PYR20

Solar Radiation / Pyranometer Sensor

(SDI-12 Interface) User Manual

Index

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2 Introduction

PYR20 pyranometer, or solar Radiation Sensor, measures global radiation of both direct and diffusion of solar irradiance. The internal temperature compensation minimizing the error caused by heating of the sensor. Each sensor is calibrated against Eppley Precision Spectral Pyranometer and offers excellent accuracy and consistency. The sensor is applicable for science research, solar power , greenhouse, weather station etc.

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

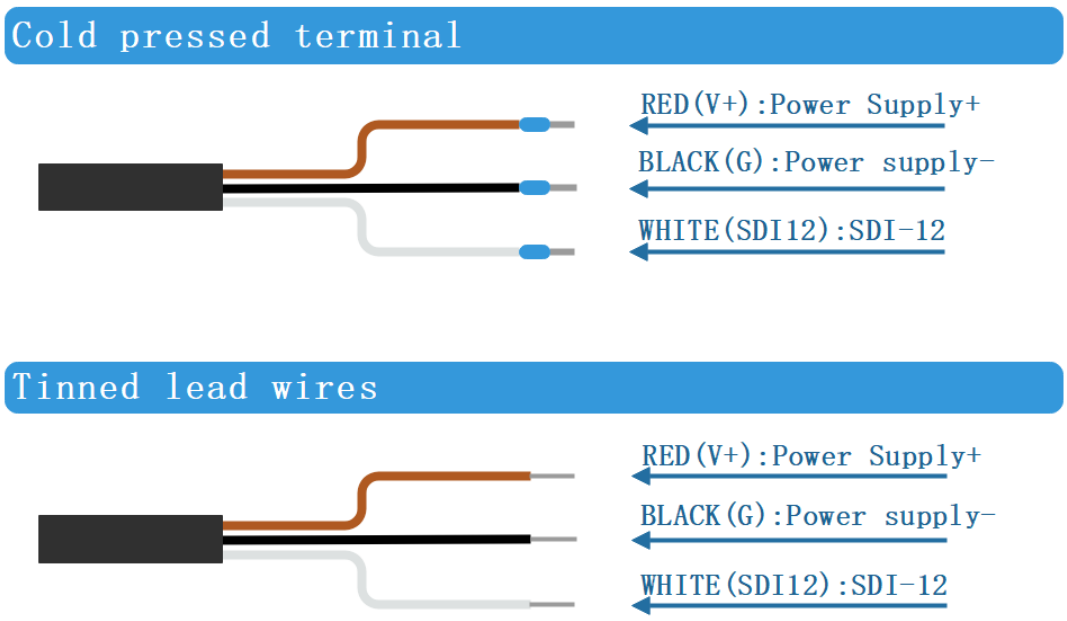
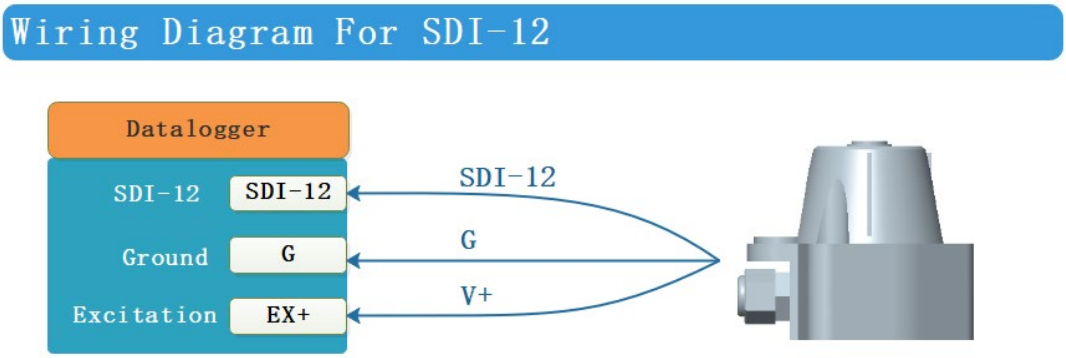
Features:

- Measurement range to 2000W/m2, Spectral range 400-1100nm
- SDI-12 Output Interface with low power design
- Temperature compensated
- Level indicator and spring loaded for installation
- Water proof to IP66 can be used outdoor
- High accuracy and consistency 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	SDI-12 Interface: Quiescent Current : <10uA Measuring Current : 10mA during 50ms measurement
Solar Radiation	Range:0-2000W/m2, Accuracy 5%, Resolution:1W/m2
Spectral Range	400-1100nm
Direction Error	Percent of reading: ±3% (0 - ±70°); ±10% (±70 - ±85°)
Operating	Temperature: -40~80°C, Humidity: 0-100%
IP Ratings	IP68
Installation	Screw hole * 3
Cable Length	2 meters or Customize
Dimension	Sensor Body 75*55*58mm

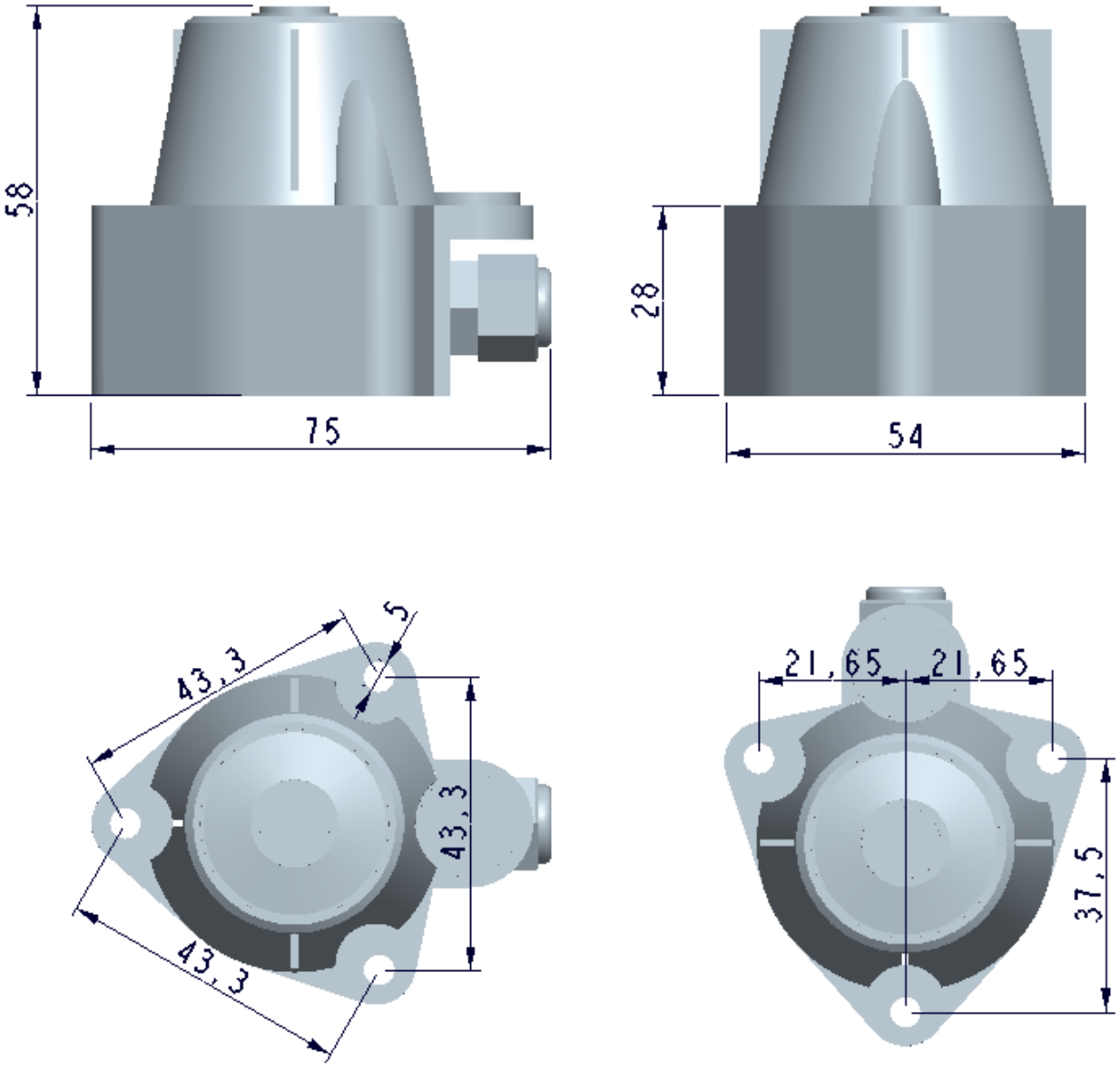
3 Wiring diagrams

3.1 SDI-12 Interface

Type	Wiring diagram
SDI-12 Interface	
Connections	

4 Dimension and Ordering Infomation

4.1 Dimension



Unit: mm

4.2 Ordering Infomation

Parameters	Code	Comments
Code 1:Product Series	PYR20	PYR20 Pyranometer series
Code 2: Range	A B	2000W/m2 Customize
Code 3: Power Supply	C	4.5-28 V DC
Code 4: Output Interface	F	SDI-12
Code 5: Cable Length	002 XXX	2 meters Customize, XXX is required cable length(Unit: meter)
Ordering Code Example: PYR20 pyranometer sensor,Range 2000W/m2,Power Supply 4.5-28V DC,Output Interface SDI-12 ,Cable length 2 meters.Ordering Code is:PYR20-ACF002		

5 Safty ,Care and Installation

5.1 Care and Safty

Keep the white optical lens on the top of the sensor clean and wiping lens by soft rag. Always checking the horizontal bubble to keep the sensor horizontally placed.

5.2 Installation

Adjusting the screw and checking the horizontal bubble to make the sensor horizontally installed.

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 character
<SAPCE>	-	Space character
<CR>	-	Carriage return character
<LF>	-	Line feed character
<Checksum>	-	SUM Checksum
<CRC_ADI>		ADI protocol CRC Checksum
<CRC>	-	SDI-12 protocol CRC Checksum
<VERIFY_STATUS>	-	Sensor Verification status
<+solar_radiation>	W/m2	Solar Radiation 0-2000.

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>	**Acknowledge Active** a: Sensor address **Example:** Request: 0! Response: 0<CR><LF>
aI!	allccccccccmmmmmmvvvxxxxxxxxxxxxxx<CR><LF>	**Send Identification** a: Sensor address ll:SDI-12 Version Number cccccccc: 8 characters vendor identification mmmmmm: 6 characters specifying the sensor model number vvv: 3 characters specifying the sensor version xxxxxxxxxxxxx: 13 characters serial number <CR><LF>: terminates the response **Example:** Request: 0I! Response: 013INFWIN PYR20 3.02402280001000<CR><LF>
?!	a<CR><LF>	**Sensor Address Query** a:Sensor address **Example:** Request: ?! Response: 0<CR><LF>

aAb!	b<CR><LF>	**Change Sensor address** a:Current Sensor address b:New Sensor address **Example:** Request: 0A1! Response: 1<CR><LF>
aM!，aMC!	a0011<CR><LF> a:Sensor address 001: Measurement data will be ready in 001 seconds 1: Number of measurement data returned by aD0! <CR><LF>:terminates the response aD0! Response data format： a<+solar_radiation>[<CRC>]<CR><LF>	**Solar Radiation Measurement** **Example:** Request: 0M! Response: 00011<CR><LF> Response: 0<CR><LF> Request: 0D0! Response: 0+120<CR><LF>
aC!，aCC!	a00101<CR><LF> a: Sensor address 001: Measurement data will be ready in 001 seconds 01: Number of measurement data returned by aD0! <CR><LF>: terminates the response aD0! Response data format： a<+solar_radiation>[<CRC>]<CR><LF>	**Solar Radiation Measurement** **Example:** Request: 0C! Response: 000101<CR><LF> Request: 0D0! Response: 0+120<CR><LF>
aV!	A0021<CR><LF> a: Sensor address 002: Measurement data will be ready in 002 seconds	**Sensor Verification Command** **Example:** Request: 0V! Response: 00021<CR><LF> Response: 0<CR><LF>

	1:Number of measurement data <CR><LF>:terminates the response aD0! Response data format： a<VERIFY_STATUS><CR><LF>	Request: 0D0! Response: 0+0<CR><LF>, “+0” indicate sensor normal, “+1” means sensor error.
aD0! aD1! aD2!	[<svvvv><svvvv><svvvv>…][<CRC>]<CR><LF> [<svvvv>]: data value [<CRC>]: Optional 3 characters CRC checksum, <CR><LF>:terminates the response	Send Data since the last aM, aMC, aC, aCC, aV command, The data returned depends on the command sent most recently.
aR0!，aRC0!	Response data format： a<+solar_radiation>[<CRC>]<CR><LF>	**Solar Radiation Measurement** **Example:** Request: 0R0! Response: 0+120<CR><LF>
aXR_SN!	aSN=<ssssssss> <ssssssss> is 8-digits serial number	**Query serial number** **Example:** Request: 0XR_SN! Response: 0SN=12345678<CR><LF>
aXW_SN_<ssssssss>!	aSN=<ssssssss>	**Configure serial number** **Example:** Request: 0XW_SN_ABCDEFGH! Response: 0SN=ABCDEFGH <CR><LF>

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.

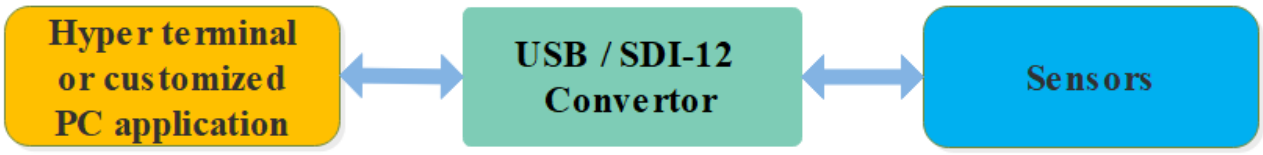
This chapter mainly introduces the communication or parameter setting on a computer for sensor through the SDI-12 converter (SDI12ELF20).

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.

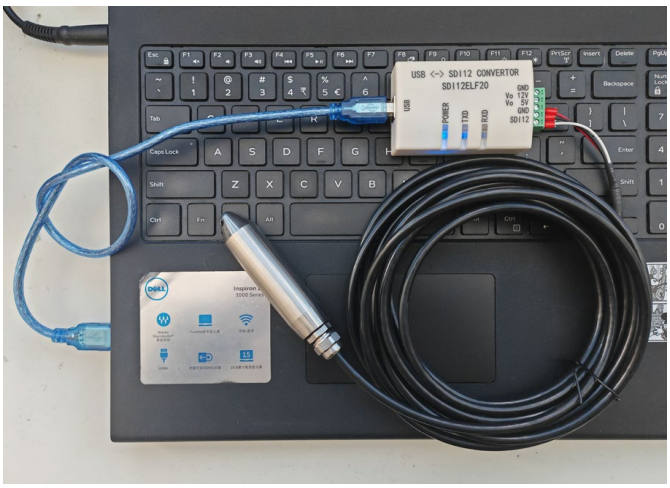
Testing Software Download	
Terminal (universal serial port debugging tool)	https://www.infwin.com/resource-serial-port-com-development-tool/
SensorOneSetSDI12 (SDI-12 sensor configuration utility)	https://www.infwin.com/resource-sensoronesetsdi12-configuration-utility-for-sdi-12-sensors/

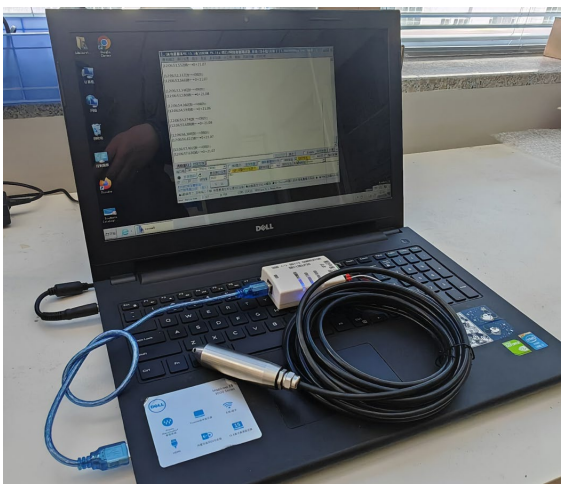
A.2 Testing Example

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.

DigiTEMP Rugged Temperature Sensor User Manual
https://www.infwin.com/digitemp-rugged-digital-temperature-sensor-sdi12-rs485-modbus/

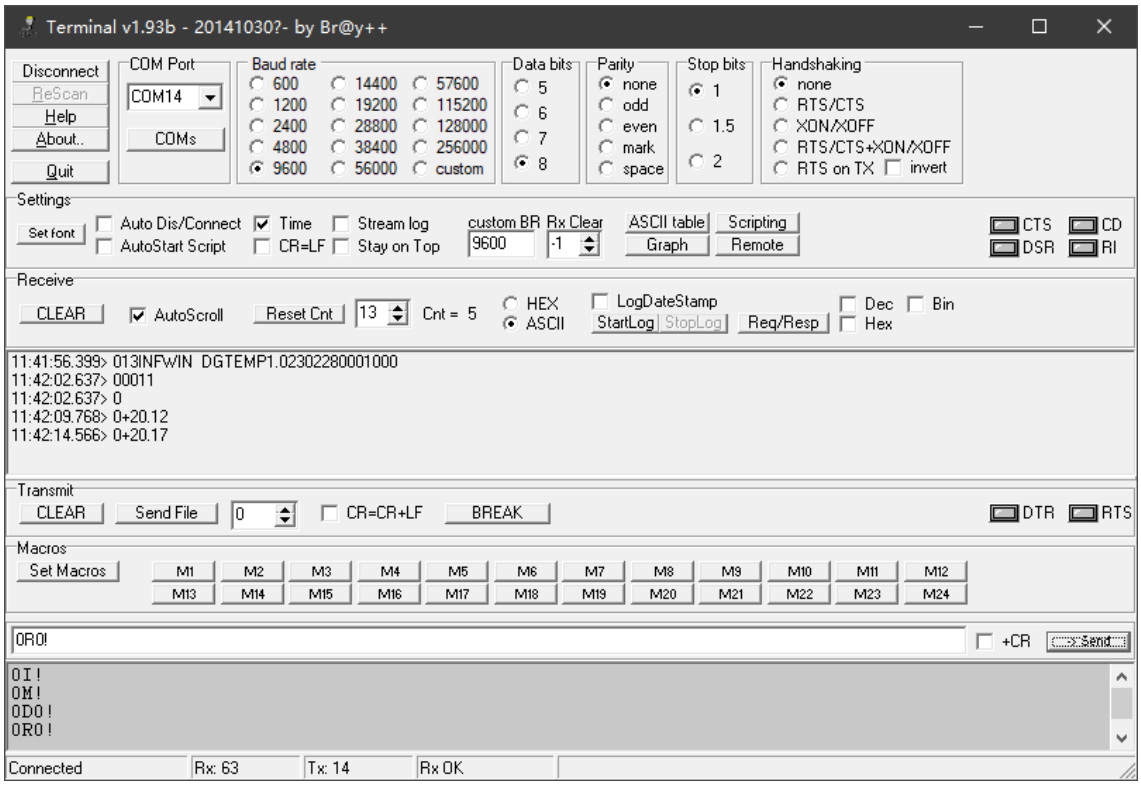
■ **Connections**





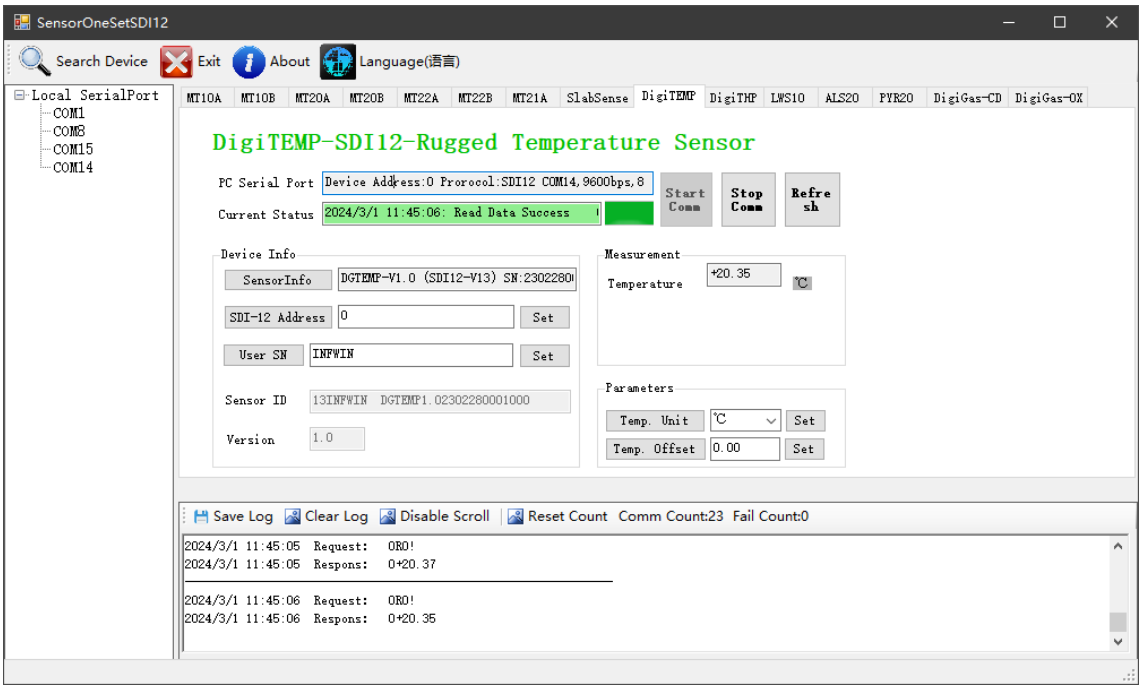
■ **Testing with serial port utility "Terminal"**

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.



■ **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
Search Device
Exit
About
Language(语言)
Local SerialPort
COM1
COM3
COM15
COM14
MT10A MT10B MT20A MT20B MT22A MT22B MT21A SlabSense DigiTEMP DigiTHP LWS10 ALS20 PYR20 DigiGas-CD DigiGas-OX
DigiTEMP-SDI12-Rugged Temperature Sensor
PC Serial Port
Device Address:0 Prorocol:SDI12 COM14,9600bps,8
Start Comm
Stop Comm
Refresh
Current Status
2024/3/1 11:45:06: Read Data Success
Device Info
SensorInfo
DGTEMP-V1.0 (SDI12-V13) SN:2302280
SDI-12 Address
0
Set
User SN
INFWIN
Set
Sensor ID
13INFWIN DGTEMP1.02302280001000
Version
1.0
Measurement
Temperature
+20.35
℃
Parameters
Temp. Unit
℃
Set
Temp. Offset
0.00
Set
Save Log
Clear Log
Disable Scroll
Reset Count
Comm Count:23 Fail Count:0
2024/3/1 11:45:05 Request: 0R0!
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

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Version Control

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2024-02-11	V1.0	Initial Creation	sl51930