General Description

Model Z203 is a complete single-phase network analyser suited for use with up to 500 Vac voltage range and 5 A (50 or 60 Hz) current.
The instrument provides all the following electrical measurable quantities: **Vrms**, **Irms**, **Watt**, **Var**, **Frequency**, **Cosϕ** .
Measurements are read through serial communication and both floating point and normalised format.
The DIP-switches can be set for the analogue retransmission of any Vrms, Irms, Watt, Var and Cosϕ quantity. The module is also distinguished by:

- Facilitated power supply and serial bus wiring by means of the bus housed in the DIN rail.
- Communication configurability through DIP-switch or software.
- RS485 serial communication with MODBUS-RTU protocol, maximum 32 nodes.
- Protection against ESD discharge up to 4 kV.
- Power input isolation: 3750 Vac respect to all the other circuits.
- Isolation between communication and power supply: 1500 Vac.
- Isolation between retransmitted output and power supply: 1500 Vac.
- Analogue output signal settable in voltage or current.
- Possibility for connection and management by an external CT.

Technical Specifications

Power Supply :	10..40 Vdc or 19..28 Vac (50..60 Hz).
Consumption :	max 2.0 W.
Communication Ports :	-RS485, 1200..115200 Baud. -RS232, 2400 Baud, Address: 01, Parity: NO, Data: 8 bits; Stop bits: 1.
Protocol :	MODBUS-RTU.

Input

Voltage Input :	up to 500 Vac; Frequency: 50 or 60 Hz.
Current Input :	Current input rated range: 5 Arms, Max peak factor: 3, Max Current : 15 A, Frequency: 50 or 60 Hz.
Class/Base Precision :	Voltmeter : 0,5 %. Amperometer : 0,5 %. Wattmeter : 0,5 %.

Analog Output

Output Voltage :	0..10 Vdc, 0..5 Vdc, minimum load resistance: 2 kΩ.
Output Current :	0..20 mA, 4..20 mA, maximum load resistance: 500 Ω.
Transmission error :	0,1 % (max. range).

Insulation voltage :	3750 Vac between the measurement input and all the other circuits. 1500 Vac between power supply and communication. 1500 Vac between power supply and retransmitted output.
Protection :	IP20.
Environmental conditions :	Temperature -10..+65 °C. Humidity 30..90 % non-condensing. Altitude: up to 2000 m a.s.l.
Storage temperature :	-20..+85 °C
Signalling by LED :	Power supply, Fail, RS485 communication.
Connections :	-Removable 3-way screw terminals, 5.08 mm pitch. -Rear IDC10 connector for DIN rail. -3.5 mm stereophonic front jack for RS232 (COM) connection.
Box :	PBT, black
Dimensions and weight :	100 x 112 x 17,5 mm, 140 g.
Reference standards :	EN61000-6-4/2002 (electromagnetic emission, industrial environment) EN61000-6-2/2005 (electromagnetic immunity, industrial environment) EN61010-1/2001 (safety). All circuits must be insulated from the other circuits under dangerous voltage with double insulation. The power supply transformer must comply with EN60742: "Insulated transformers and safety transformers".

CE

Operating logic

The module measures the following electrical measurable quantities: Vrms, Irms, Watt, Var, Frequency, Cosϕ and provides the values in the corresponding MODBUS registers.
These measurements are rendered in both floating point and normalised format between 0..+10000 (-10000 ..+10000 for VAR and Cosϕ). The module output transmits one of the previous measurable quantities selected by the user (excluding frequency) as either a current or voltage value. The range of the retransmitted output is proportional to the full scale value of the quantity measured: if the signal is a 4..20 mA current signal and the quantity to be transmitted is the Vrms voltage, for example, 4 mA will equal 0 V and 20 mA will equal 500 V because these are the top and bottom full scale values for rms voltage. Relay scaling can also be selected from 100%, 50 % or 25 %. In the example below, with 50% retransmission scaling, a 4 mA signal will equal 0 V and a 20 mA signal will equal 250 V. The retransmission values saturate at approximately 11 V for voltage outputs and at around 21 mA for current outputs. When the module is switched on, the appropriate setting coefficients are measured (depending on the choice of 50 or 60 Hz frequency). All the settings made will be automatically loaded when the module is reset.

Measurement and retransmission range

Electrical quantities	Measurement Range	Selectable retransmission Range (100% scaling)
Vrms	0..500 Vac	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Irms	0..5 A	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Active Power	0..2500 W	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Reactive Power	0..2500 VAR	5..10 V, 2,5..5 V, 10..20 mA or 12..20 mA
cosϕ	0..1	5..10 V, 2,5..5 V, 10..20 mA or 12..20 mA
Frequency	40..70 Hz	-

Note that the Vrms, Irms, Active Power and frequency values are obtained by direct measurement, whereas the Reactive Power and cosϕ values are calculated. See the tables provided in **APPENDIX A** for the measurement and retransmission ranges in the cases of 50% and 25% scaling.

Installation rules

The module is designed to be installed in vertical position on a DIN 46277 rail. In order to ensure optimum performance and the longest working life, the module(s) must be supplied adequate ventilation and no raceways or other objects that obstruct the ventilation slots.
Never install modules above sources of heat; we recommend installation in the lower part of the control panel.

Electric connections

RS485 SERIAL PORT AND POWER SUPPLY

The electric connections for power supply can be made by using either the terminals or the bus for the Seneca DIN rail. The RS485 bus connections are available only by using the bus for the DIN rail.

Power supply from terminals

2 — 10 ÷ 40 V_DC
3 — 19 ÷ 28 V_AC
2.0 W
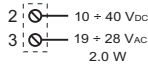
Bus connector for DIN rail connections
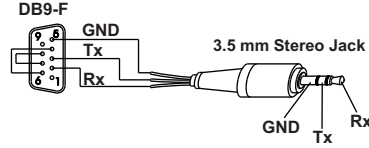
RS485 GND — Power supply AC +
RS485 A — Power supply AC -
RS485 B — IDC10
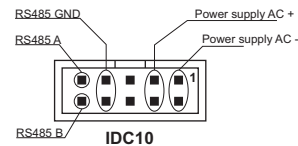
There is no isolation between RS485 and the retransmitted output.

RS232 SERIAL PORT

Connection cable DB9 with a 3.5 mm stereo Jack, can be assembled as indicated in the following figure, or can be bought as an accessory.

DB9-F
GND
Tx
Rx
**3.5 mm Stereo Jack**
GND
Tx
Rx

INPUT

The module accepts an input voltage of up to a maximum 500 Vac. The input voltage is connected to Terminals 10 and 12, whereas the load to be analysed is connected to Terminals 7 and 9.

7 — LINE OUT
MAX 5 A rms — LOAD
9 —

10 — LINE IN
MAX 500 V_AC — LINE
12 —
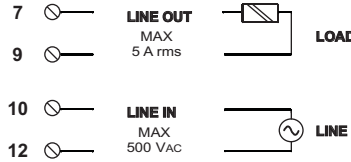
OUTPUT

The module provides an analog output in voltage (0..10 Vdc, 0..5 Vdc) or current (0..20 mA, 4..20 mA).
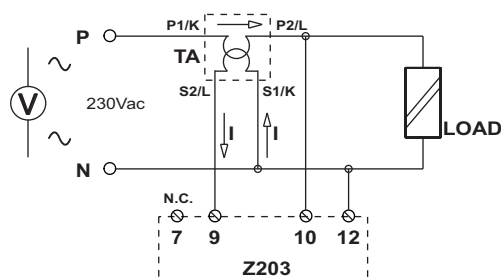We recommend using shielded cables for the electric connections above.

Voltage Output

5 — V — +
6 — −

Current Output

5 — A
4 —
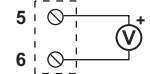
There is no isolation between RS485 and the analog output.

EXAMPLE OF CONNECTION WITH AN EXTERNAL CT

P1/K P2/L
TA
230Vac
S2/L S1/K
LOAD
N
N.C.
7 9 10 12
Z203

Indications by LED on the frontal panel

PWR LED (GREEN)	Meaning
Steady ON	Power supply is present.

ERR LED (YELLOW)	Meaning
Steady ON	Communication error between internal peripherals.
Flashing	Voltage measured at less than 40 Vac.

RX LED (RED)	Meaning
Steady ON	Data are being received through the RS485 communication port

TX LED (RED)	Meaning
Steady ON	Data are being transmitted through the RS485 communication port

Serial interface

For detailed information on RS485 serial interface, consult the documentation provided by the website www.seneca.it, in the section **Prodotti/Serie Z-PC/MODBUS TUTORIAL**.

DIP-SWITCH SETTING

Default configuration

The instrument leaves the factory with all DIP-switches configured in position 0. The settings of the DIP-switches defines the module's communication parameters: address and speed.

In all the following tables, the indication ● corresponds to a DIP-switch set in 1 (ON); no indication is provided when the DIP-switch is set in 0 (OFF).

Speed

SW1	1	2	
			9600 Baud
	●		19200 Baud
		●	38400 Baud
	●	●	57600 Baud

ADDRESS

SW1	3	4	5	6	7	8	
							Communication Parameters from EEPROM (*)
						●	Fixed Address: 01
					●		Fixed Address: 02
					●	●	Fixed Address: 03
				●			Fixed Address: 04
	X	X	X	X	X	X	Fixed Address, as from binary representation.
	●	●	●	●	●	●	Fixed Address: 63

NETWORK FREQUENCY SELECTION (50 or 60 Hz)

SW2	1	
		Network Frequency: 50 Hz
	●	Network Frequency: 60 Hz

OUTPUT

SW2	2	3	
			0..10 V
		●	0..5 V
	●		0..20 mA
	●	●	4..20 mA

RETRANSMISSIONS SCALING

SW2	4	5	
			100 %
		●	50 %
	●		25 %
	●	●	Setting not permitted.

(*) The default configuration is the following: Address 1, 38400, no parity, 1 stop bit.

SELECTION OF QUANTITY RETRANSMITTED

SW2	6	7	8	
				Retransmission of Vrms
			●	Retransmission of Irms
		●		Retransmission of Watt
		●	●	Retransmission of cosϕ
	●			Setting not permitted.
	●		●	Retransmission of VAR
	●	●		Setting not permitted.
	●	●	●	Setting not permitted.

TERMINATORE RS485

SW3	1	2	
		x	Terminator OFF, the SW3-2 is not used.
	●	x	Terminator ON, the SW3-2 is not used.

Programming

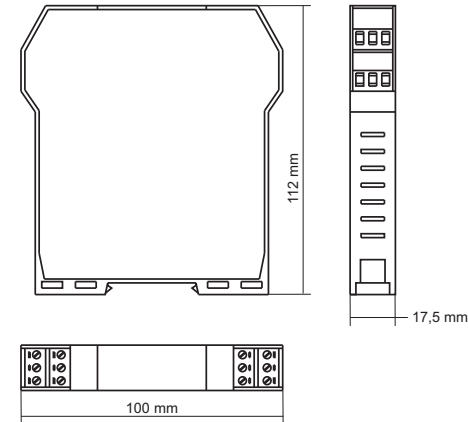For the product's programming and/or configuration tools, consult the website www.seneca.it.
During initial programming, the EEPROM (SW3 ..8 in OFF position) default setting values originally programmed as follows can be used:
Address = 01, **SPEED =38400 Baud**, **PARITY= none**, **BIT NUMBER = 8**, **STOP BIT=1**.
The module can also be programmed through the front connector (COM) while paying attention to set the following connection parameters:
Address = 01, **Speed =2400 Baud**, **PARITY =none**, **STOP BIT = 1**.
The Com communication port behaves in the same way as the RS485 bus port except for the communication parameters described above. It also has priority over the RS485 serial port and closes after 15 seconds of inactivity.

Frontal Panel and Led Position

1 2 3
4 5 6
ERR PWR
RX TX
COM
Z203
7 8 9
10 11 12

Overall Dimensions

112 mm
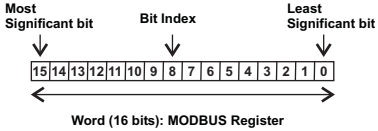17,5 mm
100 mm

csq IQNet ISO9001-2000

MODBUS REGISTERS

Z203 has MODBUS 16 bits (words) registers, accessible by RS485 or RS232 serial communication. In the next paragraphs, we shall describe the supported MODBUS commands, and the functions of the registers.

Supported MODBUS Commands

Code	Function	Description
03	Read Holding Registers	Reading of registers up to 16 words at a time **within the same group**.
06	Write Single Register	Writing of a word register

Holding Registers

The 16-bit Holding Registers have the following structure:

Most Significant bit	Bit Index	Least Significant bit
↓	↓	↓

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Word (16 bits): MODBUS Register

The Bit notation [x:y] shown in the table indicates all the bits from x to y. For example, Bit [2:1] indicates bit 2 and bit 1, and illustrates the meaning of the various linked combinations of the values of the two bits. Remember that the MODBUS 3 and 6 functions (respectively of multiple reading and single writing) can be executed on the following registers.
The following indication (only readable or also writable) is provided for every register:
 R: Readable
 W: Writeable

GROUP 1

REGISTER	Description	ADD.	R/W
MACHINE ID	**Bit [15:8]: contain the module's ID: 18** **Bit [7:0] contain the firmware's external revision.**	**40001**	**R**
ADDR	**Register for the setting of the module's address and parity control.**	**40002**	**R/W**
Bit [15:8]	Set the module's address. Permissible values from **0x00** to **0xFF** (decimal values in the interval of 0-255). Default address: 1.		
Bit [7:0]	Set the type of parity control: 00000000 : No parity (NONE) (Default) 00000001 : Even parity (EVEN) 00000010 : Odd parity (ODD)		
BAUDR	**Register for the setting of the Baud rate and the response delay time in characters.**	**40003**	**R/W**
Bit [15:8]	Set the serial communication speed value (Baudrate): 00000000 (0x00): 4800 Baud 00000001 (0x01): 9600 Baud 00000010 (0x02): 19200 Baud 00000011 (0x03): 38400 Baud (Default). 00000100 (0x04): 57600 Baud 00000101 (0x05): 115200 Baud 00000110 (0x06): 1200 Baud 00000111 (0x07): 2400 Baud		
Bit [7:0]	Set the response delay time in characters that represents the number of pauses of 6 characters each to be entered between the end of the Rx message and the start of the Tx message. Default value: 0 (hexadecimal: 0x00).		
CT_RATIO	**Register for the setting of the coefficient of the CT connected to the instrument.**	**40004**	**R/W**
Bit [15:0]	Set the coefficient for any CT connected to the module. The transformation ratio multiplied by 10 must be entered. This coefficient will influence the floating point value of IRMS, Active Power and Reactive Power, but will not influence the integer (0 - 10000) and retransmission values. Default value: 10.		
FW_CODE	**Register containing the firmware's internal code.**	**40005**	**R**

GROUP 2

VRMS_FLOAT_M	**Vrms voltage measurement in floating point (most significant word)**	40081	R
Bit [15:0]	Vrms voltage measurement in V (MSW).		
VRMS_FLOAT_L	**Vrms voltage measurement in floating point (least significant word)**	40082	R
Bit [15:0]	Vrms voltage measurement in V (LSW).		
IRMS_FLOAT_M	**Irms current measurement in floating point (most significant word).**	40083	R
Bit [15:0]	Irms current measurement in mA (MSW).		
IRMS_FLOAT_L	**Irms current measurement in floating point (least significant word).**	40084	R
Bit [15:0]	Irms current measurement in mA (LSW).		
WATT_FLOAT_M	**Active power measurement in floating point (most significant word).**	40085	R
Bit [15:0]	Active power measurement in W (MSW).		
WATT_FLOAT_L	**Active power measurement in floating point (least significant word).**	40086	R
Bit [15:0]	Active power measurement in W (LSW).		
FREQ_FLOAT_M	**Frequency measurement in floating point (most significant word)**	40087	R
Bit [15:0]	Frequency measurement in Hz (MSW).		
FREQ_FLOAT_L	**Frequency measurement in floating point (least significant word)**	40088	R
Bit [15:0]	Frequency measurement in Hz (LSW).		
VARRMS_FLOAT_M	**Reactive power measurement (in VARrms) in floating point (most significant word).**	40089	R
Bit [15:0]	Reactive power measurement in VARrms (MSW).		

VARRMS_FLOAT_L	**Reactive power measurement (in VARrms) in floating point (least significant word).**	40090	R
Bit [15:0]	Reactive power measurement in VARrms (LSW).		
COSΦ_FLOAT_M	**Cosφ measurement in floating point (most significant word)**	40091	R
Bit [15:0]	Cosφ measurement (MSW).		
COSΦ_FLOAT_L	**Cosφ measurement in floating point (least significant word)**	40092	R
Bit [15:0]	Cosφ measurement (LSW).		

GROUP 3

STATUS	**Status Register**	40093	**R/W**
Bit [15:8]	Entering the hexadecimal value 0x65 (decimal 101) forces the reset of the module.		
Bit 7	*Zero cross error* 1: signals that the input voltage is less than 40 V.		
Bit [6:5]	*Reserved.*		
Bit 4	*Communication error with the sensor:* 1: signals an error of communication with the sensor.		
Bit [3:0]	*Reserved.*		
VRMS_INT	**Register containing the measurement of the Vrms current in 0.. 10000 scale.**	40095	R
Bit [15:0]	Measurement of the Vrms voltage with 0.. 10000 scale.		
IRMS_INT	**Register containing the measurement of the Irms current in 0.. 10000 scale.**	40096	R
Bit [15:0]	Measurement of the Irms current with 0.. 10000 scale.		
WATT_INT	**Register containing the measurement of the active power in 0.. 10000 scale.**	40097	R
Bit [15:0]	Measurement of the active power with 0.. 10000 scale.		

VAR_INT	**Register containing the measurement of the reactive power in -10000..+ 10000 scale.**	40098	R
Bit [15:0]	Measurement of the reactive power with -10000..+10000 scale.		
COSΦ_INT	**Register containing the measurement of cosφ in -10000..+ 10000 scale.**	40099	R
Bit [15:0]	Measurement of cosφ with -10000..+10000 scale.		

APPENDIX A : Measurement and Retransmission Range

100 % Scaling: Measurement and Retransmission Range

Electrical Quantities	Measurement Range	Selectable Retransmission Range
Vrms	0..500 Vac	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Irms	0..5 A	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Active Power	0..2500 W	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Reactive Power	0..2500 VAR	5..10 V, 2,5..5 V, 10..20 mA or 12..20 mA
cosφ	0..1	5..10 V, 2,5..5 V, 10..20 mA or 12..20 mA
Frequency	40..70 Hz	-

50 % Scaling: Measurement and Retransmission Range

Electrical Quantities	Measurement Range	Selectable Retransmission Range
Vrms	0..250 Vac	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Irms	0..2,5 A	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Active Power	0..1250 W	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Reactive Power	0..1250 VAR	5..10 V, 2,5..5 V, 10..20 mA or 12..20 mA
cosφ	0..0,5	5..10 V, 2,5..5 V, 10..20 mA or 12..20 mA
Frequency	40..70 Hz	-

25 % Scaling: Measurement and Retransmission Range

Electrical Quantities	Measurement Range	Selectable Retransmission Range
Vrms	0..125 Vac	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Irms	0..1,25 A	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Active Power	0..625 W	0..10 V, 0..5 V, 0..20 mA or 4..20 mA
Reactive Power	0..625 VAR	5..10 V, 2,5..5 V, 10..20 mA or 12..20 mA
cosφ	0..0,25	5..10 V, 2,5..5 V, 10..20 mA or 12..20 mA
Frequency	40..70 Hz	-