr><lf></lf></cr>
aI!	allecccccccmmmmmmvvvxxxxxxxx	Send Identification
	xxxx <cr><lf></lf></cr>	a: Sensor address
		ll: SDI-12 Version Number
		ccccccc: 8 characters' vendor identification
		mmmmmm: 6 characters specifying the sensor model
		number
		vvv: 3 characters specifying the sensor version
		xxxxxxxxxxxx 13 characters' serial number
		<cr><lf>: terminates the response</lf></cr>
		Example:
		Request: 0I!
		Response: 013INFWIN PHORP
		8.1PHORP10-00012 <cr><lf></lf></cr>
?!	a <cr><lf></lf></cr>	Sensor Address Query
		a: Sensor address
		Example:
		Request: ?!
		Response: 0 <cr><lf></lf></cr>



aAb!	b <cr><lf></lf></cr>	Change Sensor address
		a: Current Sensor address
		b: New Sensor address
		Example:
		Request: 0A1!
		Response: 1 <cr><lf></lf></cr>
aM!, aMC!	attt2 <cr><lf></lf></cr>	Conductivity Value (Temperature Compensated)
	a: Sensor address	and Temperature(Calibed) Measurement
	ttt: Measurement data will be ready in	
	ttt seconds, which equals to	Example:
	<+WarmUpTime>	Request: 0M!
	2: Number of measurement data	Response: 00022 <cr><lf></lf></cr>
	returned by aD0!	Response: 0 <cr><lf></lf></cr>
	<cr><lf>: terminates the response</lf></cr>	Request: 0D0!
		Response: 0+1586+26.36 <cr><lf></lf></cr>
	aD0! Response data format:	
	a<+ConductivityT25><±Temperature	Note: The value unit of EC, Salinity and TDS is up to
	Calibed>[ <crc>]<cr><lf></lf></cr></crc>	<ecunit> settings.</ecunit>
aM1!, aMC1!	attt4 <cr><lf></lf></cr>	Conductivity Value (Non Temperature
	a: Sensor address	Compensated), Conductivity Value (Temperature
	ttt: Measurement data will be ready in	Compensated), Temperature Original,
	ttt seconds, which equals to	Temperature(Calibed) Measurement
	<+WarmUpTime>	
	4: Number of measurement data	Example:
	returned by aD0!	Request: 0M1!
	<cr><lf>: terminates the response</lf></cr>	Response: 00024 <cr><lf></lf></cr>
		Response: 0 <cr><lf></lf></cr>
	aD0! Response data format:	Request: 0D0!
	a<+ConductivityTx><+ConductivityT	Response: 0+1638+1607+25.97+25.97 <cr><lf></lf></cr>
	25><±Temperature><±TemperatureCa	Note: The value unit of EC. Solinity and TDS is up to
	IIDeu>[ <ckc>]<ck><lf></lf></ck></ckc>	CUnit> settings.
aM2!,aMC2!	attt4 <cr><lf></lf></cr>	Conductivity Value (Temperature Compensated).
	a: Sensor address	Temperature(Calibed), Salinity Value, TDS Value
	ttt: Measurement data will be ready in	Measurement
	ttt seconds, which equals to	

- 14 -

INFWIN <sup>Unleash</sup> Your Imagination		http://www.infwin.com
	<+WarmUpTime>	Example:
	3: Number of measurement data	Request: 0M2!
	returned by aD0!	Response: 00024 <cr><lf></lf></cr>
	<cr><lf>: terminates the response</lf></cr>	Response: 0 <cr><lf></lf></cr>
		Request: 0D0!
	aD0! Response data format:	Response: 0+1607+25.92+883.00+803.00 <cr><lf></lf></cr>
	a<+ConductivityT25><±Temperature	
	Canbed><+Sannty><+TDS> [ <crc>]<cr><le></le></cr></crc>	Note: The value unit of EC, Salinity and TDS is up to
		<ecunit> settings.</ecunit>
aC!,aCC!	attt02 <cr><lf></lf></cr>	Conductivity Value (Temperature Compensated)
	a: Sensor address	and Temperature(Calibed) Measurement
	ttt: Measurement data will be ready in	
	ttt seconds, which equals to	Example:
	<+WarmUpTime>	Request: 0C!
	02: Number of measurement data	Response: 000202 <cr><lf></lf></cr>
	returned by aD0!	Request: 0D0!
	<cr><lf>: terminates the response</lf></cr>	Response: 0+1586+26.36 <cr><lf></lf></cr>
	aD0! Response data format:	<b>Note:</b> The value unit of EC, Salinity and TDS is up to
	a<+ConductivityT25><±Temperature	<ecunit> settings.</ecunit>
	Calibed>[ <crc>]<cr><lf></lf></cr></crc>	
aC1!,aCC1!	attt04 <cr><lf></lf></cr>	Conductivity Value (Non Temperature
	a: Sensor address	Compensated), Conductivity Value (Temperature
	ttt: Measurement data will be ready in	Compensated), Temperature Original,
	ttt seconds, which equals to	Temperature(Calibed) Measurement
	<+WarmUpTime>	
	04: Number of measurement data	Example:
	returned by aD0!	Request: 0C1!
	<cr><lf>: terminates the response</lf></cr>	Response: 000204 <cr><lf></lf></cr>
		Request: 0D0!
	aD0! Response data format:	Response: 0+1638+1607+25.97+25.97 <cr><lf></lf></cr>
	a<+ConductivityTx><+ConductivityT 25><+Temperature><+TemperatureCa	Note: The value unit of EC, Salinity and TDS is up to
	libed>[ <crc>]<cr><lf></lf></cr></crc>	<ecunit> settings.</ecunit>
aC2!,aCC2!	attt04 <cr><lf></lf></cr>	Conductivity Value (Temperature Compensated),
	a: Sensor address	Temperature(Calibed), Salinity Value, TDS Value
	ttt: Measurement data will be ready in	Measurement

- 15 -

Unleash,You	
Imagination	

	ttt seconds, which equals to	
	<+WarmUpTime>	Example:
	4: Number of measurement data	Request: 0C2!
	returned by aD0!	Response: 000204 <cr><lf></lf></cr>
	<cr><lf>: terminates the response</lf></cr>	Request: 0D0!
		Response: 0+1607+25.92+883.00+803.00 <cr><lf></lf></cr>
	aD0! Response data format:	
	a<+ConductivityT25><±Temperature	Note: The value unit of EC, Salinity and TDS is up to
	Calibed><+Salinity><+TDS>	<ecunit> settings.</ecunit>
	<pre>[<crc>]<cr><lf></lf></cr></crc></pre>	
a∨!	attt1 <cr><lf></lf></cr>	Sensor Verification Command
		Example:
	a: Sensor address	Request: 0V!
	ttt: Measurement data will be ready in	Response: 00011 <cr><lf></lf></cr>
	ttt seconds, which equals to	Response: 0 <cr><lf></lf></cr>
	<+WarmUpTime>	Request: 0D0!
	1:Number of measurement data	Response: 0+0 <cr><lf></lf></cr>
	<cr><lf>: terminates the response</lf></cr>	"+0" indicates sensor normal.
		"+1" indicates sensor error.
	aD0! Response data format:	
	a <verify_status><cr><lf></lf></cr></verify_status>	
aD0!	[ <svvvv><svvvv>][<crc< th=""><th>Send Data since the last aM, aMC, aC, aCC, aV</th></crc<></svvvv></svvvv>	Send Data since the last aM, aMC, aC, aCC, aV
aD1!	>] <cr><lf></lf></cr>	command, The data returned depends on the command
aD2!	[ <svvv>]: data value</svvv>	sent most recently.
	[ <crc>]: Optional 3 characters CRC</crc>	
	checksum,	
	<cr><lf>:terminates the response</lf></cr>	
aR0!,aRC0!	Response data format:	Conductivity Value (Temperature Compensated)
	a<+ConductivityT25><±Temperature	and Temperature(Calibed) Measurement
	Calibed>[ <crc>]<cr><lf></lf></cr></crc>	
		Example:
		Request: 0R0!
		Response: 0+1586+26.36 <cr><lf></lf></cr>
		Note: The value unit of EC, Salinity and TDS is up to
		<ecunit> settings.</ecunit>
aR1!,aRC1!	Response data format:	Conductivity Value (Non Temperature



	$a {<} + ConductivityTx {>} {<} + ConductivityT$	Compensated), Conductivity Value (Temperature
	25><±Temperature><±TemperatureCa	Compensated), Temperature Original,
	libed>[ <crc>]<cr><lf></lf></cr></crc>	Temperature(Calibed) Measurement
		Example:
		Request: 0R1!
		Response: 0+1638+1607+25.97+25.97 <cr><lf></lf></cr>
		Note: The value unit of EC, Salinity and TDS is up to
		<ecunit> settings.</ecunit>
aR2!,aRC2!	Response data format:	Conductivity Value (Temperature Compensated),
	a<+ConductivityT25><±Temperature	Temperature(Calibed), Salinity Value, TDS Value
	Calibed><+Salinity><+TDS> [ <crc>]<cr><lf></lf></cr></crc>	Measurement
		Fyample
		Request: 0R21
		Perpense: 0+1607+25.02+883.00+803.00-CP>-/ E>
		Response. 0+1007+23.92+665.00+605.00 <cr><li></li></cr>
		Note: The value unit of EC, Salinity and TDS is up to
		<ecunit> settings.</ecunit>
aR9!,aRC9!	Response data format:	Conductivity Value (Non Temperature
	a<+ConductivityTx><+ConductivityT	Compensated), Conductivity Value (Temperature
	25><±Temperature><±TemperatureCa	Compensated), Temperature Original,
	libed><+Salinity><+TDS><+ECRaw	Temperature(Calibed), Salinity Value, TDS Value,
	ADTx><+ECRawADT25>[ <crc>]&lt;</crc>	Raw AD of Conductivity(without temperature
		compensation).Raw AD of Conductivity(with
		temperature compensation)Measurement
		Example:
		Request: 0R9!
		Response: 0+25.32+25.32+1612.25+1602.00+881.00+
		801.00+1613.00+1602.00 <cr><lf></lf></cr>
		Note: The value unit of EC, Salinity and TDS is
		up to <ecunit> settings.</ecunit>
aXR_TUNIT!	aTUNIT= <temperatureunit></temperatureunit>	Query temperature unit
	<temperatureunit> is temperature</temperatureunit>	
	unit:	Example:

- 17 -



	C: degrees centigrade	Request: 0XR_TUNIT!
	F: degrees fahrenheit	Response: 0TUNIT=C <cr><lf></lf></cr>
aXW_TUNIT_	aTUNIT= <temperatureunit></temperatureunit>	Configure temperature unit
<temperatureu< td=""><td></td><td></td></temperatureu<>		
nit>!		Example:
		Request: 0XW_TUNIT_C!
		Response: 0TUNIT=C <cr><lf></lf></cr>
aXR_TOFFSE	aTOFFSET=<±TOffset>	Query temperature offset value
T!	<±TOffset>: temperature offset value	
	between -10.00~10.00, it will be	Example:
	effective when issuing a new	Request: 0XR_TOFFSET!
	measurement command. The	Response: 010FFSET=+1.00 <cr><lf></lf></cr>
	temperature display value equals to	
	added with the temperature offset	
	value	
aXW TOFFSF	aTOFESET-<+TOffset	Configure temperature offset value
T <+TOffset>!		Example:
1_(_1011560).		Request: 0XW TOFESET +1.00!
		Response: 0TOFFSET=+1.00 <cr><lf></lf></cr>
aXR_SN!	aSN= <sssssss></sssssss>	Query serial number
	<ssssssss> is 8-digits serial number</ssssssss>	Example:
		Request: 0XR_SN!
		Response: 0SN=12345678 <cr><lf></lf></cr>
aXW_SN_ <sss< td=""><td>aSN=<sssssss></sssssss></td><td>Configure serial number</td></sss<>	aSN= <sssssss></sssssss>	Configure serial number
sssss>!		Example:
		Request: 0XW_SN_ABCDEFGH!
		Response: 0SN=ABCDEFGH <cr><lf></lf></cr>
aXR_WUT!	aWUT=<+WarmUpTime> <cr><lf></lf></cr>	Query Warm Up Time
	<+WarmUpTime>: Warm Up Time,	Example:
	The sensor measurement circuit will	Request: 0XR_WUT!
	be powered on for a period of time	Response: 0w01=+10 <cr><lf></lf></cr>
	specified by <+WarmUpTime> upon	
	receiving the measurement command,	
	then make a measurement.	
	Range:1-60 (Seconds)	
aXW_WUT_<	aWUT=<+WarmUpTime> <cr><lf></lf></cr>	Configure Warm Up Time
+WarmUpTime		Example:
>!		Request: 0XW_WUT_10!
		Response: 0WUT=+10 <cr><lf></lf></cr>



aXR_LEDENA	aLEDENABLE= <ledenable><cr>&lt;</cr></ledenable>	Query Led Indicator Enable
BLE!	LF>	Example:
	<ledenable>: LED indicator on PCB,</ledenable>	Request: 0XR_LEDENABLE!
	Range:	Response: 0LEDENABLE=1 <cr><lf></lf></cr>
	0: Disabled, the indicator light will be	
	off regardless of whether the	
	transmitter is working or not.	
	1: Enabled, the indicator will be off	
	during sleep and on to indicate that the	
	transmitter is working.	
aXW_LEDEN	aLEDENABLE= <ledenable><cr>&lt;</cr></ledenable>	Configure Led Indicator Enable
ABLE_ <leden< td=""><td>LF&gt;</td><td>Example:</td></leden<>	LF>	Example:
able>!		Request: 0XW_LEDENABLE_1!
		Response: 0LEDENABLE=1 <cr><lf></lf></cr>
aXR_TMANU	aTMANUAL=<±TManual>	Query manual input temperature
AL!	<±TManual > : Manual input temper	Example:
	ature, When < TemperatureSensorSele	Request: 0XR_TMANUAL!
	ction>=1,This value is output as te	Reponse: 0TMANUAL=+25.00 <cr><lf></lf></cr>
	mperature value.	
aXW_TMANU	aTMANUAL=<±TManual>	Configure manual input temperature
AL_<±TManua		Example:
1>!		Request: 0XW_TMANUAL_+25.00!
VD TOPNOO		Reponse: 01MANUAL=+25.00 <cr><lf></lf></cr>
aXR_TSENSO	aTSENSOR= <temperaturesensorsele< td=""><td>Query Temperature Sensor Selection</td></temperaturesensorsele<>	Query Temperature Sensor Selection
K!	CTION> <ck><lf></lf></ck>	Example:
	< remperature Sensor Selection	Request: UAK_ISENSOK!
	Pange:	Response. 013ENSOR=0 <cr><li></li></cr>
	0:External Temperature Sensor (NTC	
	10K. 3950)40 if unconnected:	
	1: Manual input temperature defined	
	by <±TManual>;	
	2:Onboard Temperature Sensor;	
aXW_TSENSO	aTSENSOR= <temperaturesensorsele< td=""><td>Configure Temperature Sensor Selection</td></temperaturesensorsele<>	Configure Temperature Sensor Selection
R_ <temperatur< td=""><td>ction&gt;<cr><lf></lf></cr></td><td>Example:</td></temperatur<>	ction> <cr><lf></lf></cr>	Example:
eSensorSelectio		Request: 0XW_TSENSOR_0!
n>!		Response: 0TSENSOR=0 <cr><lf></lf></cr>
aXR_ECUNIT!	aECUNIT= <ecunit></ecunit>	Query EC unit
	<ecunit> is Conductivity, Salinity,</ecunit>	
	TDS Unit, Range:	Example:
	0: us/cm, mg/L	Request: 0XR_ECUNIT!
	1: ms/cm, g/L	Response: 0ECUNIT=0 <cr><lf></lf></cr>



aXW_ECUNIT _ <ecunit>!</ecunit>	aECUNIT= <ecunit></ecunit>	Configure EC unit
		Example:
		Request: 0XW_ECUNIT_0!
		Response: 0ECUNIT=0 <cr><lf></lf></cr>
aXR_COFFEC TC!	aCOFFECTC= <conductivitytempco mpCoef&gt;</conductivitytempco 	Query Conductivity temperature compensation c oefficient
	<conductivitytempcompcoef> : Con</conductivitytempcompcoef>	
	ductivity temperature compensation	Example:
	coefficient	Request: 0XR_COFFECTC!
	Range : 0.000~10.000(0.000%-10.00	Reponse: 0COFFECIC=2.00 <cr><lf></lf></cr>
	0%)	
aXW_COFFEC	aCOFFECTC= <conductivitytempco< td=""><td>Configure Conductivity temperature compensatio</td></conductivitytempco<>	Configure Conductivity temperature compensatio
TC_ <conducti< td=""><td>mpCoef&gt;</td><td>n coefficient</td></conducti<>	mpCoef>	n coefficient
vityTempComp		Fyample
00012.		Request: 0XW COFFECTC 2.00!
		Reponse: 0COFFECTC=2.00 <cr><lf></lf></cr>
aXR_COFFSA	aCOFFSAL= <salinitycoef></salinitycoef>	Query Salinity coefficient
L!	<salinitycoef>: Salinity coefficient</salinitycoef>	
	Range: 0.000~1.000	Example:
		Request: 0XR_COFFSAL!
		Reponse: 0COFFSAL=0.55 <cr><lf></lf></cr>
aXW_COFFSA	aCOFFSAL= <salinitycoef></salinitycoef>	Query Salinity coefficient
L_ <saimitycoe< td=""><td></td><td>Example:</td></saimitycoe<>		Example:
1>:		Request: 0XW_COFFSAL_0.55!
AND COFETD	COFFEE Coof	Reponse: 0COFFSAL=0.55 <cr><lf></lf></cr>
axk_COFFID	acoffids= <idscore <="" td=""><td>Query TDS coefficient</td></idscore>	Query TDS coefficient
5:	<1DSCoer>: 1DS coefficient	Example:
	Range : 0.000~1.000	Request: UXR_COFFIDS! Reporte: 0COFFIDS=0.50 <cp><le></le></cp>
aXW COFFTD	aCOFFTDS- <tdscoef></tdscoef>	Configure TDS coefficient
S <tdscoef>!</tdscoef>		Computer 1DS coefficient
~_ ~~ ~ ~ ~ ~ ~ ~ ~ ~		Example: Request: 0XW COFFTDS 0.5!
		Reponse: 0COFFTDS=0.50 <cr><lf></lf></cr>
aXR ECCAL	aECCALMETHOD= <eccalibmetho< td=""><td>Ouery EC Calibration Method</td></eccalibmetho<>	Ouery EC Calibration Method
METHOD!	d> <cr><lf></lf></cr>	Example:
	<eccalibmethod>: EC Calibration</eccalibmethod>	Request: 0XR_ECCALMETHOD!
	Method :	Reponse: 0ECCALMETHOD=0 <cr><lf></lf></cr>
	0: Calibrated by electrode constant	
	К	



	1 : Calibrated by conductivity standa rd solution	
aXW_ECCAL METHOD_ <e CCalibMetho</e 	aECCALMETHOD= <eccalibmetho d&gt;<cr><lf></lf></cr></eccalibmetho 	Configure EC Calibration Method Example: Request: 0XW_ECCALMETHOD_0!
d>!		Reponse: 0ECCALMETHOD=0 <cr><lf></lf></cr>
aXR_COFFEC	aCOFFECK= <electrodeconstant></electrodeconstant>	Query Electrode Cell Constant
K!	<electrodeconstant> :Electrode Cell</electrodeconstant>	Example:
	Constant	Request: 0XR_COFFECK!
	Range : 0.500~1.500	Reponse: 0COFFECK=1.00000 <cr><lf></lf></cr>
aXW_COFFEC	aCOFFECK= <electrodeconstant></electrodeconstant>	Configure Electrode Cell Constant
K_ <electrodec< td=""><td></td><td>Example:</td></electrodec<>		Example:
onstant>!		Request: 0XW_COFFECK_1.0!
		Reponse: 0COFFECK=1.00000 <cr><lf></lf></cr>
aXW_ECCAL	aECCALRESET <cr><lf></lf></cr>	Reset standard solution calibration data
RESET!		Example:
		Request: 0XW_ECCALRESET!
		Reponse: 0ECCALRESET <cr><lf></lf></cr>
aXW_ECCAL<	aECCAL <eccalibpointindex>=&lt; E</eccalibpointindex>	Calibrate in conductivity standard solution
ECCALibPoint	CRawADT25> <cr><lf></lf></cr>	
Index>!		Example:
	<eccalibpointindex> : ECCalibrati</eccalibpointindex>	
	on point	Request: 0Xw_ECCAL0!
	Data Range . 0: Electrode in air	Reponse: UECCAL0=8 <cr><lf></lf></cr>
	1. Electrode in $EC = 1.47 \text{ us/cm}$ stand	FC-147us/cm_standard_solution '
	ard solution	Request: 0XW ECCAL1!
	2: Electrode in EC=1413us/cm stan	Reponse: 0FCCAL1=150 <cr><lf></lf></cr>
	dard solution	
	3: Electrode in EC=12880us/cm sta	EC=1413us/cm standard solution :
	ndard solution.	Request: 0XW ECCAL2!
		Reponse: 0ECCAL2=1460 <cr><lf></lf></cr>
	<+ECRawADT25> : Raw AD of Co	
	nductivity(with temperature compens	EC=12880us/cm standard solution :
	ation)	Request: 0XW_ECCAL3!
		Reponse: 0ECCAL3=12900 <cr><lf></lf></cr>
aXR_ECCAL<	aECCAL <eccalibpointindex>=&lt; E</eccalibpointindex>	Read calibration data in conductivity standard s
ECCALibPoint	CRawADT25> <cr><lf></lf></cr>	olution
index>!		Evonulor
		Example:
		Reponse: OFCCALO:
aXR_ECCAL< ECCALibPoint Index>!	ndard solution. <+ECRawADT25> : Raw AD of Co nductivity(with temperature compens ation) aECCAL <eccalibpointindex>=&lt; E CRawADT25&gt;<cr><lf></lf></cr></eccalibpointindex>	Request: 0XW_ECCAL2! Reponse: 0ECCAL2=1460 <cr><lf> EC=12880us/cm standard solution : Request: 0XW_ECCAL3! Reponse: 0ECCAL3=12900<cr><lf> Read calibration data in conductivity standard s olution Example: Request: 0XR_ECCAL0! Reponse: 0ECCAL0=8<cr><lf></lf></cr></lf></cr></lf></cr>

- 21 -



Request: 0XR\_ECCAL1! Reponse: 0ECCAL1=150<CR><LF>

Request: 0XR\_ECCAL2! Reponse: 0ECCAL2=1460<CR><LF>

Request: 0XR\_ECCAL3! Reponse: 0ECCAL3=12900<CR><LF>



## 7 Calibration

User can use two methods to calibrate the device, by setting <ECCalibMethod>: Conductivity calibration method, you can choose between them:

Calib Method	Comment	Command
1	Calibrated by electrode constant K	Request : aXW_ECCALMETHOD_0!
2	Calibrated by conductivity standard solution	Request : aXW_ECCALMETHOD_1!

## 7.1 Calibrated by electrode constant K

Usually each electrode is marked with the cell constant value, user only needs to set the constant value marked on the electrode label to measure normally, refer to the following steps:

Steps	Comment	Command
1	Check the electrode cell constant on the electrode,	Example : K=1.023,C=1.023
	usually represented by the letter K or C	
2	Configure EC Calibration Method to "Calibrated by	Request : aXW_ECCALMETHOD_0!
	electrode constant K"	
3	Configure the cell constant value to device	Request: aXW_COFFECK_1.023!
4	Clean the electrodes with demonized water. Verify the	Request:aR0 !
	measured values.	

However, transport and long-term storage will change the electrode cell constant value, and the electrode constant may also change after a period of use. user can calibrate the electrode constant as follows:

Steps	Comment	Command
1	Configure EC Calibration Method to "Calibrated by	Example:
	electrode constant K"	Request:0XW_ECCALMETHOD_0!
2	Configure < TemperatureSensorSelection> to "Manual	Example:
	input temperature", and set the manual input	Request:0XW_TSENSOR_1!
	temperature $<\pm$ TManual> to 25 (25 ° C is	Request:0XW_TMANUAL_25.00!
	recommended)	

	<u>Unleash,Your</u> magination	http://www.infwin.com
3	Immerse the electrode into the conductivity standard	Example :
	solution, and control the temperature of the conductivity	Request:0R0 !
	standard solution to the manual input temperature value,	Response : 0+1643+25.84
	such as: 1413us/cm, wait for the measured value to	
	stabilize, and observe the conductivity output value	
	<+ConductivityT25>	
4	Use the following formula to calculate the electrode	Example :
	constant (uint in us/cm) :	K= 1413 / 1643 = 0.86
	K=1413 / <+ConductivityT25>	
5	Configure the cell constant value to device	Example:
		Request:0XW_COFFECK_0.86!
6	Configure <temperaturesensorselection> to "External</temperaturesensorselection>	Example:
	Temperature Sensor (NTC 10K, 3950)"	Request:0XW_TSENSOR_0!
7	Clean the electrodes with demonized water. Verify the	Example :
	measured values.	Request:0R0 !
		Response : 0+1413+25.84

## 7.2 Calibrated by conductivity standard solution

The device use 147us/cm, 1413us/cm, 12880us/cm conductivity standard solution for calibration. Before calibration, the calibration method of the equipment should be set as "Calibration using conductivity standard liquid". The following example uses these three buffers to calibrate the electrode, as shown in the following table:

Steps	Comment	Command
1	Configure EC Calibration Method to "Calibrated by	Example
	conductivity standard solution"	Request:0XW_ECCALMETHOD_1!
2	Clean the electrodes with demonized water and dry with	Example
	a soft cloth. Keep the electrode in the air and send	Request:0XW_ECCAL0!
	calibration instructions.	
3	Clean the electrodes with demonized water. Immerse	Example
	the electrode in the EC=147us/cm standard solution, stir	Request:0XW_ECCAL1!
	the electrode moderately, and wait for the reading to	
	stabilize, and wait for the electrode temperature (if any)	
	to balance with the buffer temperature, and then send	

#### http://www.infwin.com

	calibration instructions.	
4	Clean the electrodes with demonized water. Immerse	Example
	the electrode in the EC=1413us/cm standard solution,	Request:0XW_ECCAL2!
	stir the electrode moderately, and wait for the reading to	
	stabilize, and wait for the electrode temperature (if any)	
	to balance with the buffer temperature, and then send	
	calibration instructions.	
5	Clean the electrodes with demonized water. Immerse	Example
	the electrode in the EC=12880us/cm standard solution,	Request:0XW_ECCAL3!
	stir the electrode moderately, and wait for the reading to	
	stabilize, and wait for the electrode temperature (if any)	
	to balance with the buffer temperature, and then send	
	calibration instructions.	
6	Clean the electrodes with demonized water. Verify the	Example :
	measured values.	Request:0R0 !
		Response : 0+1413+25.84
7	If calibration fails, user can reset the standard solution	Example
	calibration value to the factory setting.	Request:0XW_ECCALRESET!

INFWIN<sup>®</sup> Unleash Your Imagination

## Appendix A SDI-12 Sensor Testing and Settings

The user can test the communication or set the parameters with the SDI-12 sensors in the following method.

Use any kind of master device that supports the SDI-12 interface (such as data acquisition device, data logger, etc.) to communicate with the sensor or set the parameters.

■ Use a computer to communicate with the sensor through the SDI-12 converter (such as the SDI12ELF20 converter) and to set the parameters.

This chapter mainly introduces the communication or parameter setting on a computer for sensor through the SDI-12 converter (SDI12ELF20).

### A.1 Testing SDI-12 Sensors with SDI12ELF20 Converter

SDI12ELF20 is a communication converter between USB master device and SDI-12 sensor. It supports bidirectional transparent transmission of SDI-12 communication data and is used to control or test SDI-12 compatible sensors or devices. The USB master device can be a computer, Raspberry PI and other hosts that support USB interface.

SDI12ELF20 Converter User Manual

https://www.infwin.com/sdi12elf20-sdi-12-to-usb-converter/

In this example, a computer is used as a USB host to connect the sensor through the SDI12ELF20 converter for SDI-12 communication test.



#### **Installation steps:**

Install USB Virtual COM port driver on PC, laptop or other USB master device. The converter uses the CH340C as the USB bridge chip. Download and install the CH340C driver and install it. After the converter is connected to the PC, a COM port is added to the system port. Use this port number in the debugging software to debug the communication with the converter.

#### **Driver Download**

https://www.infwin.com/resource-usb-to-serial-port-driver-ch340-series

Connect the converter to a PC, laptop or other USB master device through USB port

Connect the sensor of the SDI-12 port to the converter

The sensor can be powered by the power output that comes with the converter or by an external power supply which has common POWER GROUND with the converter power supply

Users can use any serial communication software for SDI-12 communication, such as Terminal,

The default communication parameters of SDI12ELF20 is 9600bps, none parity, 8 data bits, 1 stop bit. Please use ASCII mode to send and receive data.

Testing Software Download	
Terminal (universal	https://www.infwin.com/resource-serial-port-com-development-tool/
serial port	
debugging tool)	
SensorOneSetSDI1	https://www.infwin.com/resource-sensoronesetsdi12-configuration-utility-for-sdi-12-sens
2 (SDI-12 sensor	<u>ors/</u>
configuration	
utility)	

## A.2 Testing Example

In this example, we use the SDI12ELF20 converter to communicate between a computer and the rugged temperature sensor DigiTEMP, The power supply of DigiTEMP is also provided by SDI12ELF20.



Connections



Testing with serial port utility "Terminal"



Take "Terminal" as an example, when debugging, please select the corresponding serial port number, baudrate is set to 9600bps, none parity, 8 data bits, 1 stop bit (the default communication Settings of SDI12ELF20), open the serial port and input the SDI-12 command and send. Please note that the ASCII format should be used for data communication.

🧞 Terminal v1.93b - 20141030?- by Br@y++	—		×				
Disconnect     COM Port     Baud rate     Data bits     Parity     Stop bits     Handshaking       BeScan     COM14     C     600     C 14400     C 57600     C 5     © none     © 1     © none     © RTS/CTS       Help     COMs     C 4800     C 28800     1 28000     C 7     © mark     C 1.5     C XON/XOFF       Quit     © 9600     C 56000     C custom     © 8     C space     C 2     C RTS/CTS+XON/XOFF	,						
Set font   Auto Dis/Connect   ✓ Time   Stream log   custom BR   Rx Clear   ASCII table   Scripting     Set font   AutoStart Script   CR=LF   Stay on Top   9600   -1   ✓   Graph   Remote		CTS DSR	CD RI				
Receive □ <	1						
11:41:56.399> 013INFWIN_DGTEMP1.02302280001000 11:42:02.637> 00011 11:42:02.637> 0 11:42:03.768> 0+20.12 11:42:14.566> 0+20.17							
Transmit CLEARSend File CR=CR+LFBREAKDTRRTS							
Macros     M1     M2     M3     M4     M5     M6     M7     M8     M9     M10     M11     M12       M13     M14     M15     M16     M17     M18     M19     M20     M21     M22     M23     M24							
0R0!		+CR 🖸	->:Send				
0I! 0M! 0D0! 0R0!			^ ~				
Connected Rx: 63 Tx: 14 Rx 0K			- //				

Testing with SDI-12 sensor configuration utility "SensorOneSetSDI12"

Start up the application, select the corresponding product page DigiTEMP, click "start

communication" and choose the proper serial port number, 9600bps, none parity, 8 data bits, 1 stop bit (SDI12ELF20 default communication Settings) and start communication.



🔛 SensorOneSetSDI12	- 🗆 X
Search Device	🔀 Exit 🚺 About 🚮 Language(语言)
Comi Comi Comi Comi Comi Comi Comi Comi	NTION NTIOB NT20A NT20B NT22A NT22B NT21A SlabSense DigiTEMF DigiTMF LNSIO ALS20 PYR20 DigiGas-CD DigiGas-OX DigiTEMP-SDI12-Rugged Temperature Sensor PC Serial Fort Device Address: 0 Prorocol:SDI12 COM14,9600bps,8 Current Status 2024/3/1 11:45:06: Read Data Success Device Info SensorInfo DOTEMF-VI.0 (SDI12-VI3) SN:2302280 SDI-12 Address 0 Set User SN INFWIN Set Sensor ID 13INFWIN DOTEMF1.02302280001000 Version 1.0 Temp. Offset 0.00 Set
	2024/3/1 11:45:05 Respons: 0+20.37
	2024/3/1 11:45:06 Request: 0R0! 2024/3/1 11:45:06 Respons: 0+20.35

- 29 -



## **Copyright and Trademark**

This document is copyrighted, by Dalian Endeavour Technology Co., Ltd. All rights are reserved. Dalian Endeavour Technology Co., Ltd. reserves the right to make improvements to the products described in this manual at any time without notice. No part of this manual may be reproduced, copied, translated or transmitted in any form or by any means without the prior written permission. Information provided in this manual is intended to be accurate and reliable. However, Dalian Endeavour Technology Co., Ltd. assumes no responsibility for its use, nor for any infringements upon the rights of third parties, which may result from its use.

INFWIN® is the trademark of Dalian Endeavour Technology Co., Ltd.

## **Version Control**

Date	Version	Comment	Updated by
2024-02-11	V1.0	Initial Creation	sl51930