Technical Manual

iSens2

AC current sensor

Analog and pulse output

Project ID PJ163
Version 0.01

Synopsis

Limited Warranty and disclaimer

These products are guaranteed to be free of defects in workmanship or materials. Any product that proves to be defective will be replaced or repaired.

LIMITATION
This limited warranty only covers conditions resulting from normal use of products. The warranty shall not apply to the following products: products or parts repaired, altered or modified by other than Idetron or an authorized repair representative, failure to follow proper installation, operation or maintenance instructions and damage resulting from improper storage conditions.

Contents

1. Purpose

This document describes the user manual and the functional specifications of the iSens2 AC current sensor. The iSens2 is identified by Project-ID PJ163.

2. Intended Audience

The intended audience is generally anybody who wants to familiarize with and use the iSens2 sensor.

3. Glossary

AC	Alternating current
DC	Direct current
GND	Ground
Hz	Hertz
mA	milli Ampère
ppm	Parts pro milion; 1ppm=0,0001%=1/1000000
PWR	power
true RMS	true Root Mean Square, Urms = sqrt(mean(U^2))

4. Safety Regulations

4.1. Warning, caution and notes

Warnings, cautions and notes within this manual will be used as follows:

WARNING: Used to denote a danger to personnel of serious injury and/or death. The warning will be preceded by the caption WARNING and the detail of any warning will be in bold and uppercase.

CAUTION: Used to denote a possibility of damage to material or equipment but not a danger to personnel. The caution will be preceded by the caption CAUTION and the detail of any caution will be in bold and lowercase.

NOTE: used to draw attention to information that is extraneous to the immediate subject of the text. A note will be preceded by the caption NOTE and the detail will be in italics.

All warnings, cautions and notes will precede the relevant sections of the text.

4.2. General Safety Regulations

WARNING: THIS DEVICE IS NOT DESIGNED FOR AND THEREFORE NOT INTENDED FOR USE IN ANY ENVIRONMENT WHERE HUMAN LIFE DEPENDS DIRECTLY ON THE USE OF PROVEN RELIABILITY AND FAILSAFE TECHNIQUES AND COMPONENTS.

WARNING: THIS DEVICE MUST ONLY BE OPERATED IN ENVIRONMENTS LIMITED TO THE SPECIFIED TEMPERATURE AND HUMIDITY CONDITIONS.

WARNING: THIS DEVICE IS NOT PROTECTED AGAINST ANY CORROSION FROM ANY TOXICAL VAST PARTICLE, FLUID OR GAS.

WARNING: THIS DEVICE MUST NOT BE USED IN NUCLEAR PLANTS OR IN ANY EXPLOSIVE ENVIRONMENT.

CAUTION: The maximum input voltages must not be exceeded.

5. Instrument Description

The iSens2 4..20mA AC current sensor measures AC currents up to 3200A true-rms on a single phase power cable.
The sensor has 2 outputs:

- The analog output is proportional to measured input and ranges from 4 mA to 20 mA.
- The pulse output generates a pulse frequency proportional to the current. This allows for a simple power meter by using a pulse counter attached to the pulse output. The pulse outputs of up to 3 iSens2 sensors can be connected together. Our private hard and software assures that there is no overlap between the pulses of different sensors.

Full range capacity and pulse rate are customer designed and should be mentioned at ordering.

The sensor has an indication LED. This blinks when the iSens2 is powered. The rate at which it blinks is proportional to the output current.

Power on time until valid output is 1.2 second.
Each sensor has a unique serial number and is delivered with a calibration certificate and report.

The following figure shows the module dimensions. The area of the loop formed by the measurement coil (light gray on the figure) depends on the full range capacity. For large currents, the area is larger to cope with wide power cables.

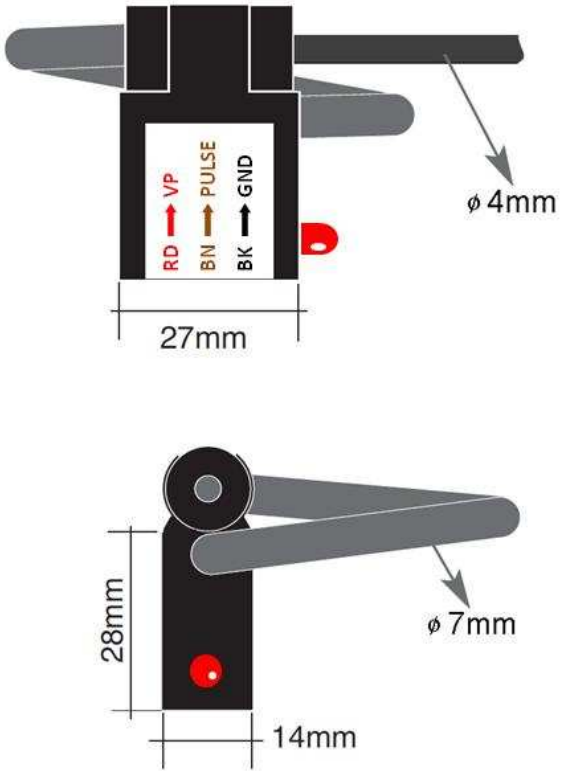

Figure 5-1 Global view of the sensor

6. Installation

6.1. Connection to the cable

To install the iSens2 sensor, wrap the measurement coil round the single phase power cable. Click the free end (with electronics) into the clamp holder on the coil cable. The coil has to make a **closed** loop around the power cable.

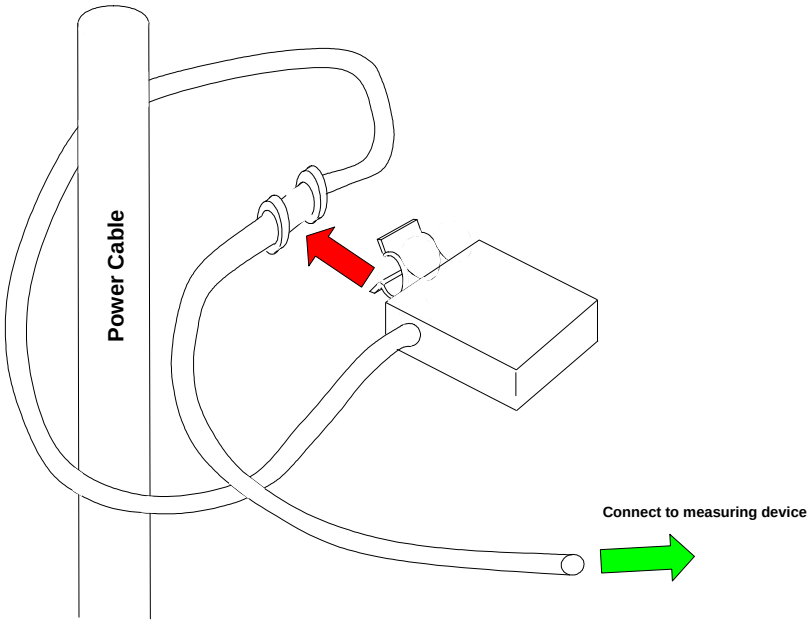

Figure 6-1 Correct sensor connection

The following figure illustrates a faulty installation.

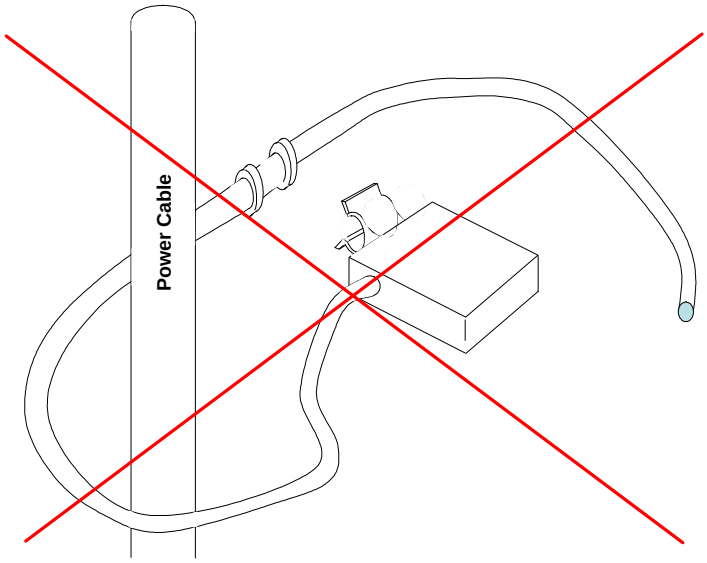

Figure 6-2 Incorrect sensor connection

NOTE: *The sensor is not sensitive to power direction.*

NOTE: *Wrapping the coil twice around the power cable doubles the sensor's sensitivity. Use this feature to measure small currents.*

The sensor has to be properly aligned to the cable, as shown in the following figure.

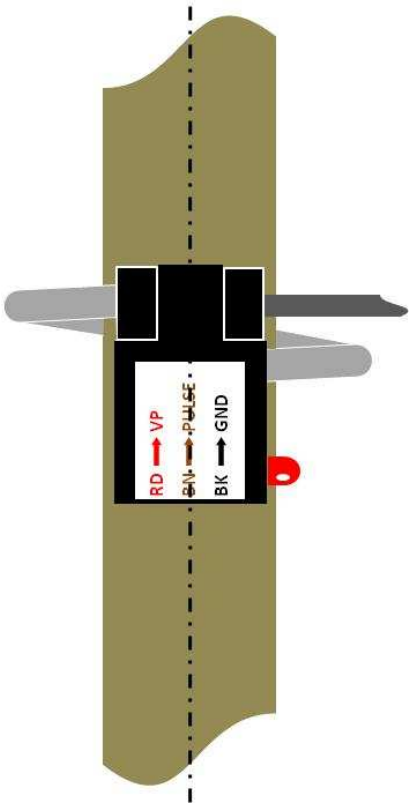

Figure 6-3 Correct sensor alignment

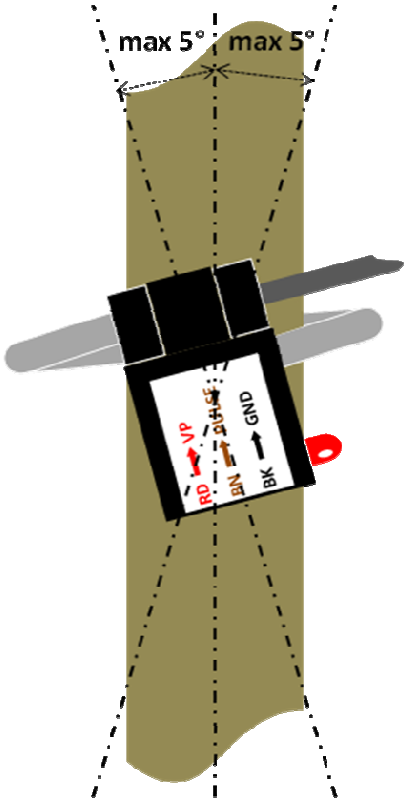

Figure 6-4 Maximum alignment deviation

WARNING: HIGH VOLTAGES ARE HAZARDOUS AND CAUSE AN IMMEDIATE RISK TO SERIOUS INJURY OR EVEN DEATH.

WARNING: BE VERY CAREFUL TO RESPECT ALL GENERAL AND LOCAL SAFETY PRECAUTIONS (E.G DISCONNECT POWER, WEAR SAFETY GLASSES, RUBBER GLOVES AND ADEQUATE CLOTHES, ETC)

6.2. Power-On/Off

The iSens sensor has no power on/off switch. Applying power to the sensor starts its internal power-up sequence. Switch the sensor off by removing its power supply.

The typical delay between applying power and valid output is about 1.2 seconds. The outputs can be erroneous during this delay period. After the delay the output is valid to within 1% of the full range.

7. Connection

7.1. Wiring diagram

The next figures show the wiring for the iSens2.

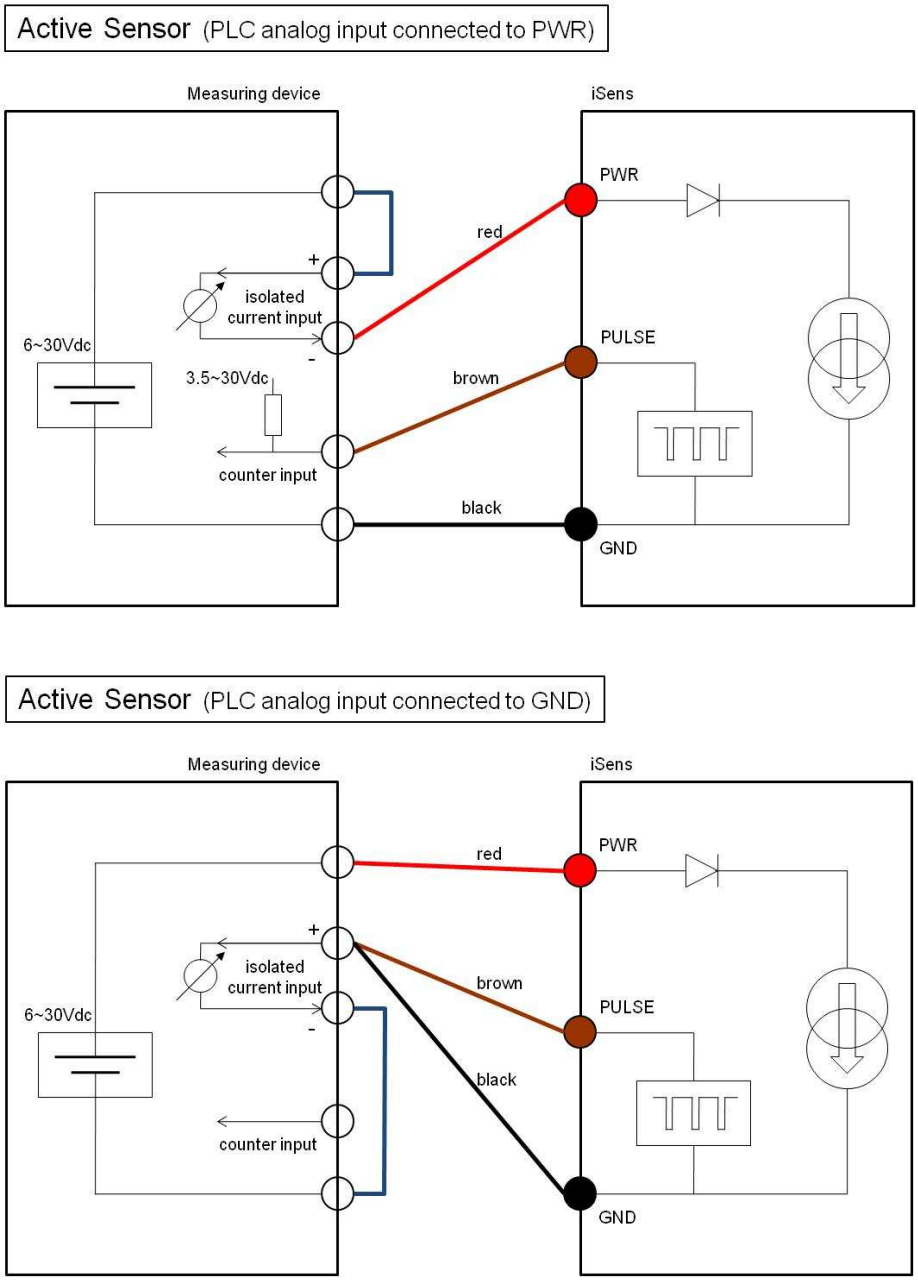

Figure 7-1 Sensor wiring

The iSens2 sensor has 3 wires. Two of these are used for the supply. The third is a pulse output. The sensor has 2 outputs: a 4 to 20mA current output and a pulse output.

The output of 4 to 20mA flows in the supply lines. The current can be measured either in the power line or the ground line. When the pulse output is used, the ground line is not suited because it carries extra current from the pulse output.

The pulse output requires a pull-up resistor. It can be connected to a counter input. The pulse output generates some extra current consumption.

When the pulse output is not used, connect it directly to GND or through a pull-up resistor to a supply. Never connect it directly to the supply, the supply will then be shorted to GND whenever a pulse is sent.

7.2. Terminals

Terminal	**Color**	**Designation**
GND	Black	Ground
PWR	Red	6 to 30 Vdc
PULSE	Brown	GND ≤ PULSE ≤ PWR Connect to a supply with a pull-up resistor

Table 7-1 Sensor terminals

8. Ordering

8.1. Ordering codes

The iSens2 sensor is available with different settings. These are shown in the table below.

Ordering code	Frequency	Current range	Pulses/Ah	Coil length
-	Hz	Arms		mm
iSens2A100	50/60	100	10	170
iSens2A200	50/60	200	10	170
iSens2A400	50/60	400	10	170
iSens2A800	50/60	800	10	170
iSens2B800	50/60	800	1	250
iSens2B1500	50/60	1500	1	250
iSens2C1500	50/60	1500	1	350
iSens2C3200	50/60	3200	1	350
iSens2H40	400	40	100	170
iSens2H80	400	80	100	170

Table 8-1 Ordering codes

8.2. Evaluation tool

iSens2EVA is a USB evaluation and configuration device for the iSens2 sensor. It consists of a hardware module and software for Windows. This tool has the following features:

- measure and plot the output current, export in a format that can be pasted in a spreadsheet
- count the pulses
- configure the sensor for a different current range or pulse weight

9. Technical Specifications

Specification	Unit	Min	Typ	Max	Conditions
Voltage (PWR to GND)	Vdc	6	-	30	(1) (2)
Pulse Supply Voltage	Vdc	3.5	-	30	(3) (4)
Power consumption	mA	4	-	20	
LED blink frequency	Hz		0.4		no current
			2		full range
Power-on delay until valid	s		1.2		output within 1%
Crest factor	-		2.8		
Measurement bandwidth	Hz		720		50/60Hz version
			3400		400Hz version
Noise	Arms		0.2		50/60Hz version range 800A
			0.04		400Hz version, range 40A
Supply coefficient	ppm/V		160		(5)
Temperature coefficient	ppm/℃		100		(6)
Accuracy	% full scale	-1		1	(7)

(1) The sensor works with a supply down to 5Vdc. However, below 6Vdc the accuracy is about 1% worse for high output current.
(2) The sensor is loop powered, there is no need for a separate power supply.
(3) A pull-up resistor must be included between the PULSE output and the pulse supply voltage.
(4) The pulse supply voltage can be lowered to 3V. However the pulses will then be active only if the power consumption is below 10mA.
(5) The change of the output current, if the sensor voltage changes one Volt.
(6) The change of the output current, if the sensor temperature changes one degree Celcius.
(7) When mounted as shown in paragraph 6.1.

Table 9-1 Electrical specs

Specification	Unit	Min	Typ	Max	Conditions
Current output	mA	4	-	20	
Current input range	Arms	100	-	3200	50Hz current
		20	-	80	400Hz current
Pulse rate	Hz	0	-	2.66	

Table 9-2 Output ranges

Specification	Value
Coil Length	170 mm, 250 mm, 350 mm
Allowed Cable Diameter	35 mm, 65 mm, 95 mm
Coil Diameter	7 mm
Coil Bend Radius	35 mm
Coil Coupling Diameter	12.8 mm
Housing W x H x D	26.7 mm x 41.4 mm x 13.6 mm
Output Cable	3 m UL-LiYY, double insulation
Weight (Housing + Coil)	120gr

Table 9-3 Mechanical specs

Specification	Value

Position sensitivity	0.7% of full scale for sensor rotated over 5º
Operational ambient temperature	-20 ºC to +70 ºC
Operational relative humidity	max 95%, non condensing
Storage ambient temperature	-20 ºC to +70 ºC
Storage relative humidity	max 95%, non condensing

Table 9-4 Environmental specs

List of figures

List of Tables