USER MANUAL

Z-TWS11

Z-miniRTU

Multi-protocol Programmable Controller with embedded Analog Inputs

Multi-protocol Programmable Controller with embedded I/O and GSM/GPRS modem

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Date	Version	Changes
	100	First Revision
29/07/2016	101	Added info on Firmware Update chapter

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Z-TWS11/Z-miniRTU

1. Preliminary information / Informazioni preliminari

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2. Z-TWS11/Z-miniRTU

Z-TWS11 and Z-miniRTU are programmable, communication oriented PLCs with embedded IO, Z-miniRTU is equipped also with a quad band GPRS modem for IOT purpose.

The devices are based on a 32bits ARM processor, equipped with a Real Time operating system.

The Z-TWS11 and Z-miniRTU are programmable according to the IEC61131-3 standard by means of the StratON™ environment.

For more info see:

http://www.copalp.com/en/products/straton-ide-integrated-development-environment/index.html

WARNING!

Z-TWS11 and Z-miniRTU needs a file system fat 32 so you MUST have inserted the microSD card.

3. Z-TWS11 Technical specifications

COMMUNICATION PORTS	
RS 485	Maximum Baud rate 115 Kbps COM 4 (screw terminals 10-11-12) COM 2 (IDC10 bus connector)
RS 232	Maximum Baud rate 115 Kbps COM 4 (as an alternative to RS485)
Ethernet	Ethernet 10/100 Mbps RJ45 connectors on front-panel Maximum connection length 100 m.
USB #1 HOST	Plug-in: micro USB (COM16)
Embedded Analog Inputs	
NR 2 Analog Inputs	Each configurable from 0 to 30 V or from 0 to 20 mA
CPU and memory	
Microprocessor	ARM 32 BIT
Slot for external memory	Micro SD card: up to 32 Gbytes

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FeRAM	Available 4096 bytes (infinity writeable not volatile RAM)
StratON Program size	MAX 248 KBytes
StratON RAM memory (variables)	MAX 38 KBytes
SERVICES/PROTOCOLS	
Protocols and Services	Protocols support: Modbus RTU salve, Modbus RTU Master, Modbus TCP-IP Server (slave), Modbus TCP-IP Client (master).Webserver (customizable), FTP client. Http post. NTP client, Support for custom protocols. SMTP client.

4. Z-miniRTU Features

COMMUNICATION PORTS	
RS 485	Maximum Baud rate 115 Kbps COM 4 (screw terminals 10-11-12) COM 2 (IDC10 bus connector)
RS 232	Maximum Baud rate 115 Kbps COM 4 (as an alternative to RS485)
Ethernet	Ethernet 10/100 Mbps RJ45 connectors on front-panel Maximum connection length 100 m.
USB #1 HOST	Plug-in: micro USB (COM16)
GSM/GPRS MODEM	•Quad-Band 850/ 900/ 1800/ 1900 MHz •GPRS multi-slot class 10/8 •GPRS mobile station class B •Compliant to GSM phase 2/2+ – Class 4 (2 W @850/ 900 MHz) – Class 1 (1 W @ 1800/1900MHz) •GPRS class 10: max. 85.6 kbps (downlink) •PBCCH support •Coding schemes CS 1, 2, 3, 4 •PPP-stack Specifications for SMS via GSM/GPRS •Point to point MO and MT •SMS cell broadcast •Text and PDU mode

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	StratOn libraries for use PPP connection, send email/ftp, send audio alarms, send/receive sms, http post, etc…
Embedded I/O	
NR 2 Analog Inputs	Configurable from 0 to 30 V or from 0 to 20 mA
NR 4 Digital Inputs	Configurable into PNP or NPN mode NR 4 counters/totalizer (max sampling rate 1ms)
NR 2 Digital Outputs	2 Digital Output relays
CPU and memory	
Microprocessor	ARM 32 Bit
Slot for external memory	Micro SD card: up to 32 Gbytes
FeRAM	Available 4096 bytes (infinity writeable not volatile RAM)
StratON Program size	MAX 248 KBytes
StratON RAM memory (variables)	MAX 38 KBytes
SERVICES/PROTOCOLS	
Protocols and Services	Protocols support: Modbus RTU salve, Modbus RTU Master, Modbus TCP-IP Server (slave), Modbus TCP-IP Client (master). Webserver (customizable), FTP client. Http post. NTP client, Support for custom protocols. SMTP client. PPP protocol supported.

5. Limitations

The number of sockets in the 502 port is limited to 3 (for example NR 3 modbus TCP-IP client)

The Workbench use 2 sockets so when is connected only 1 Modbus TCP-IP client is allowed.

The webserver accept only 1 connection at a time.

The Modbus TCP-IP port must be the same of the StratON Workbench (default port 502).

The number of files into the same microSD card directory must be lower than 500.

The maximum size of PLC Retain Memory is limited to 4096 bytes (infinity writeable NVRAM).

The maximum size of PLC Program is limited to 248 Kbytes.

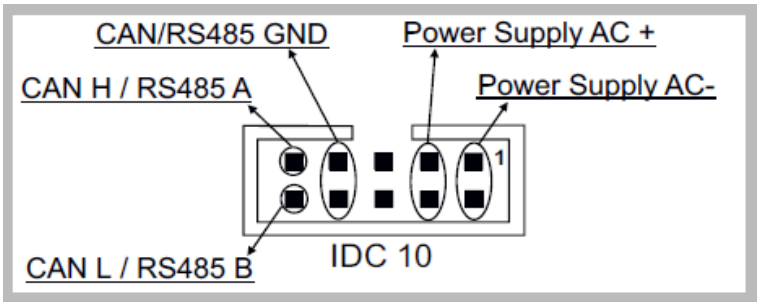
The maximum size of PLC RAM Variables is limited to 38 Kbytes.

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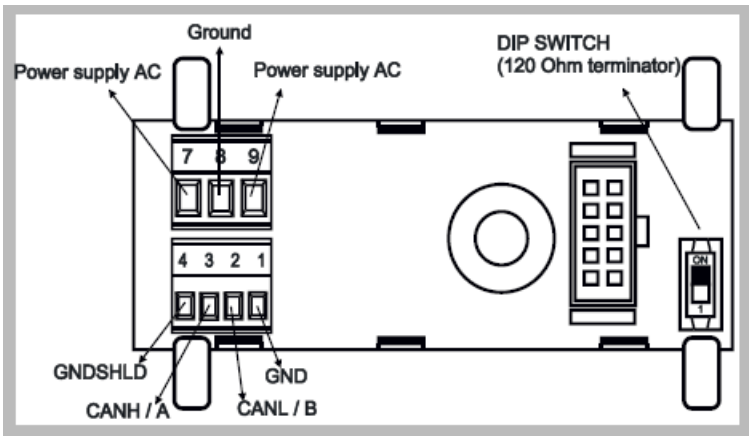
6. Connections

6.1. POWER SUPPLY, SERIAL PORT COM 2, micro USB, micro SD

Power Supply and Serial interface are available by using the bus for the Seneca DIN rail, by the rear IDC10 connector or by Z-PC-DINAL1-35 accessory. The following picture shows the meaning of the IDC10 connector pins. Power supply is available only from the rear connector.



If Z-PC-DINAL1-35 accessory is used, the power supply signals and communication signals may be provided by the terminals block into the DIN rail support. In the following figure the meaning and the position of the terminal blocks are shown. The DIP-switch that sets the 120 Ω terminator is used only for CAN communication (don't use for normal RS485 communication).

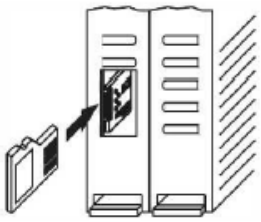


The Z-TWS11/Z-miniRTU has two RS 485 serial ports for Modbus communication, the port COM4 can also been configured in RS232.

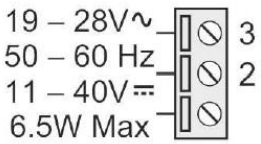
The Z-TWS11/Z-miniRTU has a USB connector, with micro-USB plug-in, that can be used to connect to a PC (virtual com mode) (for this functionality, the USB driver supplied by Seneca has to be installed on the PC).

The Z-TWS11/Z-miniRTU has a plug-in connector for micro SD card placed in the side part of the case.
To insert the SD card into the connector, be sure that the SD card is oriented with metal contacts facing towards left.

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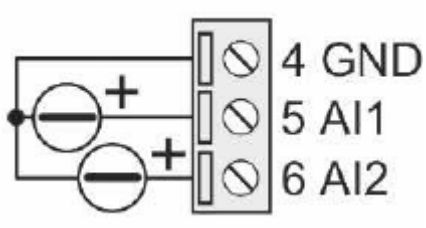


Power Supply can also be connected from the Clamp 2-3 without using the Z-PC-DINAL1-35 accessory:

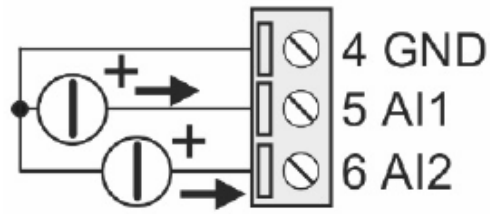


6.2. Analog Inputs

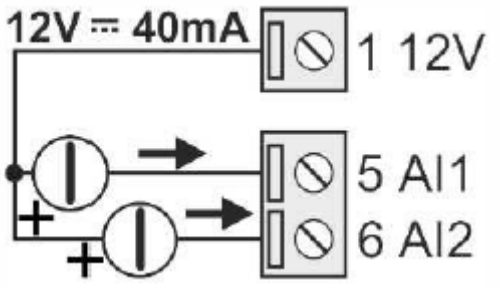
Connection for Voltage (0-30V):



Connection for Current (0-20mA):



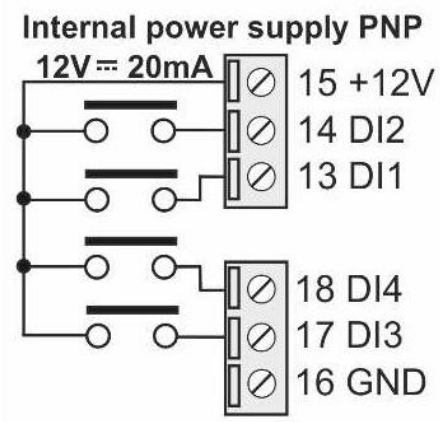
Connection for Current (2 wires) (0-20mA 12V):



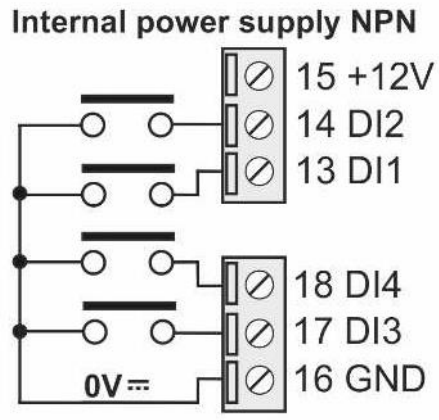
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6.3. Digital Inputs (Only Z-miniRTU)

Connection for Digital Inputs in PNP mode configuration:

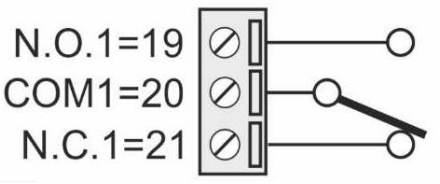


Connection for Digital Inputs in NPN mode configuration:



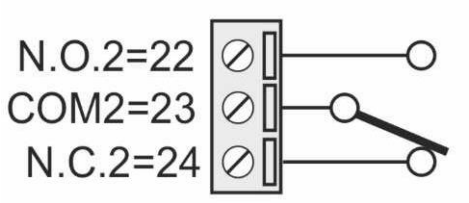
6.4. Digital Outputs (Only Z-miniRTU)

Connection for Digital Output 1:



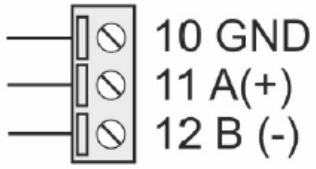
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Connection for Digital Output 2:

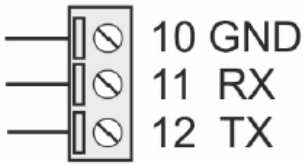


6.5. Serial port COM4

DIP SWITCH SW2 = OFF (RS485 mode):

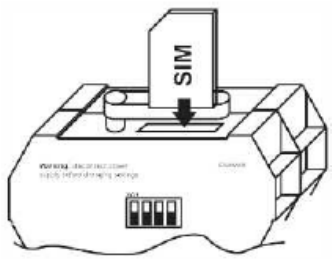


DIP SWITCH SW2 = ON (RS232 mode):



6.6. SIM CARD (Only Z-miniRTU)

Insert a SIM card like in figure:



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SIM (mini SIM format) must be compatible with the 2G network. For using the Audio Feature the SIM must be compatible also with the voice calls.

7. FACTORY DEFAULT

For reset all parameters to default put all dip switches to ON, then power on the board.

When the board is started, after 10 seconds power down the board then put all dip switches SW1 to OFF.

The default communication parameters are:

DHCP disabled
IP address: 192.168.90.101
IP MASK: 255.255.255.0
IP GATEWAY: 192.168.90.1
DNS: 192.168.90.1
Webserver authentication: User admin Password admin
Webserver port 80

8. LEDs signalling

8.1. Z-miniRTU LEDs

LED	*STATUS*	*LEDs meaning*
DO1 Red	ON	Digital output 1, relay energized
	OFF	Digital output 1, relay de-energized
DO2 Red	ON	Digital output 2, relay energized
	OFF	Digital output 2, relay de-energized
485 ACT Green	Blinking	RS485 activity
GSM Yellow	OFF	GPRS Modem OFF
	Slow blinking	Connected to the GSM network
	Medium blinking	Searching the GSM or GPRS network
	Fast blinking	Connected to the GPRS network
DI1 Red	ON	Digital Input 1: Energized (closed contact)
	OFF	Digital Input 1: De-energized (open contact)

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DI2 Red	ON	Digital Input 2: Energized (closed contact)
	OFF	Digital Input 2: De-energized (open contact)
DI3 Red	ON	Digital Input 3: Energized (closed contact)
	OFF	Digital Input 3: De-energized (open contact)
DI4 Red	ON	Digital Input 4: Energized (closed contact)
	OFF	Digital Input 4: De-energized (open contact)
DI1+D2+D3+D4	Blinking	PLC program not present
PWR/STS Green	ON	Z-miniRTU ON
	OFF	Z-miniRTU OFF
	Blinking	Z-miniRTU powered from internal batteries (UPS mode)
SD/STS Red	Blinking	Micro SD card access
ETH LNK Green	Blinking	RJ45 connection activated
ETH ACT Yellow	Blinking	Traffic on Ethernet port

8.1. Z-TWS11 LEDs

LED	**STATUS**	**LED meaning**
PWR	ON	External Line Powered
TX1 RX1 TX2 RX2	BLINKING	No StratON program loaded
TX1	ON	COM2 in transmission
RX1	ON	COM2 in receive
TX2	ON	COM4 in transmission
RX2	ON	COM4 in receive
SD	ON	Access to microSD card
ETH TRF	ON	Ethernet Traffic
ETH LNK	ON	Ethernet Link

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9. Z-NET and StratON environment

Z-Net is an integrated environment that allows the IO Seneca configuration and the program variables export to Straton.

For more info about Z-NET refers to the User Manual.

9.1. StratON environment

Z-NET can be used for configure Z-miniRTU/Z-TWS11 and it's integrated with StratON.

StratON provides the full support for IEC 61131-3 PLC Standard.

The StratON Integrated Development Environment includes several tools such as: a fieldbus configuration tool, an analog signal editor and editors compliant with the five languages of the IEC 61131-3 Standard: Sequential Function Chart (SFC), Function Block Diagram (FBD), Ladder Diagram (LD), Structured Text (ST), Instruction List (IL).

With StratON IDE, it's simple to write, download and debug IEC 61131-3 code.

9.2. Seneca StratON package

Seneca provides a package that automatically install the Z-NET/StratON environment with libraries and tools.

Download Seneca StratON package from Seneca website.

10. QUICK START WITH THE FIRST PROGRAM

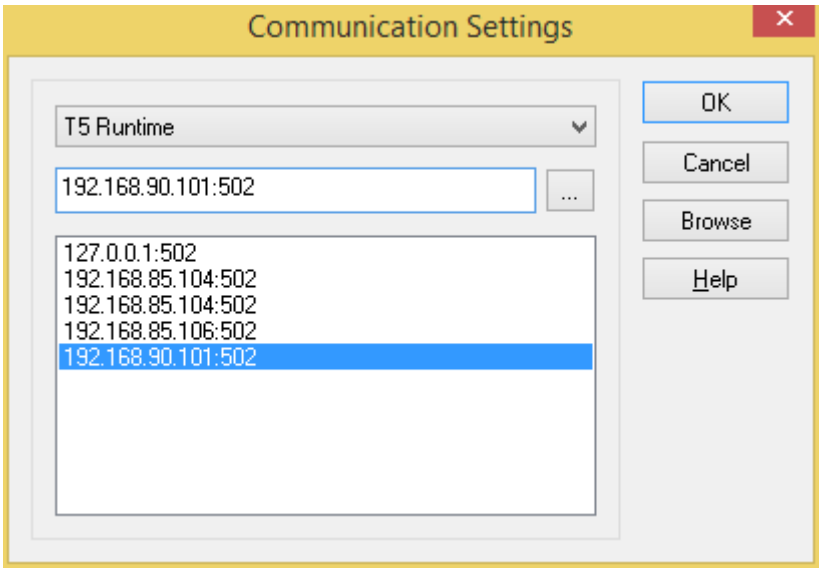
1) Install Seneca StratON Package from www.seneca.it in the Z-miniRTU/Z-TWS11 section
2) Launch Z-NET4
3) Configure the Z-miniRTU/Z-TWS11
4) Compile and send the project to Z-miniRTU/Z-TWS11 with the icon 
5) Passare al Workbench di Straton con il pulsante , il progetto sarà aperto in automatico

10.1. Writing, downloading and running the first program

In Straton set the correct target IP address (for example 192.168.90.101 instead of 10.0.0.14);

the deafult port is 502:

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Then press the icon  to compile the project.

Download the code by pressing the icon .

11. Maintenance Web Configuration Pages

Z-TWS11/Z-miniRTU can be fully configured by means of a set of web configuration pages.

To access to the configuration site, you must enter in the browser the IP address, default:

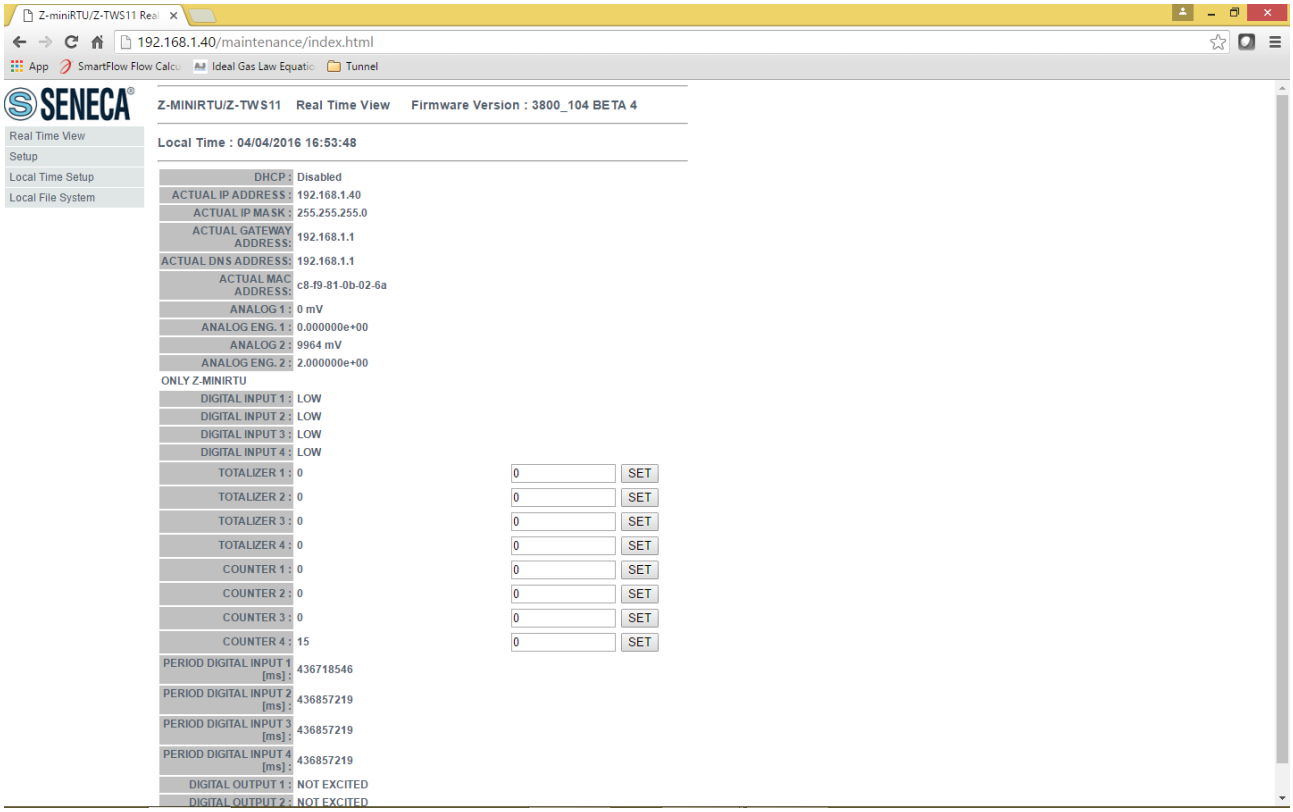
http://192.168.90.101/maintenance/index.html

and, when asked, provide the following credentials , default:

Username: admin
Password: admin

You come to the following page:

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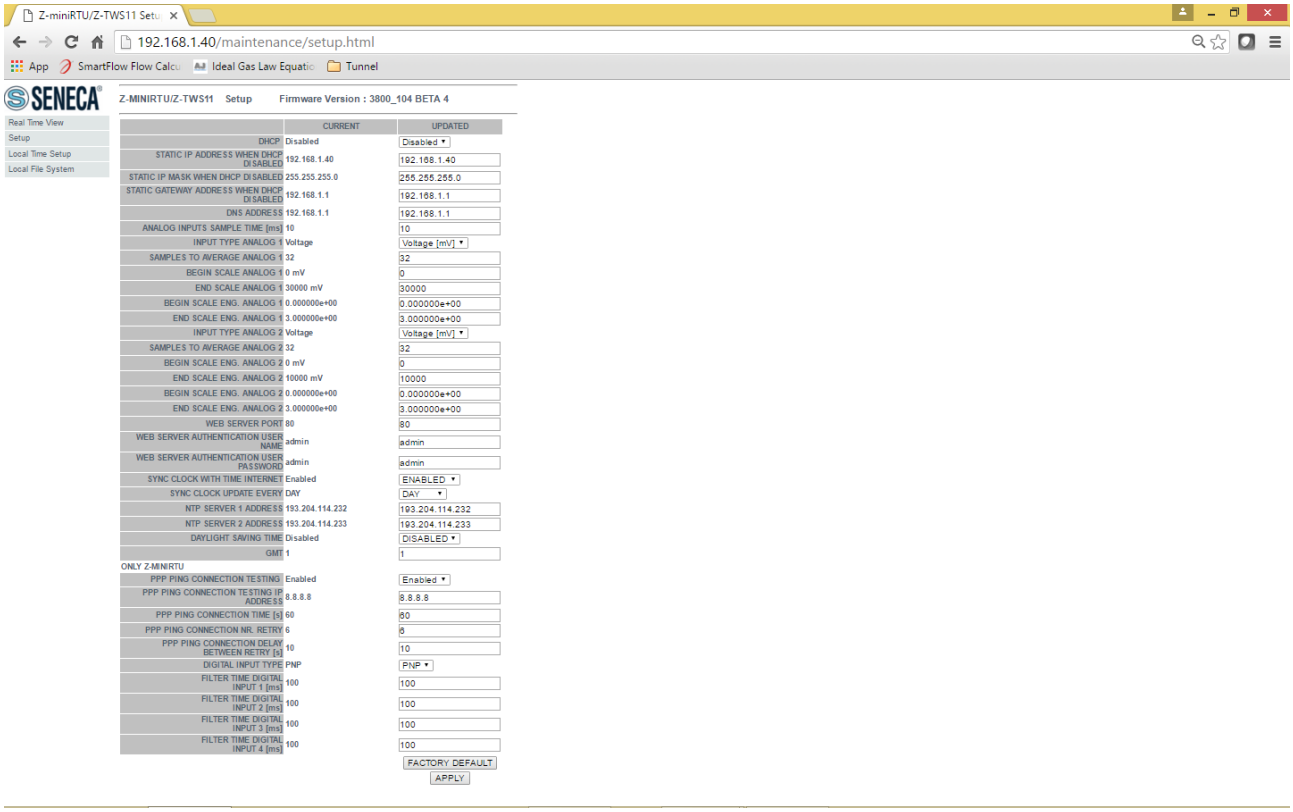


In this page, all configuration parameters are shown, with their current values.

The “RESET” button can be used to perform a reboot.

To change the parameter values, you have to go to the “Setup” page.

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In the following table, configuration parameters are listed with a brief explanation.

11.1. Z-miniRTU Setup Parameters

Z-miniRTU / Z-TWS11 Setup Parameters	
Field	**Meaning**
DHCP	Enable or Disable the Dynamic Host Configuration Protocol Client for obtaining the IP/MASK/GATEWAY and DNS automatically from the DHCP server
IP ADDRESS	Static IP address
IP MASK	Static Network mask
GATEWAY ADDRESS	Static Gateway address
DNS ADDRESS	DNS server address
ANALOG INPUTS SAMPLE TIME [ms]	Sampling time for the analog inputs
INPUT TYPE ANALOG 1	Select from Voltage (0-30V) or current (0-20 mA)

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SAMPLES TO AVERAGE ANALOG 1	Average samples number fo analog 1. Number of elements for the mobile average. Higher values will improve stability but will slow down the measurement
BEGIN SCALE ANALOG 1	Begin Scale value
END SCALE ANALOG 1	End Scale value
BEGIN SCALE ENG. ANALOG 1	Engineering value for the Start scale
END SCALE ENG. ANALOG 1	Engineering value for the Stop scale Example: Start Scale value = 0 mV Begin Engineering value = -50°C Stop Scale value = 10000 mV Begin Engineering value = 200°C
INPUT TYPE ANALOG 2	Select from Voltage (0-30V) or current (0-20 mA)
SAMPLES TO AVERAGE ANALOG 2	Average samples number fo analog 2. Number of elements for the mobile average. Higher values will improve stability but will slow down the measurement
BEGIN SCALE ANALOG 2	Begin Scale value
END SCALE ANALOG 2	End Scale value
BEGIN SCALE ENG. ANALOG 2	Engineering value for the Start scale
END SCALE ENG. ANALOG 2	Engineering value for the Stop scale Example: Start Scale value = 0 mV Begin Engineering value = -50°C

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	Stop Scale value = 10000 mV Begin Engineering value = 200°C
WEBSERVER PORT	Webserver port to be used
WEB ADMIN USERNAME	Username for access the webserver
WEB ADMIN PASSWORD	Password for access the webserver
SYNC CLOCK WITH INTERNET TIME	Flag to enable/disable the time synchronization by means of the Network Time Protocol (NTP)
SYNC CLOCK UPDATE EVERY	How often perform the time synchronization
NTP SERVER 1	IP address or name for the Primary NTP Server
NTP SERVER 2	IP address or name for the Secondary NTP Server
DAYLIGHT SAVING TIME	Enable or Disable the automatic Daylight saving time (European)
GMT	Offset for local time. For example: GMT 0 = London GMT +1 = Rome Etc…
PPP PING CONNECTION TESTING	Enable or Disable the automatic ping test for the PPP (GPRS Modem) connection. When the ping fails the firmware automatically renew the GPRS connection The PPP connection must be enabled from the PLC program.
PPP PING CONNECTION TESTING IP ADDRESS	IP to ping
PPP PING CONNECTION TIME [s]	Pause between two ping
PPP PING CONNECTION NR. RETRY	Number of pings that must

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	be bad for generate a fail condition
PPP PING CONNECTION DELAY BETWEEN RETRY [s]	Delay between two ping retry
DIGITAL INPUTS TYPE	Configure all 4 Inputs from NPN or PNP mode
FILTER DIGITAL INPUT 1 [ms]	Filter on inputs 1 [ms]
FILTER DIGITAL INPUT 2 [ms]	Filter on inputs 2 [ms]
FILTER DIGITAL INPUT 3 [ms]	Filter on inputs 3 [ms]
FILTER DIGITAL INPUT 4 [ms]	Filter on inputs 4 [ms]

In the “Setup” page, you can change any of the above parameters; to apply the changes, press the “Apply” button; this saves the changes and performs a reboot.

If needed, you can restore factory default values for all parameters, by pressing the “FACTORY DEFAULT” button.

If you need to change the date/time settings, go to the “Real Time Clock Setup” page; please note that this makes sense if time synchronization by means of the NTP protocol is not enabled.

11.1. Z-TWS11 Setup Parameters

Z-miniRTU / Z-TWS11 Setup Parameters	
Field	**Meaning**
DHCP	Enable or Disable the Dynamic Host Configuration Protocol Client for obtaining the IP/MASK/GATEWAY and DNS automatically from the DHCP server
IP ADDRESS	Static IP address
IP MASK	Static Network mask
GATEWAY ADDRESS	Static Gateway address
DNS ADDRESS	DNS server address
ANALOG INPUTS SAMPLE TIME	Sampling time for the analog

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[ms]	inputs
INPUT TYPE ANALOG 1	Select from Voltage (0-30V) or current (0-20 mA)
SAMPLES TO AVERAGE ANALOG 1	Average samples number fo analog 1. Number of elements for the mobile average. Higher values will improve stability but will slow down the measurement
BEGIN SCALE ANALOG 1	Begin Scale value
END SCALE ANALOG 1	End Scale value
BEGIN SCALE ENG. ANALOG 1	Engineering value for the Start scale
END SCALE ENG. ANALOG 1	Engineering value for the Stop scale Example: Start Scale value = 0 mV Begin Engineering value = -50°C Stop Scale value = 10000 mV Begin Engineering value = 200°C
INPUT TYPE ANALOG 2	Select from Voltage (0-30V) or current (0-20 mA)
SAMPLES TO AVERAGE ANALOG 2	Average samples number fo analog 2. Number of elements for the mobile average. Higher values will improve stability but will slow down the measurement
BEGIN SCALE ANALOG 2	Begin Scale value
END SCALE ANALOG 2	End Scale value
BEGIN SCALE ENG. ANALOG 2	Engineering value for the Start scale
END SCALE ENG. ANALOG 2	Engineering value for the Stop scale Example:

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	Start Scale value = 0 mV Begin Engineering value = -50°C Stop Scale value = 10000 mV Begin Engineering value = 200°C
WEBSERVER PORT	Webserver port to be used
WEB ADMIN USERNAME	Username for access the webserver
WEB ADMIN PASSWORD	Password for access the webserver
SYNC CLOCK WITH INTERNET TIME	Flag to enable/disable the time synchronization by means of the Network Time Protocol (NTP)
SYNC CLOCK UPDATE EVERY	How often perform the time synchronization
NTP SERVER 1	IP address or name for the Primary NTP Server
NTP SERVER 2	IP address or name for the Secondary NTP Server
DAYLIGHT SAVING TIME	Enable or Disable the automatic Daylight saving time (European)
GMT	Offset for local time. For example: GMT 0 = London GMT +1 = Rome Etc…

In the “Setup” page, you can change any of the above parameters; to apply the changes, press the “Apply” button; this saves the changes and performs a reboot.

If needed, you can restore factory default values for all parameters, by pressing the “FACTORY DEFAULT” button.

If you need to change the date/time settings, go to the “Real Time Clock Setup” page; please note that this makes sense if time synchronization by means of the NTP protocol is not enabled.

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11.2. CUSTOM WEBSERVER

Z-TWS11/Z-miniRTU products support a custom webserver pages.

The html pages must be copied into the

"/web" microSD card directory.

For access to the custom webserver simply type the ip address (If the webserver port is 80, and the default address)

http://192.168.90.101

12. Internal Backup Battery (UPS) mode (Only Z-miniRTU)

The Z-miniRTU is equipped with an internal UPS that act as a backup power source. When there is a power fail the "pshutdown" StratON function is called.

Here the code can unmount the micro SD card file system and then shutdown the Z-miniRTU in a safe mode.

If a "forced" power off is needed press for 5 seconds the button PS1, then the Z-miniRTU will shutdown automatically.

Note that the Date/Hour will be maintained because the clock is always powered.

The Z-miniRTU can be powered with the internal UPS for several hours, when the battery will be lower than 2V the Z-miniRTU will shutdown in safe mode autonomously for preserve the battery.

A complete battery recharge require about 48 hours.

13. Writing data to a microSD card with Z-TWS11 (Only Z-TWS11)

The Z-TWS11 is NOT equipped with an internal UPS so, when there is a power fail and the Z-TWS11 is writing into the micro SD card **the file system can be corrupted**.

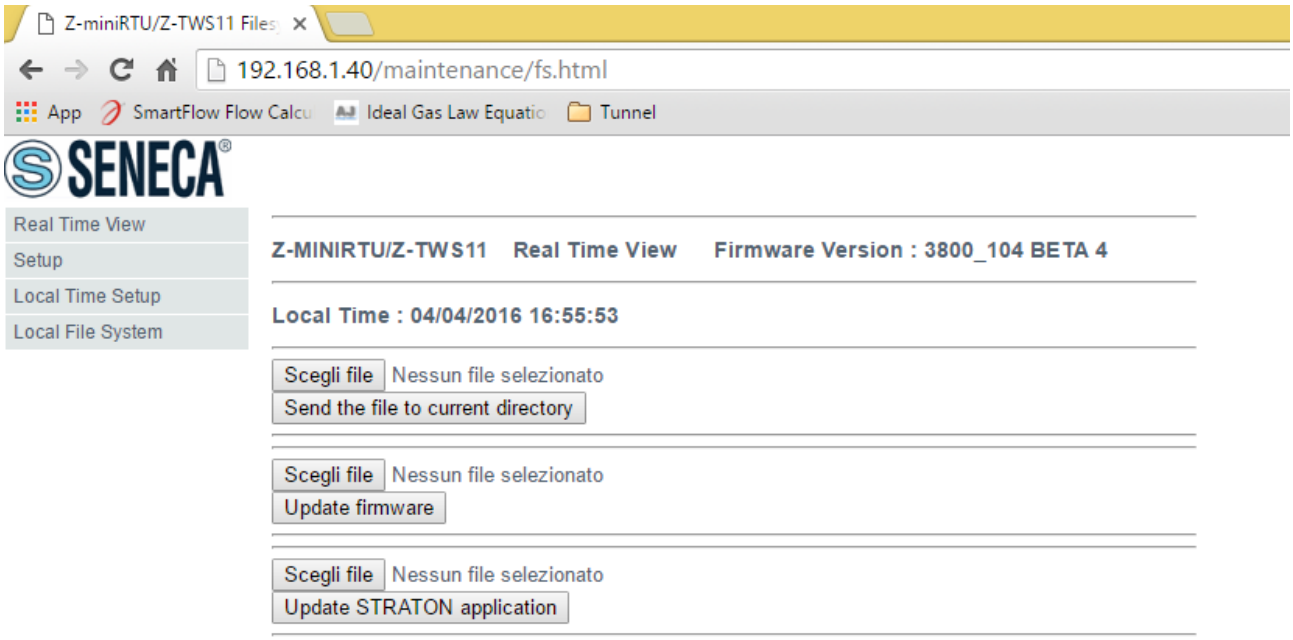
In this case an external UPS is highly recommended, the power fail UPS output pin must be connected to an external IO device (for example a Modbus RTU/TCP-IP slave), then the "pshutdown" StartON function can be called for a safe shutdown.

Note that the Date/Hour will be maintained because the clock is always powered by the internal battery.

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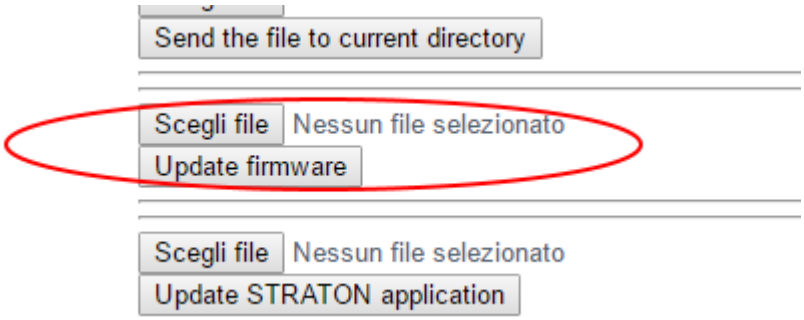
14. Firmware / PLC Program Update

The Local File system in the webserver section can be used for upload a generic file or for firmware/program update.



14.1. Firmware Update from Webserver

Select a new firmware “ztwsrtu.bin” on your hard disk, then press the “Update firmware” button:



Don’t power down the Z-miniRTU/Z-TWS11 board until the firmware update process is complete!

When the file is copied the update procedure will automatically starts.

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WARNING!

Note that the file name MUST be "ztwsrtu.bin", the RTU will only accept this filename for the update process.

14.2. Firmware Update from SD card

Power off the Z-miniRTU / Z-TWS11.

Extract the SD card.

Format the SD card and Copy the file "ztwsrtu.bin" to the root directory.

Insert the SD card.

Power on the Z-miniRTU / Z-TWS11.

The update procedure will start automatically.

At the end power off the Z-miniRTU / Z-TWS11.

Extract the SD card from Z-miniRTU / Z-TWS11.

Format the SD card.

Insert the SD card into Z-miniRTU / Z-TWS11.

WARNING!

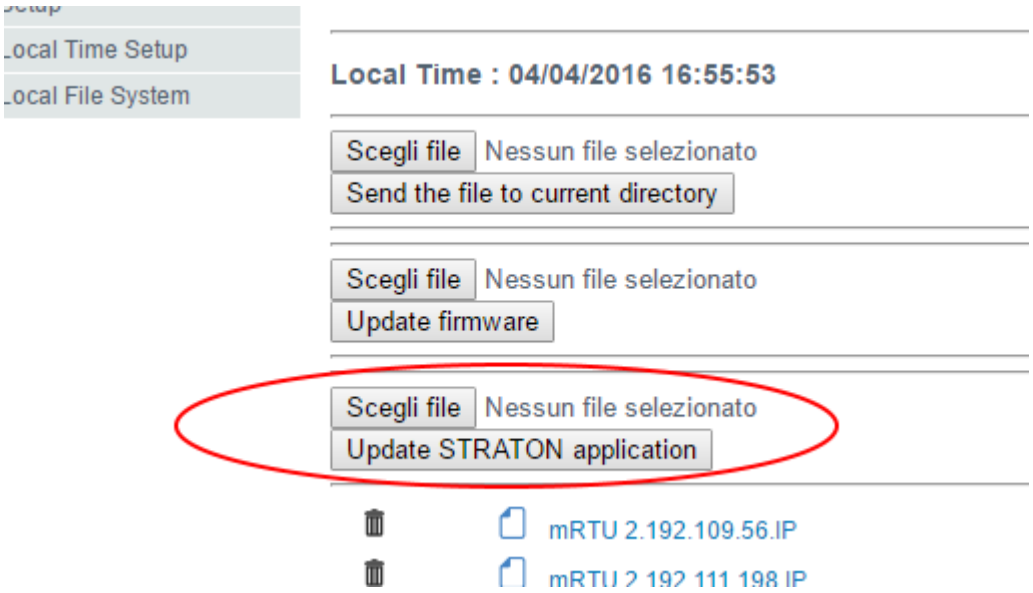
Note that the file name MUST be "ztwsrtu.bin", the RTU will only accept this filename for the update process.

14.3. PLC Application Update from the Webserver

Use the software "Seneca XTI to BIN" for convert the StratON "APPLI.XTI" file to the output file "program.bin".

Then, in the webserver upload the "program.bin" Straton application file

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When the file is uploaded the procedure will automatically starts.

WARNING!

Note that the file name MUST be "program.bin", the RTU will only accept this filename for the update process.

14.4. PLC application update from SD card

Use the software "Seneca XTI to BIN" for convert the StratON "APPLI.XTI" file to the output file "program.bin".

Power off the Z-miniRTU / Z-TWS11.

Extract the SD card.

Format the SD card and Copy the file "program.bin" to the root directory.

Insert the SD card.

Power on the Z-miniRTU / Z-TWS11.

The update procedure will start automatically.

At the end power off the Z-miniRTU / Z-TWS11.

Extract the SD card from Z-miniRTU / Z-TWS11.

Format the SD card.

Insert the SD card into Z-miniRTU / Z-TWS11.

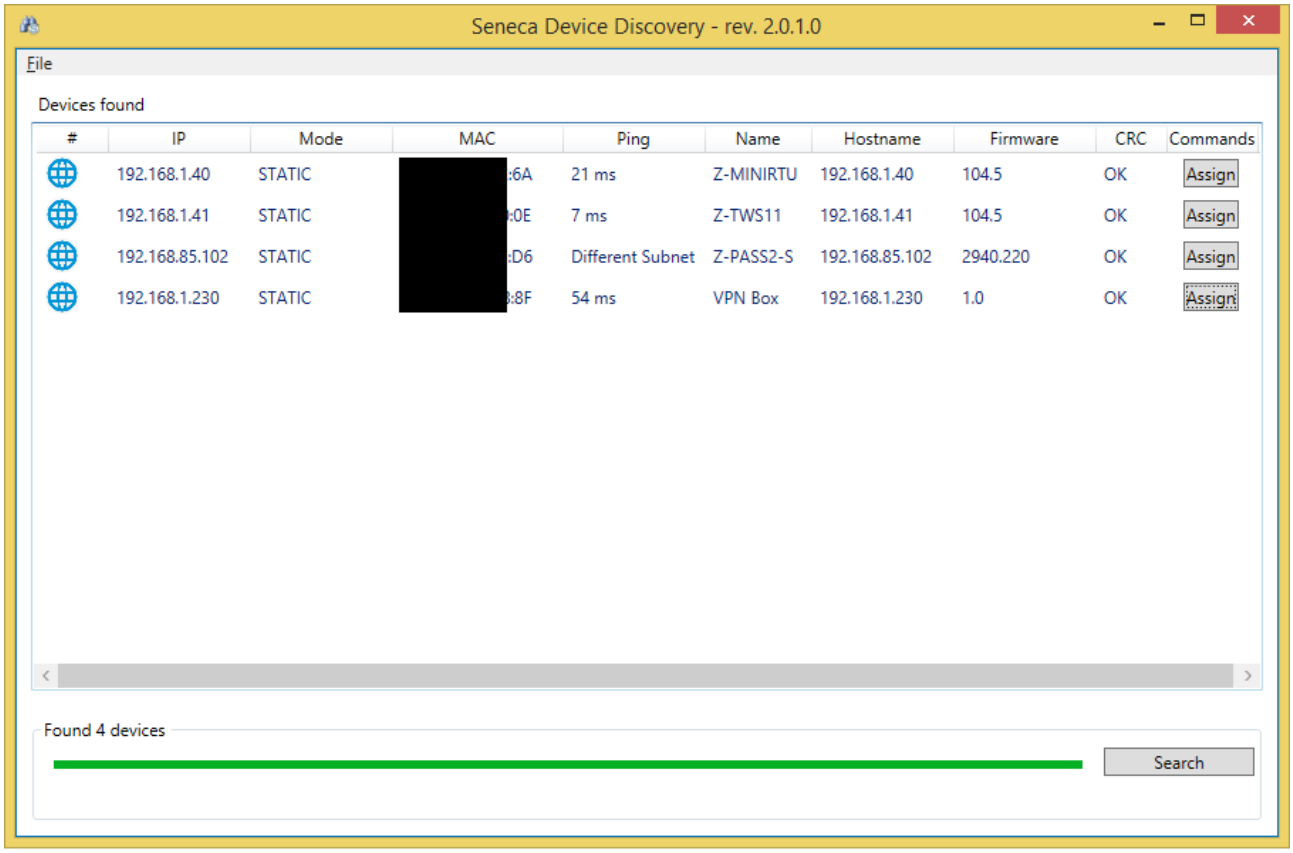
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WARNING!

Note that the file name MUST be "program.bin", the RTU will only accept this filename for the update process.

15. Seneca Discovery Utility

Seneca discovery utility can be used for obatin the actual Z-miniRTU/Z-TWS11 IP address also if you are in a different network configuration:



Depending of the firmware version is also possible to change directly the board Network configuration.

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