DY-5121
Protocol Converter
ModBUS TCP/RTU WebSCADA
User Manual

Revision 1.0

Ascon spa
Via Falzarego, 9/11
201021 Baranzate
(Milano) Italy
Tel.: +39 02 333 371
Fax: +39 02 350 4243

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REVISION LIST:

Revision	Date	Author	Chapter	Description
1.00	4/2006	ASCON	All	First release

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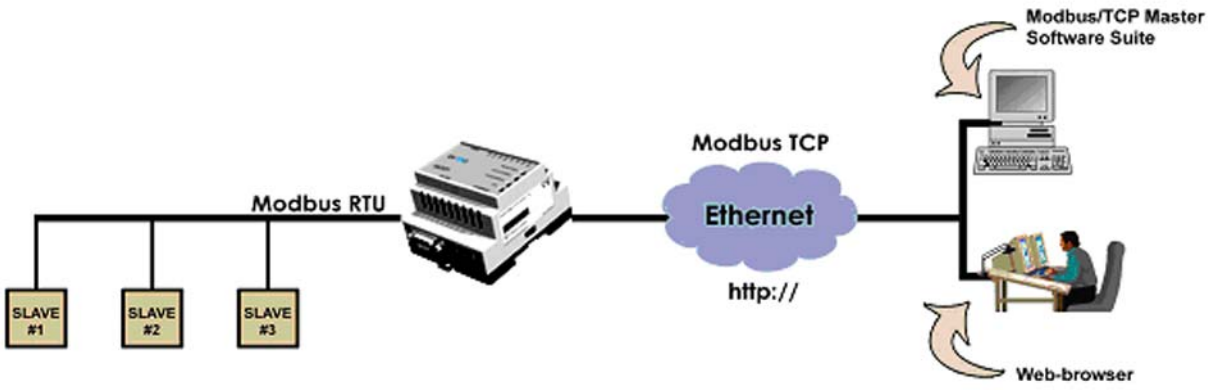
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1 About the Modbus Protocol converter

1.1 General

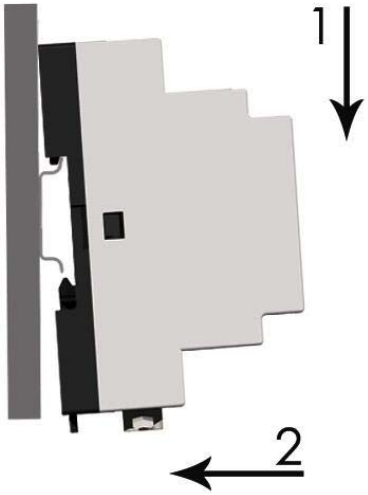
The protocol converter webSCADA device can be used to connect a Modbus/TCP master to one or several Modbus/RTU slaves and also view Modbus registers on a web-page. The module has a simple configuration interface to define which registers will be viewed on the web-pages. It also contains an alarm-handler to send alarms via email or SMS (requires a GSM-modem) and logging capabilities.



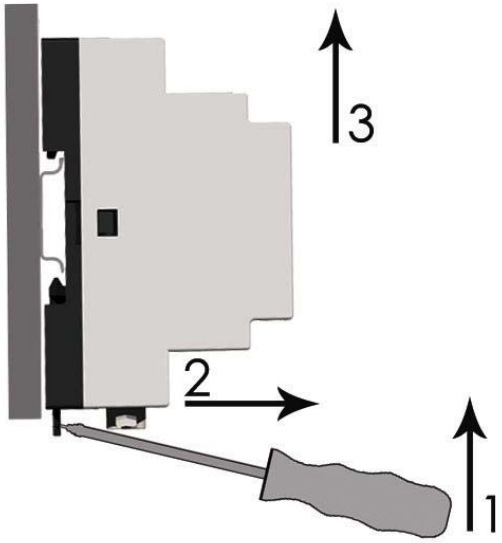
The protocol converter Modbus TCP/RTU supports an RS-232 connection through a 9-pole DSUB or RS-485 through an RJ12 connector. It also supports 10/100Mbps Ethernet through a standard Ethernet connector (RJ-45).
It can be configured via a user-friendly web-interface or by using the Config utility.

1.2 Mounting

A – Snap on



B – Snap off



1 – Snap the device on the DIN-rail (as described in picture A above).

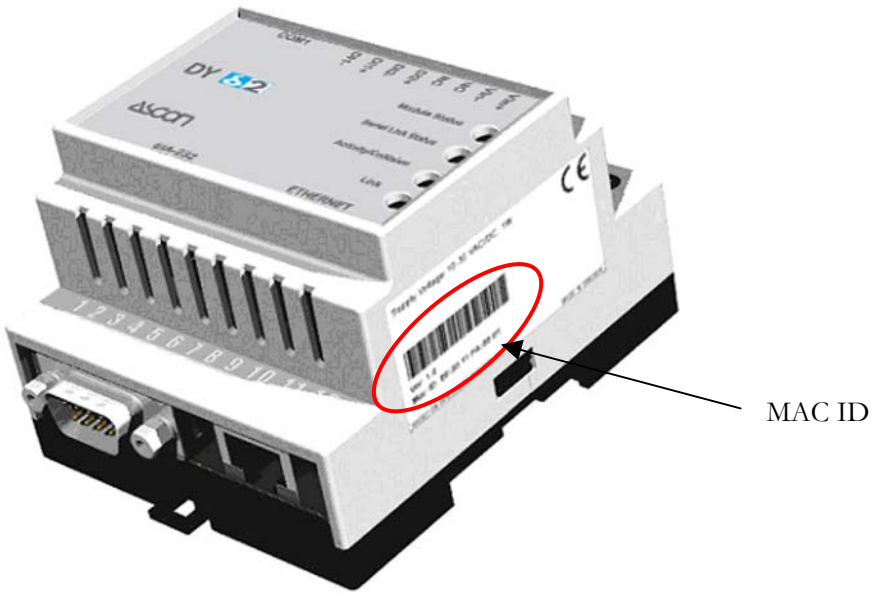
2 – Connect the Ethernet cable to the RJ45 connector.

3 – Connect the ModbusRTU network to the DSUB connector (RS-232) or the 6-pole RJ12 connector (RS-485).

4 – Connect the Power Supply and apply power.

5 – Now you can start using the Protocol converter. Use the “DY5xx1 Config Utility” to configure the IP address and other network settings. See section 2.1 for further information.

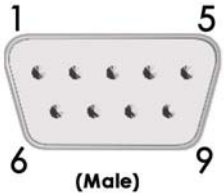
The default IP address of the webSCADA Protocol converter is 10.200.1.X, where X is the last number of the MAC ID (Can be found on a label on the device).



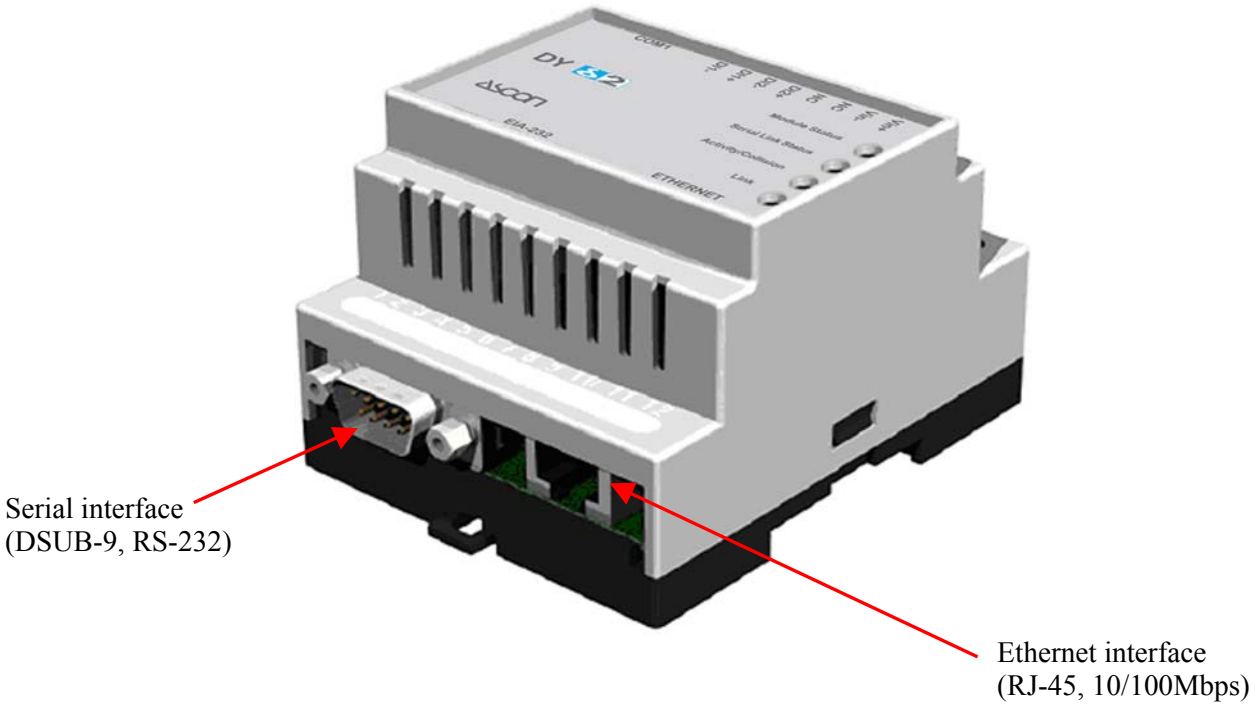
1.3 Connectors

1.3.1 ModbusRTU interface, RS-232

The 9-pole DSUB, male connector on the device contains an RS-232 interface. This port can be used to connect any equipment with an RS-232 interface.

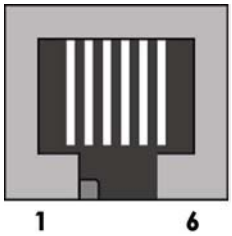


Pin number	Function
1	Not used
2	Rx (Receive)
3	Tx (Transmit)
4	Not used
5	GND
6	Not used
7	Not used
8	Not used
9	Not used

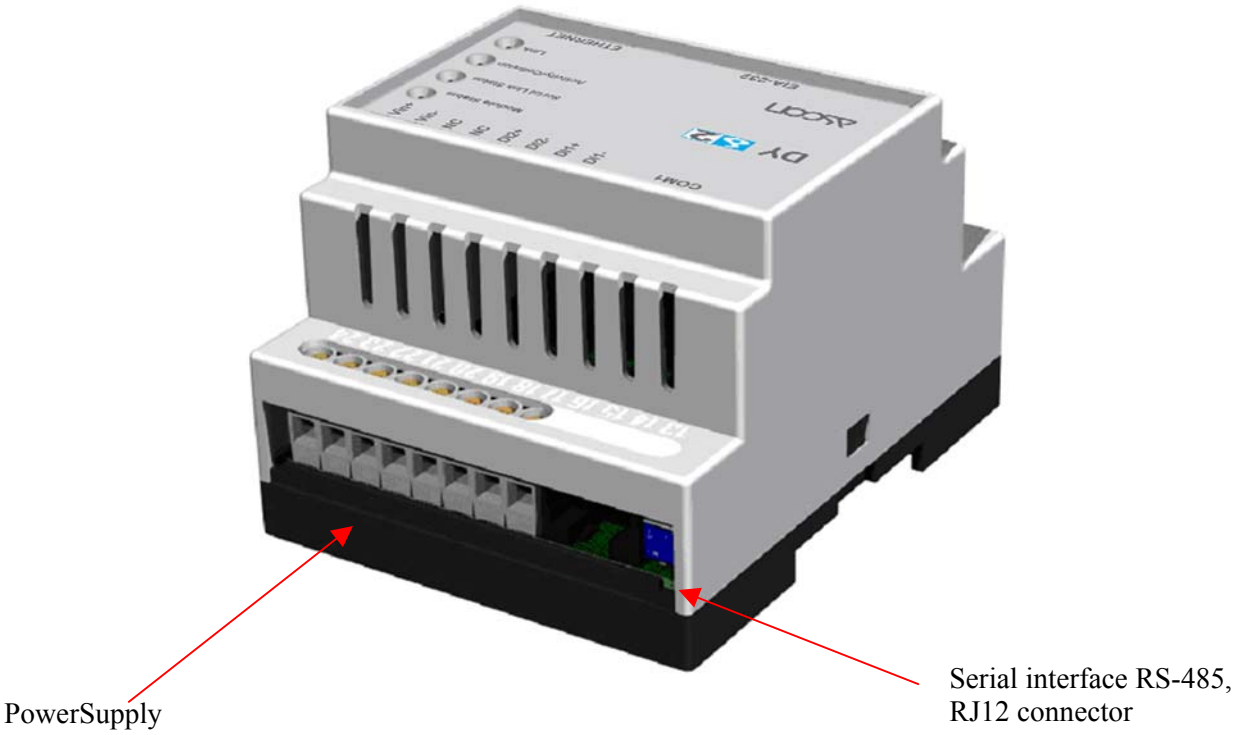


1.3.2 ModbusRTU interface, RS-485

The 6-pole RJ-12 connector contains an RS-485 interface. This port can be used to connect to any equipment with an RS-485 interface.



Pin number	Function
1	RS-485, Line A
2	RS-485, Line B
3	Common
4	Common
5	Not connected
6	Not connected



1.3.3 Ethernet interface

The Ethernet interface supports 10/100Mbps, using a standard RJ-45 connector.

1.3.4 Power supply connection

The device can be powered by a 9-32VAC/DC supply (Power requirement 1.7W).

1.3.5 Digital inputs

The digital inputs are opto-isolated, and can accept a 10-24VDC signal for logic HIGH input.
For logic LOW the voltage should be in the range 0-2VDC.

The status of the inputs can be read in the Protocol converter Internal Registers (if enabled). See section 4.8.1 for more information.

Pin number	Function
24	Vin+
23	Vin- (Ground connection)
22	Not Used
21	Not Used
20	Digital in 2+
19	Digital in 2-
18	Digital in 1+
17	Digital in 1- (Digital in1- and Digital in2- are internally tied together)

1.4 Indicators



LED functionality

Name	Colour	Function
Module Status	OFF	No power
	Green	Module is running in normal mode
	Orange	Hardware fault
	Flashing orange	Error during initialization
Serial Link Status	Flashing Green	Serial Packet receive
	Flashing Red	Serial Packet transmit
	Orange	During boot-up
Ethernet Activity/Collision	Flashing Green	Ethernet Packet received
	Flashing Red	Ethernet Collision detected
Link	OFF	No Ethernet Link detected
	Green	Ethernet network detected, 10Mbps
	Orange	Ethernet network detected, 100Mbps

2 Getting started

2.1 Configure the device IP-address

2.1.1 About the Config utility

The Config utility is a PC-based configuration utility to set TCP/IP network settings in the device. This utility has the ability to scan the Ethernet network to find the connected devices and let the user set IP-address, net mask, protocol converter, DNS and hostname for each unit.

2.1.2 Installation

System Requirements

- Pentium 133 MHz or higher
- 5 Mb of free space on the hard drive
- Win 95/98/ME/NT/2000/XP
- Network Interface Card (Ethernet)

Installation Procedure

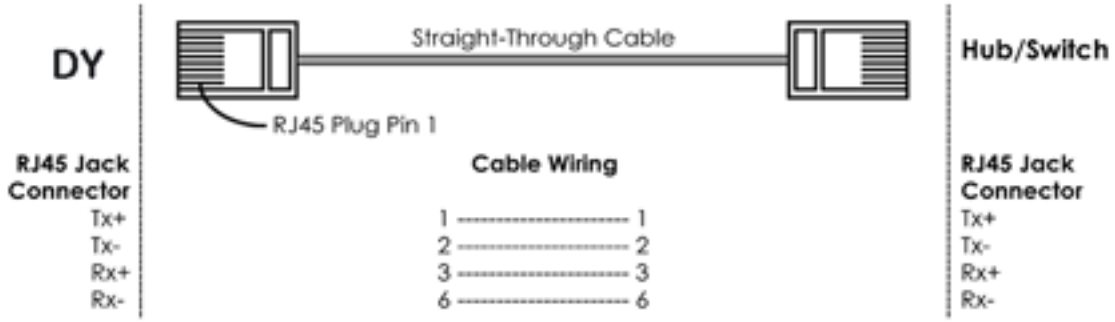
Download the program: **Ascon_SW_5xx1_Config.zip** from the site www.ascon.it (section *download/software*). Install and run it.

Note: The first time you enter the Software Download area, you need to register yourself, by clicking on the register button.

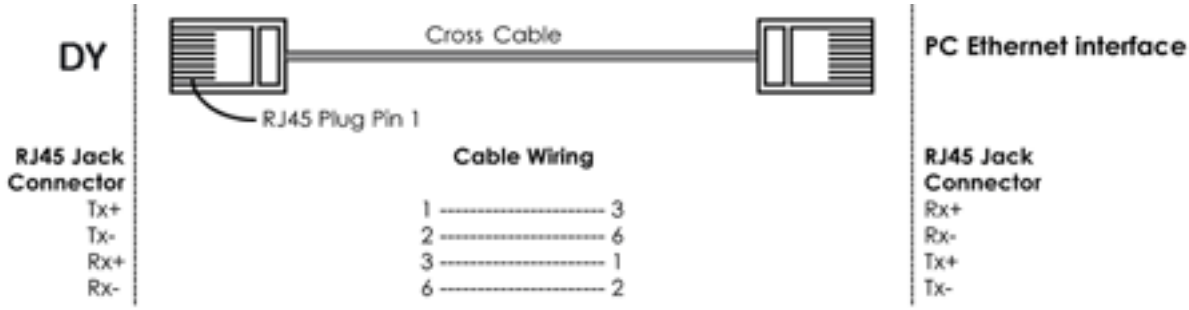
2.1.3 Scanning for connected devices

First ensure that you have connected the devices you want to install on the same Ethernet network as the PC is connected to. Use standard Ethernet cables, straight-through or crossover cable depending on how you connect to the device. See pictures below for details.

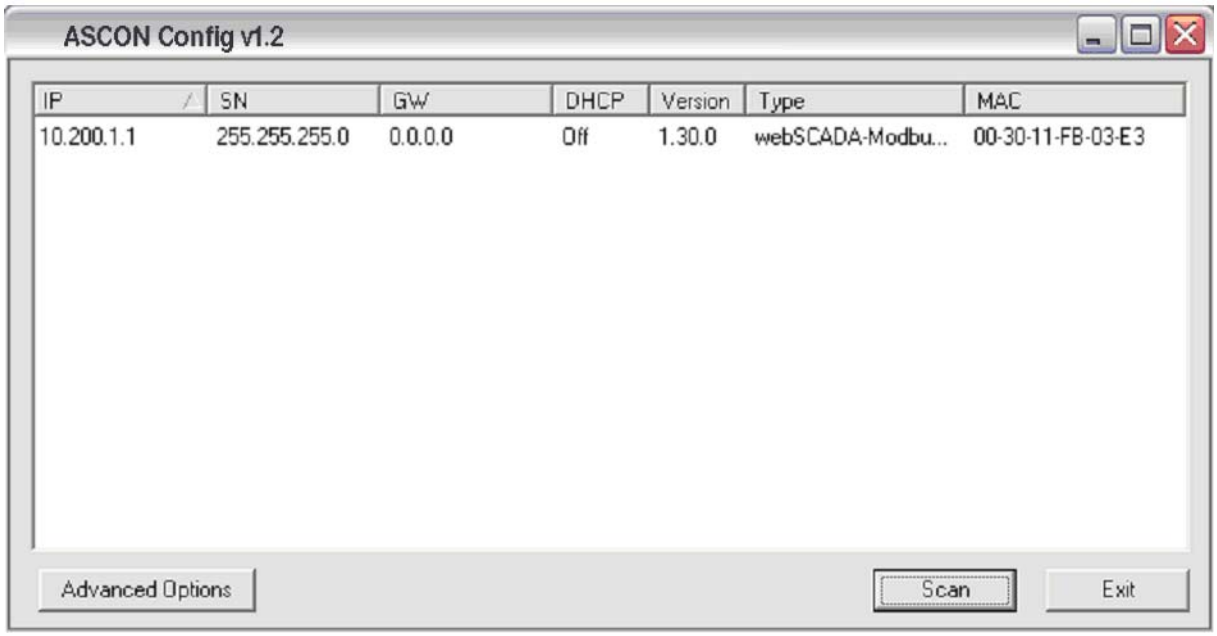
Connecting the device to a hub or Switch



Connecting the device directly to a PC



When the Config utility is started, it will scan the Ethernet network to find the connected devices. All detected devices will be presented in a list in the main window. If you want to force a new scan for devices, you can press the "**Scan**" button.



IP: The IP address of the device

SN: The subnet mask

GW: The default protocol converter

DHCP: Dynamically assigned IP address On/Off

Version: Firmware version

Type: Product type (webSCADA-Modbus)

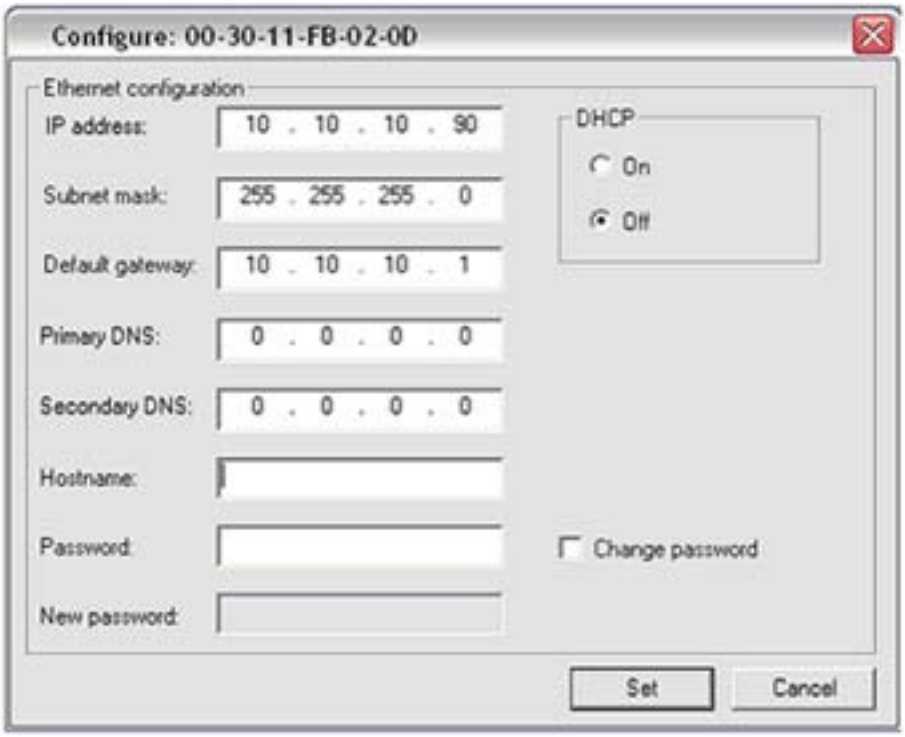
MAC: The Ethernet MAC address

Use the "Advanced Options" button to enable the Config DHCP Server.
This is useful when you have set DHCP to "On" in the device, but don't have a DHCP-server available on the network.

2.1.4 Changing IP settings

To change the IP settings on a detected device, double-click on the device you want to configure in the list of devices. This will open up a dialog where you can enter the desired IP configuration.

To obtain the necessary information about IP address, subnet mask etc. please contact your network administrator.



DO NOT SET DHCP TO "ON" IF YOU DON'T HAVE A DHCP-SERVER AVAILABLE ON THE NETWORK.

Host Name: Here you can enter a hostname of your device (**optional**).

IP Address: The IP address of the device.

Netmask: The subnet mask

Protocol converter: The default protocol converter

Primary DNS: The primary Domain Name Server (**optional**)

Secondary DNS: The secondary Domain Name Server (**optional**)

The default password for authentication of the new settings is "**admin**".

Pressing "**Set**" will cause the device to reboot and after that the new settings will be enabled.

You can test the new settings by opening a web-browser and enter the IP you just selected. If you selected DHCP and want to know what IP your device have been assigned, you can do a new scan with the Config utility to view the new network configuration information.

2.2 Log in

Open a web browser (Internet Explorer for example) and enter the IP address you have set on the unit with the Config utility. For example, if you entered the address 10.10.10.82 then you should enter the text below in the address field of the browser and press enter.

http://10.10.10.82

Now you should see the login screen:



To be able to configure the Protocol converter you should enter "**admin**" in the user-name box. The default password is "**admin**".

You can later change the default password to something else (recommended). This will be described in the section "User Configuration" below.

If you have problems to log in and you are sure that your password is correct, make sure that Caps Lock is not enabled on your keyboard.

3 Web-page overview

3.1 Browser requirements

The web-pages are optimized for Internet Explorer 6.0 and Mozilla Firefox. Other browsers can work as well, but the web-pages might appear differently. **The browser must be JAVA enabled.** If it's not, please visit www.java.com to download a JAVA-plug-in for your browser.

The picture below shows the welcome screen which is shown when you first log into the module.



3.2 Menu overview

To navigate on the web-pages, use the three menu items available: Page Select, Status/Log and Configuration.



When you choose the configuration menu, a sub menu will appear.

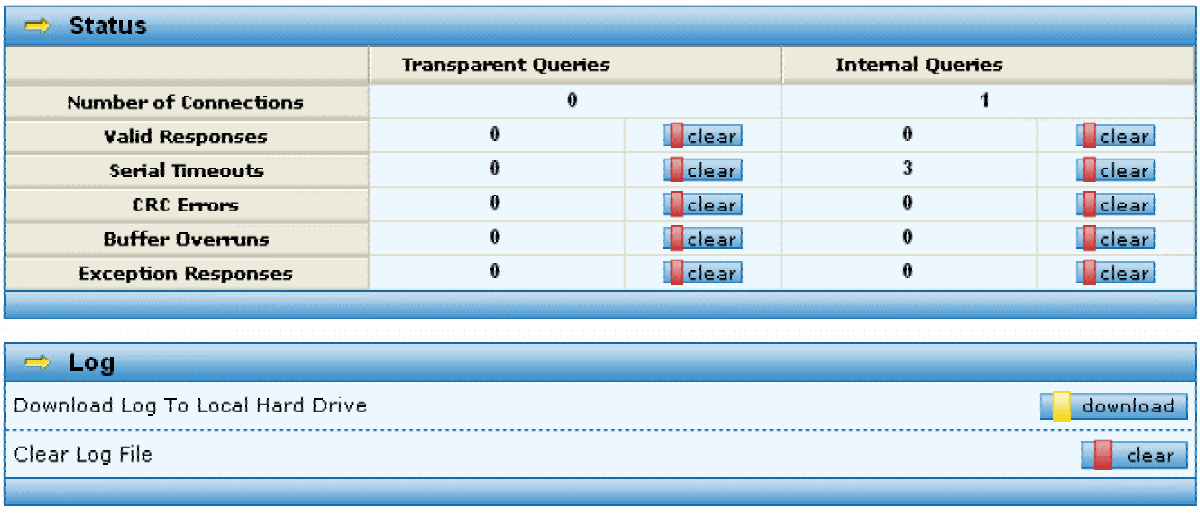


- The "**Pages**" configuration sub-menu can be used to create web-pages for monitoring and control.
- On the "**Alarm**" page all alarm configurations can be done.
- On the "**Log**" page different logging properties can be set.
- The "**Users**" page handles all user configurations (passwords, alarm recipients etc.)
- The "**Miscellaneous**" page can be used to set Time/Date, backup/restore configurations and enter generic module information
- The "**Modbus**" configuration page defines baudrate, which physical port to use etc.
- The "**Network**" menu can be used to change the IP-settings of the module (IP-address, subnet mask etc.)

3.3 Status/Log

This page shows some status information about the Modbus interface. The status is split into two columns, "Transparent queries" and "Internal queries". The Transparent fields shows information about requests that originate from a ModbusTCP master attached to the protocol converter, and the Internal fields shows information about requests that originate from either Internal applications (Log/Alarm) and WebPages.

From this page it's also possible to download the log file from the module (if logging has been enabled). Simply click the "**download**" button to download/view the file, or click the "**clear**" button to remove all data from the log-file.



Number of connections: Indicates the number of open connections to a Modbus TCP master. Internal queries indicate number of pending queries from WebPages + the internal connection from (Alarm/Log) application.

Valid Responses: Counts valid responses from the Modbus/RTU slaves.

Serial Timeouts: The number of time-outs from attached slaves.

CRC Errors: The number of CRC errors on incoming Modbus/RTU responses.

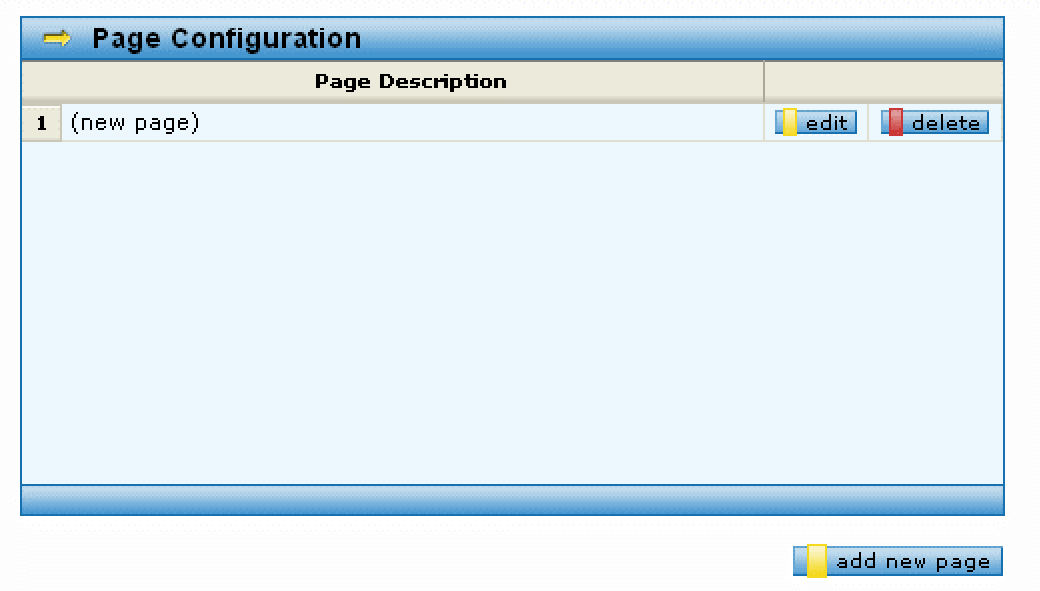
Buffer Overruns: If an incoming Modbus/RTU response is bigger than 300 bytes, it will cause the input buffer to overflow.

Exception Responses: Counts all exception responses from the connected Modbus/RTU slaves.

4 Module Configuration

4.1 Create a page

Clicking on the “Configuration/Pages” link will bring up the following screen:



Here you can create up to 10 pages using the “**add new page**” button. To modify the properties of each page, click the “**edit**” button. To remove a page, click the “**delete**” button.

4.2 Page properties

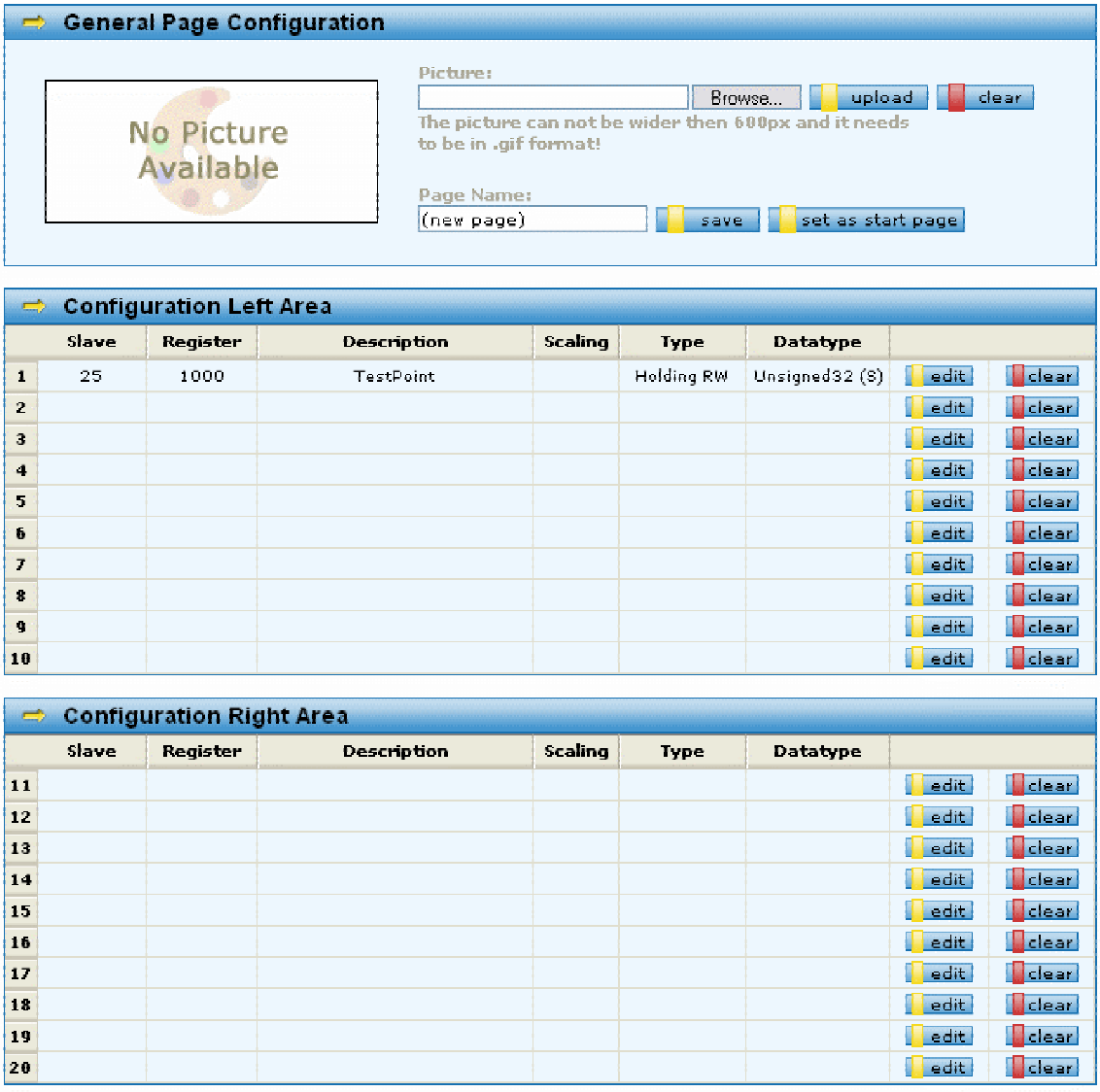
On this page all page properties can be configured. A maximum of 20 Modbus points can be on each page.

4.2.1 Picture

This option lets you choose a picture to be presented on the page. The picture must not be more than 600 pixels wide and must be in GIF-format. The picture will be sent to the device when you press the "**Upload**" button. To remove a picture from the device, press the "**Clear**" button.

4.2.2 Page name

This field can be used to give the page a more descriptive name. Click the "**set as start page**" button if this page should be the first page to be presented when logging in to the module.

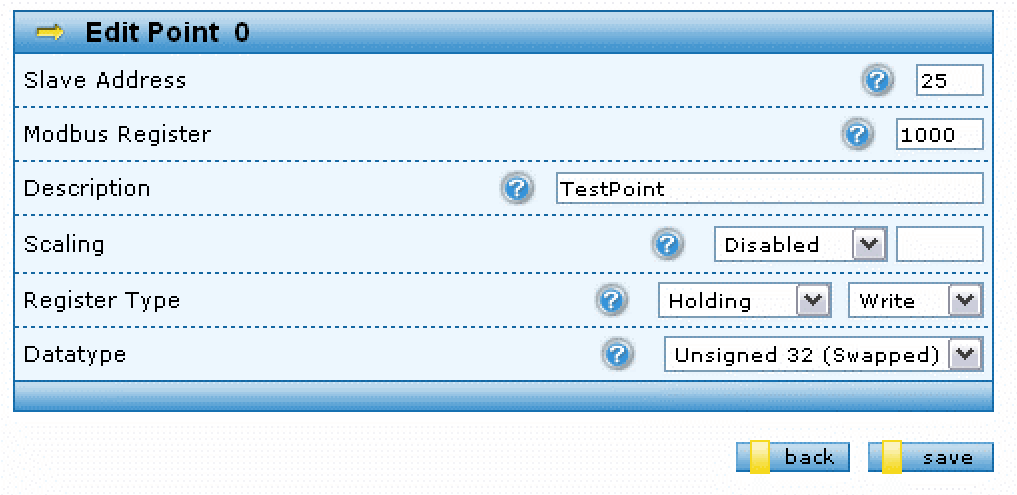




TIP! Place the READ-registers in one column, and the WRITE-registers in the other to get a good page-design.

4.2.3 Modbus register setup

To add/edit a Modbus register, press the "**edit**" button on the register you want to work with. This will bring you to the "Edit Point" page:



Slave Address: Defines the address of the attached slave.

Modbus Register: The Modbus register to Read/Write. When using 32-bit/float values this is the start register.

Description: A string that describes the register. Can also be a reference to a tag in the picture.

Scaling: The Modbus register value will be divided by the scale value before presented on the web-page,
or multiplied before value is written to a slave device.

Examples:

Modbus register value = 510, Scale value = 10 → 51,0 will be viewed on web-page

Modbus register value = 5118, Scale value = 100 → 51,18 will be viewed on web-page

Web-page input = 127,5 Scale value = 10 → 1275 will be written to Modbus register

Register Type: Defines the Modbus register type (Holding, Input, Coil, Discrete input) and also if the register is of Read or Write type. (Selecting Write will cause a Set button to appear next to the parameter on the view-page).

Datatype: Defines the datatype of the Modbus register(s). Can be one of the following:

Unsigned 16 – 16-bit positive value
Signed 16 – 16-bit value, with sign

Unsigned 32 - 32-bit positive value. Most significant word (register) on **low** address.

modbus reg	i		i+1	
Int32	1(MSB)	2	3	4(LSB)

Signed 32 - 32-bit value, with sign. Most significant word (register) on **low** address.

modbus reg	i		i+1	
Int32	1(MSB)	2	3	4(LSB)

Unsigned 32 (swapped) - 32-bit positive value. Most significant word (register) on **high** address.

modbus reg	i		i+1	
Int32 (s)	3	4(LSB)	1(MSB)	2

Signed 32 (swapped) - 32-bit value, with sign. Most significant word (register) on **high** address.

modbus reg	i		i+1	
Int32 (s)	3	4(LSB)	1(MSB)	2

Float – 32-bit floating point. (IEEE-754) Most significant word (register) on **low** address.

modbus reg	i		i+1	
Float	1(MSB)	2	3	4(LSB)

Float (swapped) - 32-bit floating point. (IEEE-754) Most significant word (register) on **high** address.

modbus reg	i		i+1	
Float (s)	3	4(LSB)	1(MSB)	2

Double - 64-bit floating point. (IEEE-754) Most significant word (register) on **low** address.

modbus reg	i		i+1		i+2		i+3	
Double	1(MSB)	2	3	4	5	6	7	8(LSB)

Double (swapped) - 64-bit floating point. (IEEE-754) Most significant word (register) on **high** address.

modbus reg	i		i+1		i+2		i+3	
Double (s)	7	8(LSB)	5	6	3	4	1(MSB)	2

4.3 Alarm configuration

The webSCADA can send alarm messages with email or SMS. **(SMS alarms requires an external GSM modem).** The alarm functionality can be enabled/disabled on the Alarm configuration page.

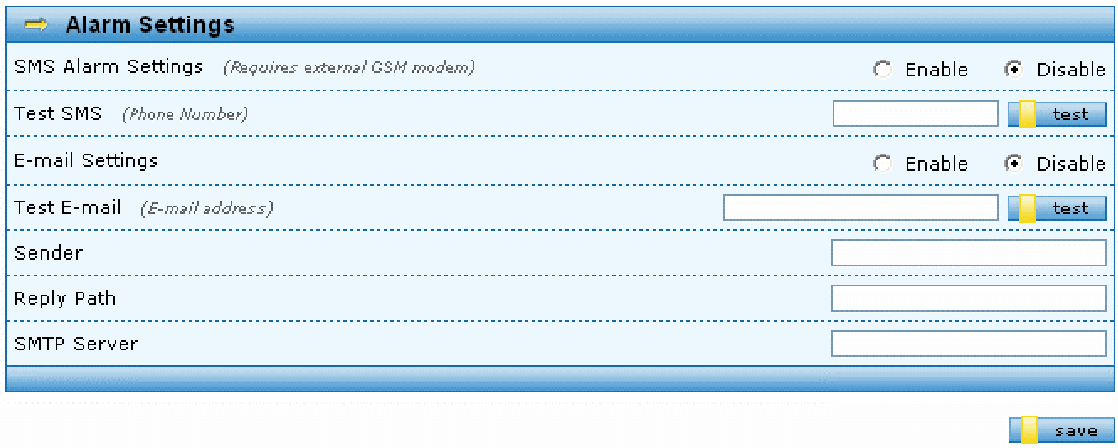
A maximum of 20 alarm points can be configured. It's also possible to use the two digital inputs on the module as alarm triggers.

The following configuration properties are available:

- Sender – From field in the alarm mail. Example "WebSCADA"
- Reply path – The E-mail address to send a mail to when someone reply on an alarm mail.
- SMTP server – IP-number or domain name to the SMTP server that the WebSCADA should use when sending E-mails. If domain name is used make sure that you have entered a DNS under the Network configuration.

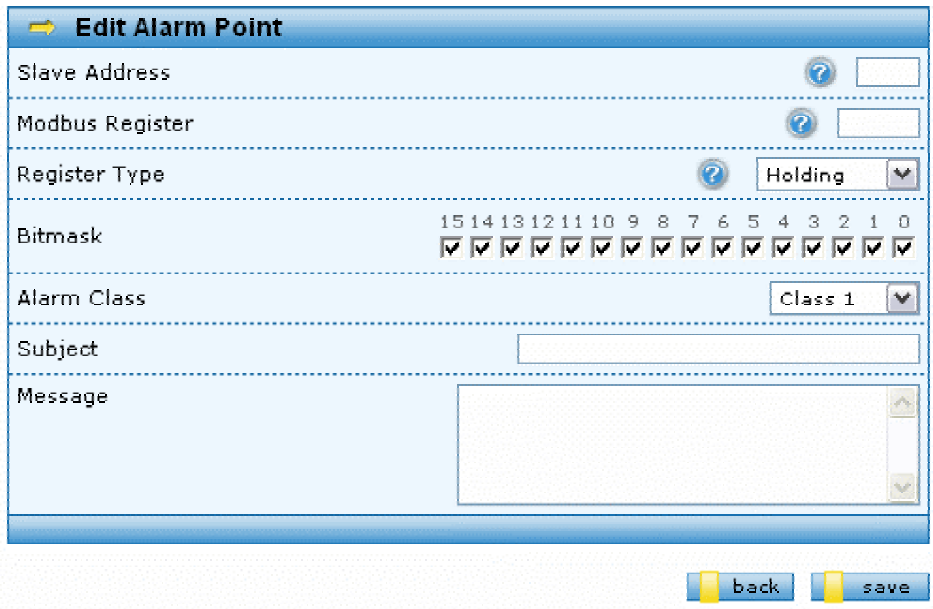
TIP! Hostname on Network configuration is used when connecting to the SMTP server and some servers require that it is set (normally it does not care what it is set to).

To verify the setup, use the Test SMS/Test E-mail functionality. Clicking one of these buttons will generate a test e-mail/SMS. (To be able to use the Test button, the SMS/Email functionality must be **Enabled**)



4.3.1 Modbus alarm points

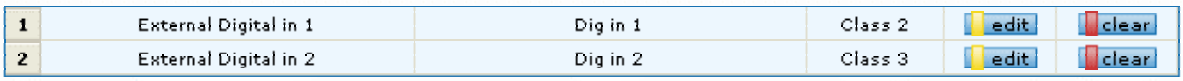
To add an alarm point, click on the "**edit**" button in the Alarm Configuration list. This will bring you to the "Edit Alarm Point" page.

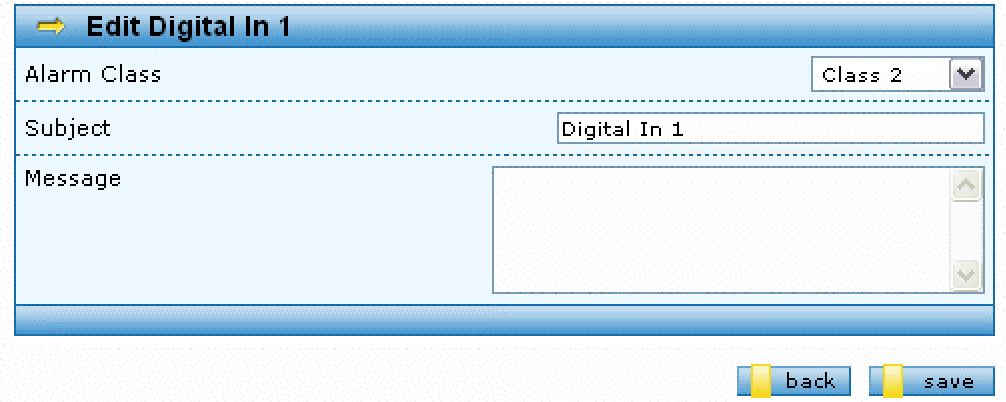


- **Slave Address:** Defines the address of the attached slave.
- **Modbus Register:** The Modbus register to trigger the alarm.
- **Register Type:** Defines the Modbus register type (Holding, Input, Coil, Discrete input).
- **Bitmask:** Defines which bits in a word should trigger an alarm.
- **Alarm class:** Can be used to set different priorities on the alarm (class 1, 2, 3)
- **Subject –** Defines the text to be shown as Subject in the email/SMS
- **Message –** The body of the alarm message

4.3.2 Digital input alarm point

Below the 20 Modbus alarm points there are two digital input alarms. Click "**edit**" to modify their properties.





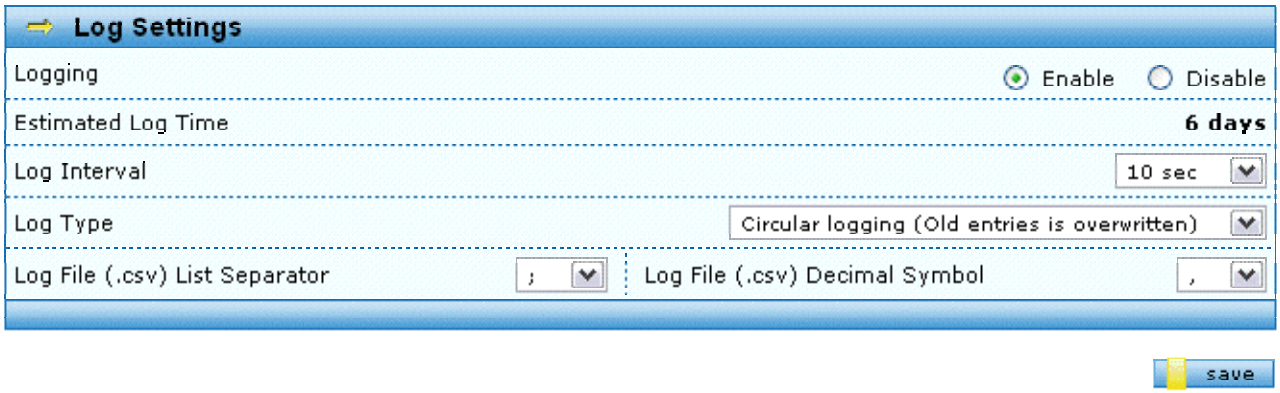
4.4 Log configuration

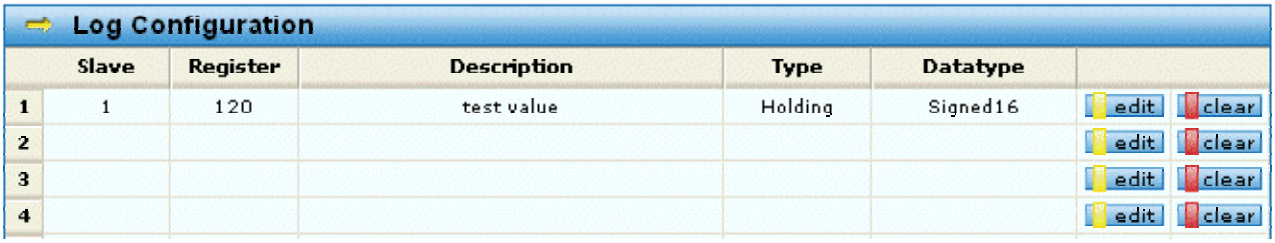
The webSCADA can be used to log Modbus registers. All data is stored in a CSV-file that can be uploaded to a computer for further analysis in e.g. Excel. A maximum of 20 points can be configured.

To start logging, make sure the "**Enable**" box is activated.

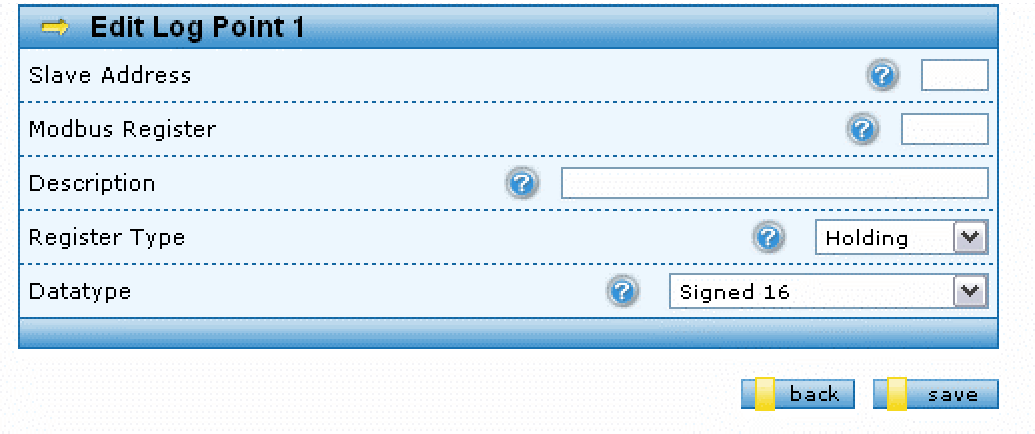
- **Estimated Log Time –** gives an estimation about how long it takes to fill the log-file.
- **Log interval –** defines the sample interval
- **Log type –** choose whether to stop logging when the log has reached it's maximum, or to overwrite old values (circular log).
- **List separator** - Can be either colon (,) or semi-colon (;).
- **Decimal Symbol** – Can be either dot (.) or colon(,).

The list separator and decimal symbol should be selected so it matches the configuration on the computer where the file will be analysed.





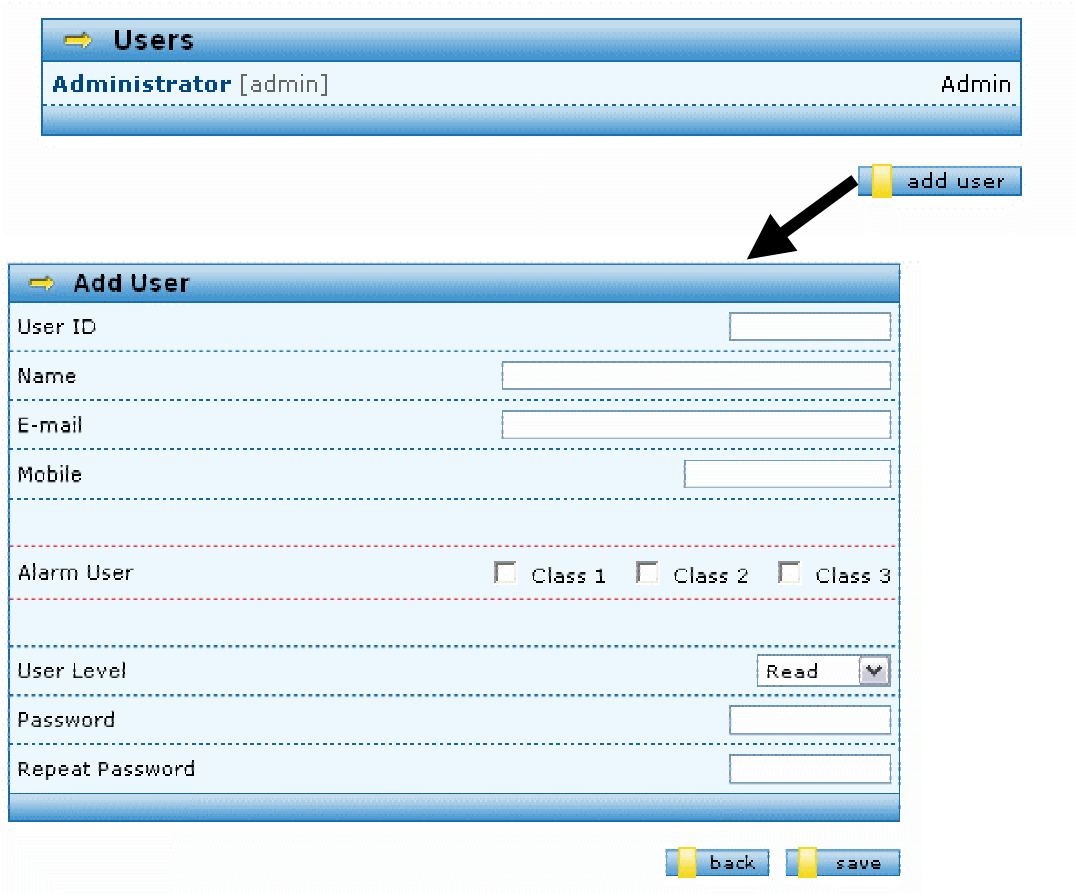
To add a log-point, click the "**edit**" button. This will bring you to the "Edit Log Point" page.



- **Slave Address:** Defines the address of the attached slave.
- **Modbus Register:** The Modbus register to trigger the alarm.
- **Description:** A string that describes the register.
- **Register Type:** Defines the Modbus register type (Holding, Input, Coil, Discrete input).
- **Datatype:** Defines the datatype of the Modbus register. (See section 4.2.3 for details).

4.5 Users

If you press the "**Users**" link you will be transferred to the Users administration page. Here you can add, edit and remove users. To add a user, press the "**add user**" button, and to modify/remove a user click on the user you want to modify/remove.



Here you can enter the User ID (used on the login screen), name, contact info and a password.

If an e-mail address is configured, then alarms will be sent to this address (if user is configured as an alarm recipient and e-mail alarm is enabled).

If a mobile number is configured, then SMS-alarms will be sent to this number (if user is configured as an alarm recipient and SMS-alarm is enabled).

To configure a user as an alarm-recipient, enable one or more of "Alarm User classes" (Class 1, 2 and 3).

The user will only receive alarms that match this selection.

The user level defines what the user can do on the web-pages:

Read: View pages but can't do any configuration or modify Modbus Registers
Write: Can view pages and modify Modbus registers.
Admin: Read, Write and also change configuration of module.

To add/edit users, you must be logged in as an administrator

4.6 Miscellaneous

The miscellaneous page contains configuration for time and date, generic module information and also a backup/restore feature.

4.6.1 Time and date

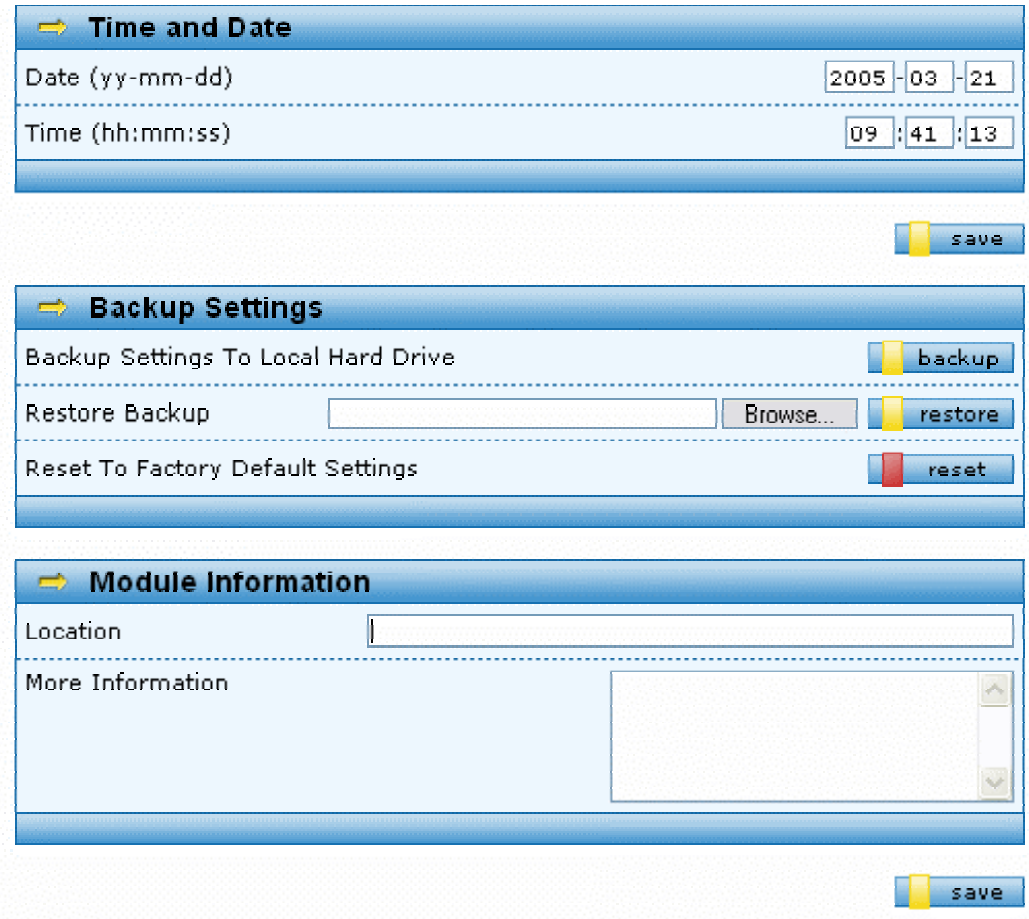
Configures the real-time clock on the module. The clock will continue to work during power-loss (max. 1 week). Time and date is primarily used by the log-functionality.

4.6.2 Backup Settings

The backup functionality makes it possible to backup and restore configurations (page config, pictures, alarm/log config).

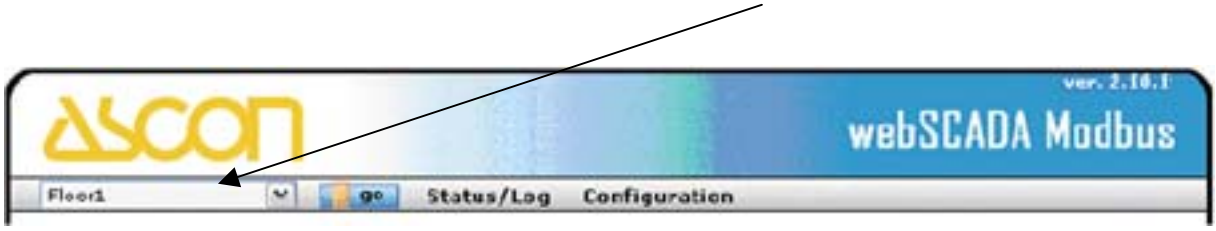
When restoring a configuration, ALL existing data in a module will be erased and IP-address will be set to 10.200.1.1.

To bring a module back to Factory default configuration, click the "**reset**" button.



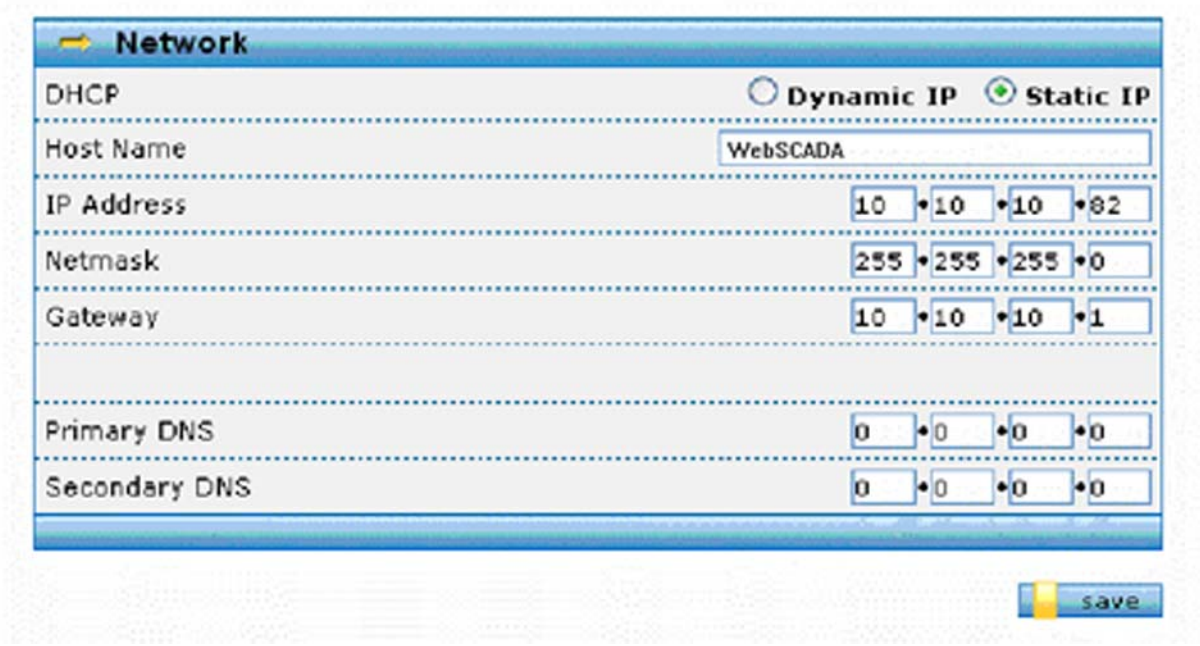
4.6.3 Module information

The "**Location**" string can be used to add information about where the module is located (address, building id etc.) This information will appear on all page-headers.



4.7 Network settings

If you press the Configuration/Network link you will be presented with the following view:



On this page you can view and change the TCP/IP network settings in the module. These settings are the same as the ones set by the Config utility.

Dynamic IP: Select this if you have a DHCP server on your network and you want the IP address be assigned automatically by the server.

DO NOT SELECT THE DYNAMIC IP OPTION IF YOU DON'T HAVE A DHCP SERVER AVAILABLE ON THE NETWORK.

Host Name: Here you can enter a hostname of your device (if E-mail alarms should be used this field must contain something)

IP Address: The IP address of the device.

Netmask: The subnet mask

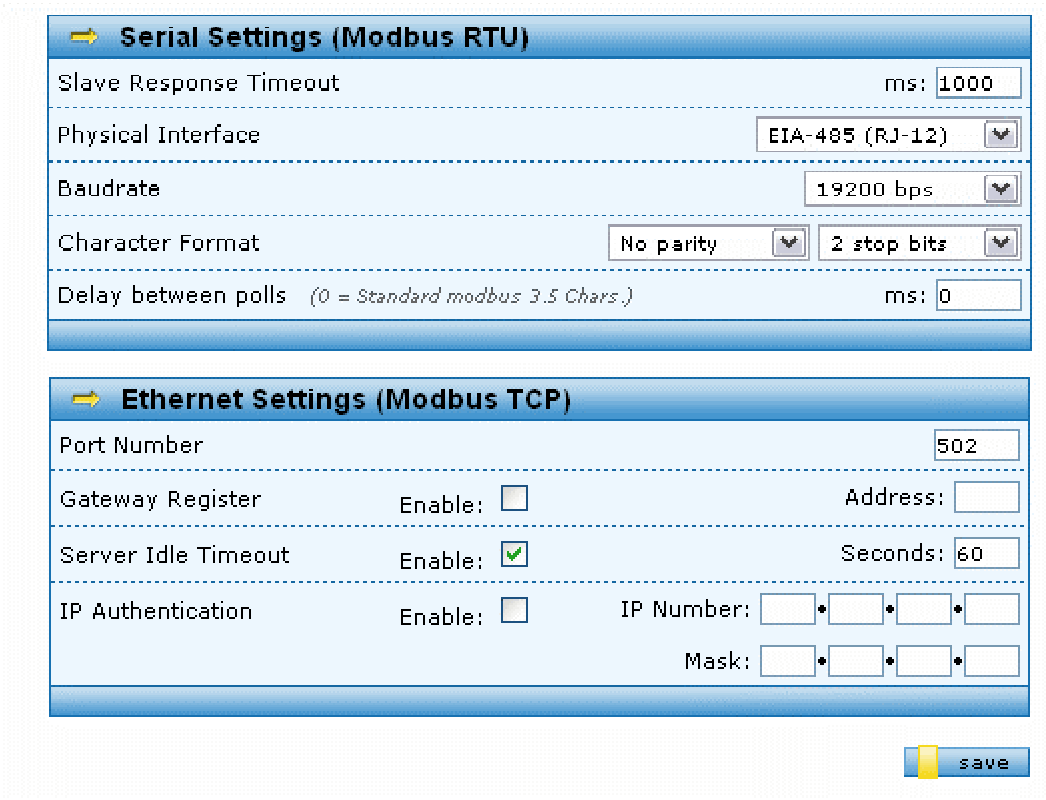
Protocol converter: The default protocol converter

Primary DNS: The primary Domain Name Server (**optional**)

Secondary DNS: The secondary Domain Name Server (**optional**)

4.8 Modbus Configuration

If you press the Configuration/Modbus menu you will be presented with the following view:



Serial Settings (Modbus RTU)

Slave Response Timeout: The time that the module will wait for a response from a slave, before a Serial timeout will occur. (Default 1000 ms)

Physical Interface: EIA-485 or EIA-232

Baudrate: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 bps.

Character Format: Select number of stop bits and if parity should be enabled (Odd, Even).

Delay between polls: time to delay between Modbus messages.

Ethernet Settings (Modbus TCP)

Port number: Which port to use for Modbus TCP communication (502 default).

Protocol converter Registers: The address to the protocol converter internal registers (if enabled). See section 4.3.1 for details about the internal registers.

Server Idle Timeout: This parameter gives the idle timeout in seconds for the Modbus/TCP connection.
If the Protocol converter receives no Modbus/TCP query within this time the connection will be closed (default value is 60 seconds).

IP Authentication: This can be used to configure the IP-number that is allowed to connect to the Protocol converter.

It is of great importance to ensure at the time of the procedure of assigning Modbus device addresses, that there are not two devices with the same address. In such a case, an abnormal behavior of the whole serial bus can occur, the Master being then in the impossibility to communicate with all present slaves on the bus.

4.8.1 Internal Registers

If Protocol converter registers are enabled, queries sent to that address will not be forwarded to the Serial Modbus/RTU network; the device will respond to these queries by it self.

See **Appendix B** for a list of the internal registers.

Valid Modbus commands for internal registers:

Command	Name
3	Read Holding Registers
6	Preset Single Register
16	Preset Multiple Registers

APPENDIX A: Specifications

Ethernet connection

10Base-T or 100Base-TX (IEEE 802.3). RJ45 connector.

Serial interfaces

EIA-232 with full modem control (RTS, CTS, DCD, DTR, DSR, RI)
300… 115.200bps. 9 pole DSUB connector

EIA-485, 300-115.200bps. 6-pole RJ-12 connector.

Power Supply

9-32 VAC/DC (1.7W)

Temperature range

Operating: 0… 60 °C
Storage: -25… +75 °C

Humidity range

5… 93% RH, non-condensing

Cover material

Grey plastic, LEXAN 940, self-extinguishing acc. to UL94-V0

Mounting option

DIN rail (EN 50022)

CE certification

According to EN 50 081-2:1993 and EN 61000-6-2:1999

APPENDIX B: Internal registers

Holding register	Name	Values	Options	Comment
1	Digital input 1 status	0 or 1		Read only
2	Digital input 2 status	0 or 1		Read only
	Serial Status (Modbus/TCP)			See section (3.3)
3	Number Active Connections	0...10		Read only
4	Number Active Internal Connections	0...10		Read only
5	Valid responses	0...65535		Can be cleared
6	Serial timeouts	0...65535		Can be cleared
7	CRC errors	0...65535		Can be cleared
8	Input Buffer overruns	0...65535		Can be cleared
9	Exception responses	0...65535		Can be cleared
	Serial Status (Buffered messages)			
10	Valid responses	0...65535		Can be cleared
11	Serial timeouts	0...65535		Can be cleared
12	CRC errors	0...65535		Can be cleared
13	Input Buffer overruns	0...65535		Can be cleared
14	Exception responses	0...65535		Can be cleared
	Serial Status (Internal requests and Webpages)			
15	Valid responses	0...65535		Can be cleared
16	Serial timeouts	0...65535		Can be cleared
17	CRC errors	0...65535		Can be cleared
18	Input Buffer overruns	0...65535		Can be cleared
19	Exception responses	0...65535		Can be cleared
	Configuration Registers			
20	Modbus/TCP Port	1...65535		Default port number is 502
21	Protocol converter Modbus address	(-1)...255		
		-1	Disabled	Default
		0…255	Enabled	
22	Modbus/TCP idle timeout	0...65535 s		Default 60 seconds
		0	Disabled	
		1...65525	Enabled	
23	Baudrate	0...9		
		0	300 bps.	

Holding register	Name	Values	Options	Comment
		1	600 bps	
		2	1200 bps	
		3	2400 bps	
		4	4800 bps	
		5	9600 bps	
		6	19200 bps	Default value
		7	38400 bps	
		8	57600 bps	
		9	115200 bps	
24	Parity	0...2		
		0	No parity	Default
		1	Even parity	
		2	Odd parity	
25	Number of Stop bits	1...2		Default 1 stop bit
26	Slave timeout time	25...65535 (ms)		Default 200 ms.
27	Physical interface	0...1		
		0	EIA-485 (RJ12)	Default
		1	EIA-232 (DSUB)	
	Authentication			
28	Valid IP address 1	0...255		First byte of IP address
		0	Disabled	IP address auth disabled
		1...255	Enabled	
29	Valid IP address 2	0...255	Enabled	Second byte of IP address
30	Valid IP address 3	0...255	Enabled	Third byte of IP address
31	Valid IP address 4	0...255	Enabled	Fourth byte of IP address
32	Mask for Valid IP address 1	0...255	Enabled	First byte of mask
33	Mask for Valid IP address 2	0...255	Enabled	Second byte of mask
34	Mask for Valid IP address 3	0...255	Enabled	Third byte of mask
35	Mask for Valid IP address 4	0...255	Enabled	Fourth byte of mask