

RTU32M Series

Modular RTU, PLC and Utility Controller

User Manual

Version 1.65.5.54 - August 2018

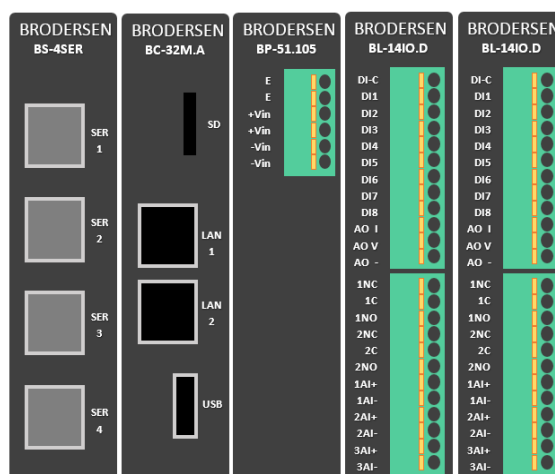




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1. Customer Information

1.1 Copyright Notice

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1.2 Trademark Acknowledgement

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Brodersen A/S makes no representation or warranty that such application will be suitable for the specified use without further testing or modification.

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BRODERSEN A/S's PRODUCTS ARE NOT FOR USE AS CRITICAL COMPONENTS, IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE PRIOR WRITTEN APPROVAL OF BRODERSEN A/S.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into body, or (b) support or sustain life and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

1.5 Brodersen Customer Services

Your satisfaction is our primary concern. Here is a guide to Brodersen customer services. To ensure you get the full benefit of our services, please follow the instructions below carefully.

1.6 Technical Support

We want you to get the maximum performance from your products. So if you run into technical difficulties, we are here to help. For the most frequently asked questions, you can easily find answers in the product documentation. These answers are normally a lot more detailed than the ones we can give over the phone. So please consult this manual first.

To receive the latest version of the user manual, please visit our Web site at:

<http://www.brodersen.com>,

Choose the product in question under product search and under each product you will find accompanying data sheets, manuals, and user guides etc.

If you still cannot find the answer, gather all the information or questions that apply to your problem, and with the product close at hand, call your dealer. Our distributors are well trained and ready to give you the support you need to get the most from your Brodersen products. In fact, most problems reported are minor and are able to be easily solved over the phone.

In addition, technical support is available from Brodersen engineers every business day. We are always ready to give advice on application requirements or specific information on the installation and operation of any of our products. Please do not hesitate to call or e-mail us on support@brodersen.com.

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1.7 Product Warranty

Brodersen warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Brodersen, or which have been subject to misuse, abuse, accident or improper installation. Brodersen assumes no liability under the terms of this warranty as a consequence of such events. Because of Brodersen's high quality control standards and rigorous testing, most of our customers never need to use our repair service. If a Brodersen product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time, and freight. Please consult your distributor for more details. If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, Product type and s/n, hardware and software version etc.) Note anything abnormal and describe the error in a product failure report.
2. Call your distributor and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, make arrangement with your distributor about this.
4. Carefully pack the defective product, a complete failure report and a photocopy of proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Ship it to your distributor.



2 Introduction

2.1 RTU32M – The modular Brodersen RTU, PLC and Industrial Controller

The Brodersen RTU32M series is based on a 32-bit i.Mx6 ARM platform, providing a small footprint modular RTU and PLC with leading edge functionality. As well as being a versatile RTU and PLC with flexible I/O designed to perform embedded data processing, control, data logging and monitoring, it is also a networking communicator for collecting, managing and communicating data via protocols on different physical interfaces upwards and downwards in an industrial environment.

Typical applications for the RTU32M are:

- Control and monitoring of water and waste water pump stations
- Substation automation applications
- Railway level crossing monitoring
- Communication Gateway applications between SCADA protocols – including Modbus, DNP3 and IEC60870.

The RTU32M hardware platform includes a 200-900MHz CPU with 128-256MB RAM and integrated 128MB NAND Flash. In addition, an optional removable microSD Flash card (default is 4GB, supports up to 64GB), provides an easy to use portable access/upgrade option. The integrated Flash stores the main RTU32 firmware including embedded Linux OS and your PLC runtime application. Standard drivers like the Modbus Protocol Suite, IEC60870 or DNP3 are stored in the integrated NAND Flash. The removable microSD card can be used for storing backup files and data logging files.

2.2 WebServer configuration and PLC programming in all IEC61131 languages

The RTU32M, like the other RTU32 Series of RTUs is configured via the integrated WebServer. Settings like LAN port addressing, time functions and 3g/4g modem credentials are handled in webpages. Online monitoring of connected physical I/O and display of graphical overviews is possible via webpages.

Programming of logic functions and configuration of communications drivers is managed using the Brodersen WorkSuite package software. WorkSuite is a powerful tool that is used for configuration and programming of all RTU32 Series products. Applications developed and running in the RTU32M will easily run directly on the other RTU32 Series products. The full suite WorkSuite software package is included in the product package, and it will run in demo mode without any license (with some runtime restrictions).



3 Getting Started

3.1 Configuration and default settings

The LAN interface on the RTU32M is set to its factory default settings at delivery:

LAN1: 192.168.0.1, Subnet: 255.255.255.0

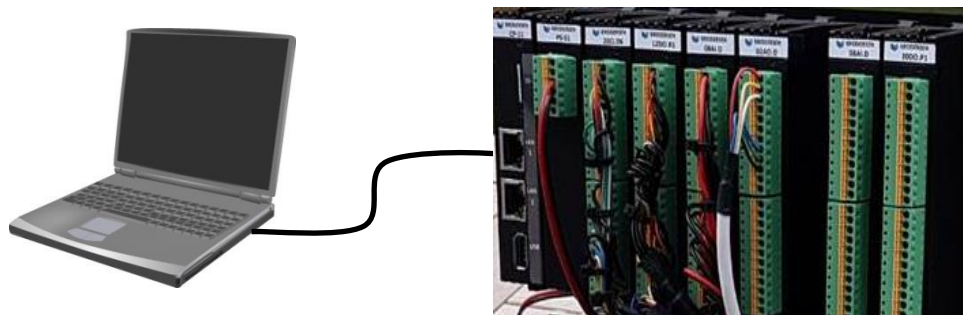
You can use the LAN1 interface to configure the basic settings in the RTU32M. The basic settings include setup of network parameters such as IP address, Subnet mask, default gateway, time settings, general username and password for accessing the web server pages and file system with FTP etc.

The configuration is done via web pages in the RTU32M Web Server. You must use your normal web browser to setup the basic settings for the RTU32M. The web pages are optimized for MS Internet Explorer, Firefox and Chrome. If you are experiencing problems with using the latest MS Internet Explorer version, please enable Compatibility settings in the browser.

4 How to connect and prepare your PC to configure the RTU32M

4.1 Wiring

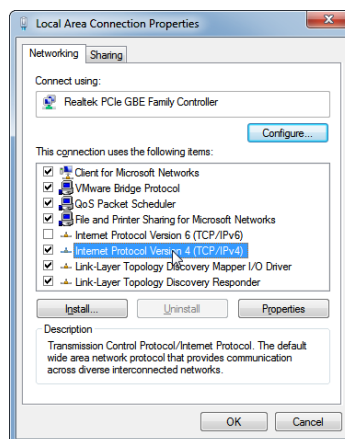
Use a cross-wired or standard patch cable to connect your PC Ethernet interface to the LAN1 Ethernet interface of the RTU. Apply power to the RTU – make sure that you connect the correct power supply voltage (24VDC).



4.2 Setting up your PC Ethernet driver (Windows)

Your PC Ethernet driver must be setup to work in the same network segment as the LAN interface on the RTU32 you use. You must setup your PC Ethernet TCP/IP driver to work in the segment IP 192.168.0.x.

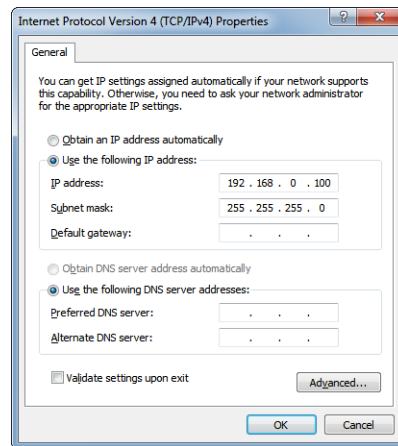
To setup the Ethernet driver select *start – Settings – Network Connections – Local Area Connections* and the following window will appear:



Click on Internet Protocol 4 (TCP/IPv4), and click *Properties*. A new window for setting the PC IP address will appear. Set an IP address in the same segment as the selected LAN IP address, for example 192.168.0.100 as shown here below.



NOTE: If you want to re-configure your Ethernet TCP/IP driver back to initial settings, it is recommended that you note the settings before you change them for setting up the RTU32M.



Click **OK** and **OK** again at the Local Area Connection Properties window. Now your PC Ethernet driver is setup for communicating with the RTU32M. Now apply power to the RTU32M. Wait for the RTU32M to boot up – takes approx. 20s. As a minimum the orange Run LED on the CPU front PANEL must be lit.

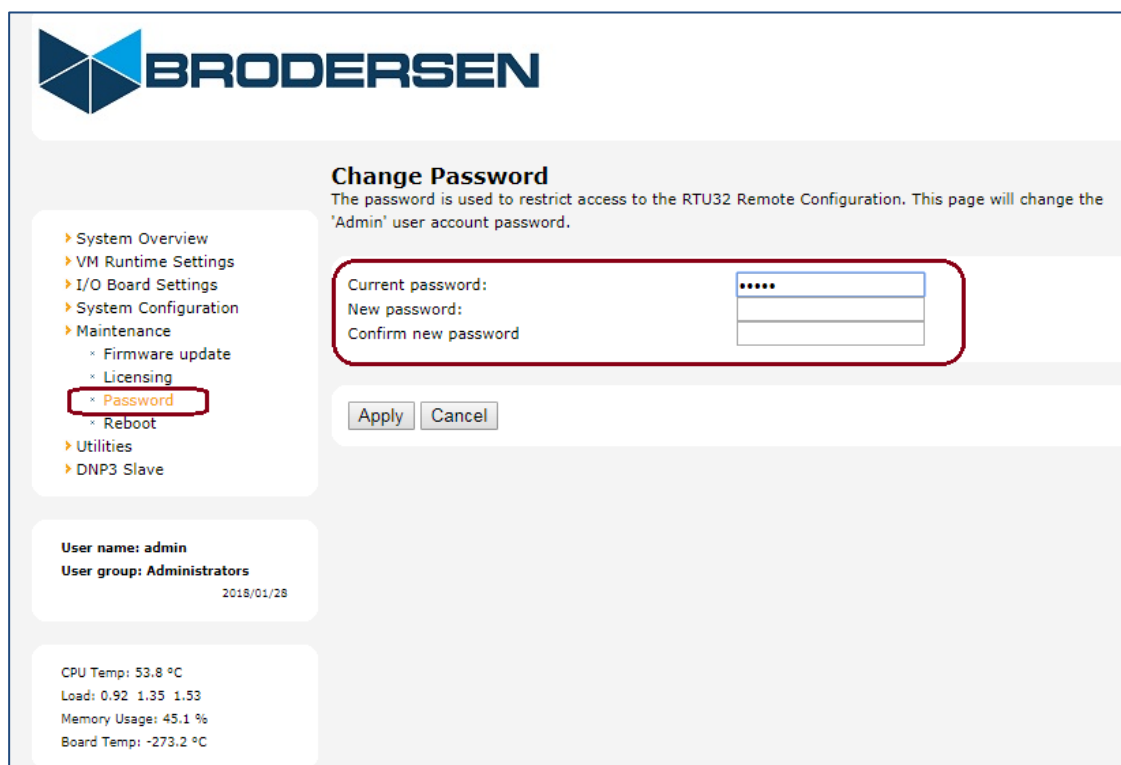
4.3 First time configuration

Start your Internet browser and enter the IP address of the RTU32M in the address field:

Now the first web page will appear in your browser and you will be asked to enter a username and password.

The username is admin.

The RTU32M is shipped with the administrator password set to admin. Be sure to change the default password from the Maintenance>Password menu item.





4.4 RTU32M – Licensing

The RTU32M includes license options that manage the tag quantity and enable use of advanced drivers and options, hence some restrictions may be imposed, including limiting the number of project variables, drivers and driver tags/data points. The System Overview page includes information about the licensing, as shown in the example below.

System Overview

Local Area Network (LAN) settings
This section displays a summary of your LAN network settings. These settings indicate the current configuration of your LAN ports.

Network Settings LAN1	eth0
Obtain an IP Address via DHCP	DISABLED
Local IP Address	192.168.0.1
Subnet mask	255.255.255.0
Default gateway	
Preferred DNS Server	
Alternate DNS Server	
MAC address	F8:DC:7A:14:8E:53
RX/TX Bytes	28.7/25.5 MiB

RTU32 Version Information

RTU32 Firmware Version	1.65.5.37
RTU32 Firmware Date	2018/05/09
RTU32 Firmware ID	93046
VM Runtime Version	<u>8.7.150121</u>
RTU32 Linux Image Date	2017
RTU32 Linux Version	4.1.15-2.0.0.1069+g0a8cb4d
RTU32 Linux Build Version	1

Drivers installed

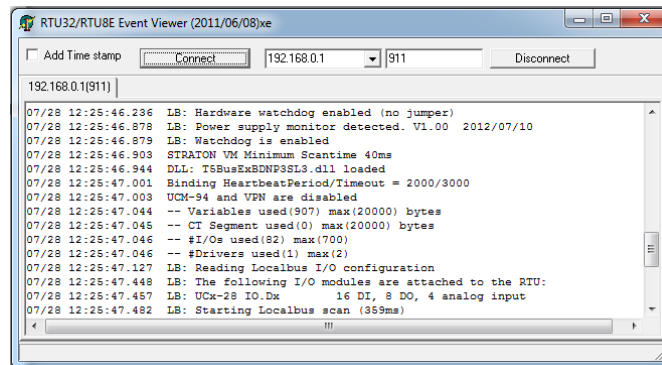
Modbus Master/Slave	Licensed
IEC_60870-5-101_Slave	Licensed
IEC_60870-5-104_Client	Licensed
IEC_60870-5-104_Server	Licensed
DF1 Master	Not licensed
DNP3 Master	Licensed
DNP3 Slave	Licensed
IEC 61850 Client	Not licensed
IEC 61850 Server	Not licensed

The license limitations are managed by the firmware of the RTU32M. If you try to start a logic application in the RTU32M that exceeds these limits, the project will NOT start and an info message in the Runtime info window in WorkSuite will indicate the status of the limits in your project. Every time you start a runtime project the current status will be shown in the Runtime message window

PilligaRes - 192.168.0.1:502		
#	Time	Event description
1	2014/07/28 12:22:17.351	-- Variables used(907) max(20000) bytes
2	2014/07/28 12:22:17.353	-- CT Segment used(0) max(20000) bytes
3	2014/07/28 12:22:17.356	-- #I/Os used(82) max(700)
4	2014/07/28 12:22:17.356	-- #Drivers used(1) max(2)

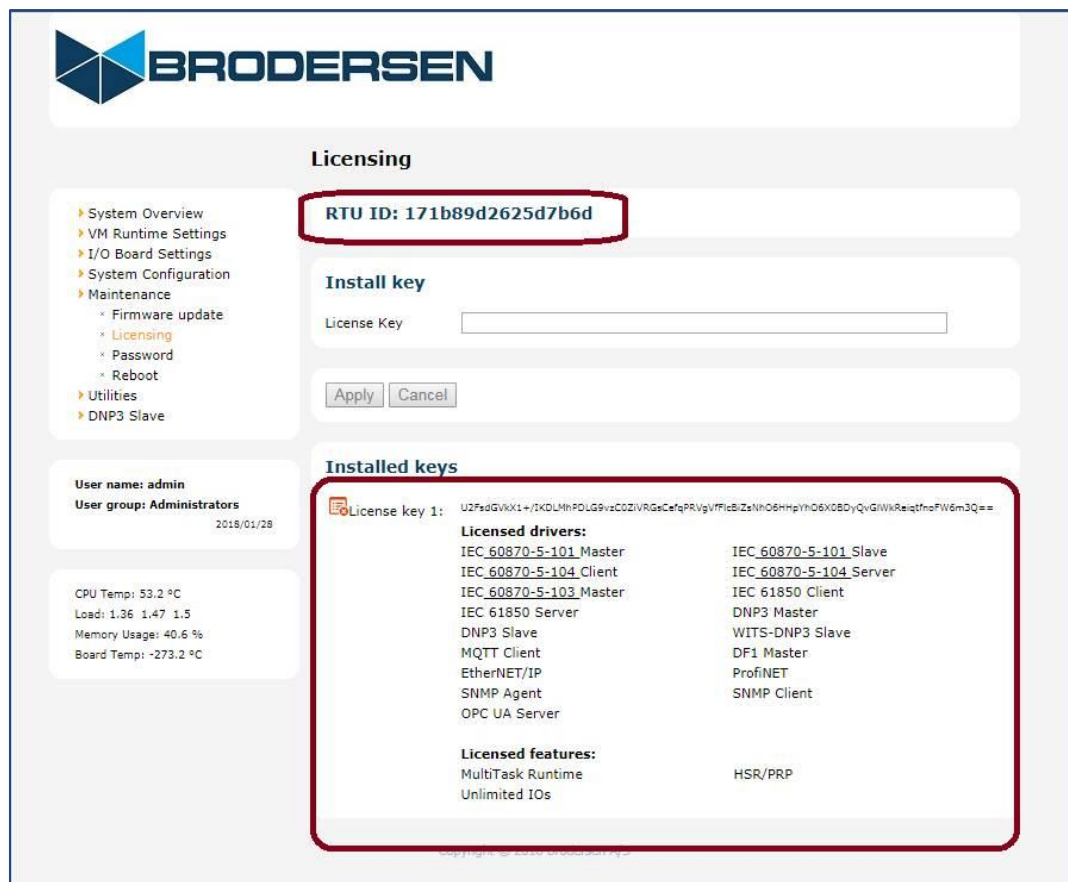


and in the System Log of the RTU32M:



4.5 Adding Drivers and Runtime Options

The RTU32M Licensing interface allows loading and activation of runtime license options. The RTU ID is used by the Brodersen factory to generate a unique license code that enables the required functionality. If you need additional drivers or other increased functionality that requires a license upgrade, please contact Brodersen or your authorized distributor and provide them with the RTU ID and details of the license requirements. You will then be sent a new license key that can be pasted in to the License Key field and then select 'Apply' to activate the new license options. The example below shows a RTU32M licensed with many driver and functionality options.





4.6 Settings overview


The first page that you access when you enter the RTU32M Web pages is the Settings Overview page:

System Overview

Local Area Network (LAN) settings

This section displays a summary of your LAN network settings. These settings indicate the current configuration of your LAN ports.

Network Settings LAN1	eth0
Obtain an IP Address via DHCP	DISABLED
Local IP Address	192.168.0.1
Subnet mask	255.255.255.0
Default gateway	
Preferred DNS Server	
Alternate DNS Server	
MAC address	F8:DC:7A:12:BC:ED
RX/TX Bytes	13.6/5.9 MiB

Network Settings LAN2	eth1 
Obtain an IP Address via DHCP	ENABLED
Local IP Address	0.0.0.0
Subnet mask	0.0.0.0
Default gateway	0.0.0.0
Preferred DNS Server	0.0.0.0
Alternate DNS Server	0.0.0.0
MAC address	F8:DC:7A:12:BC:EC
RX/TX Bytes	0.0/0.0 MiB

Hostname	imx6ul-var-dart
----------	-----------------

Project Information

Project Name	RTU32M_IO_1
Project Runtime Start	2018/06/28 01:29:20.956
Project IO count	128
Project Build Time	2018/06/22 00:46:19
Project Build Version	63
Project Build CRC	16#53a86eb1

RTU32 Version Information

RTU32 Firmware Version	1.65.5.40
RTU32 Firmware Date	2018/06/15
RTU32 Firmware ID	93046
VM Runtime Version	<u>8.7.150121</u>
RTU32 Linux Image Date	2018
RTU32 Linux Version	4.1.15-2.0.0.1069+g0a8cb4d
RTU32 Linux Build Version	1

On this page you will get an overview of the network settings and versions of the primary system files and drivers. If you are contacting your support office or distributor, you will always be asked for the RTU32M Version Information eg. 1.65.5.40.

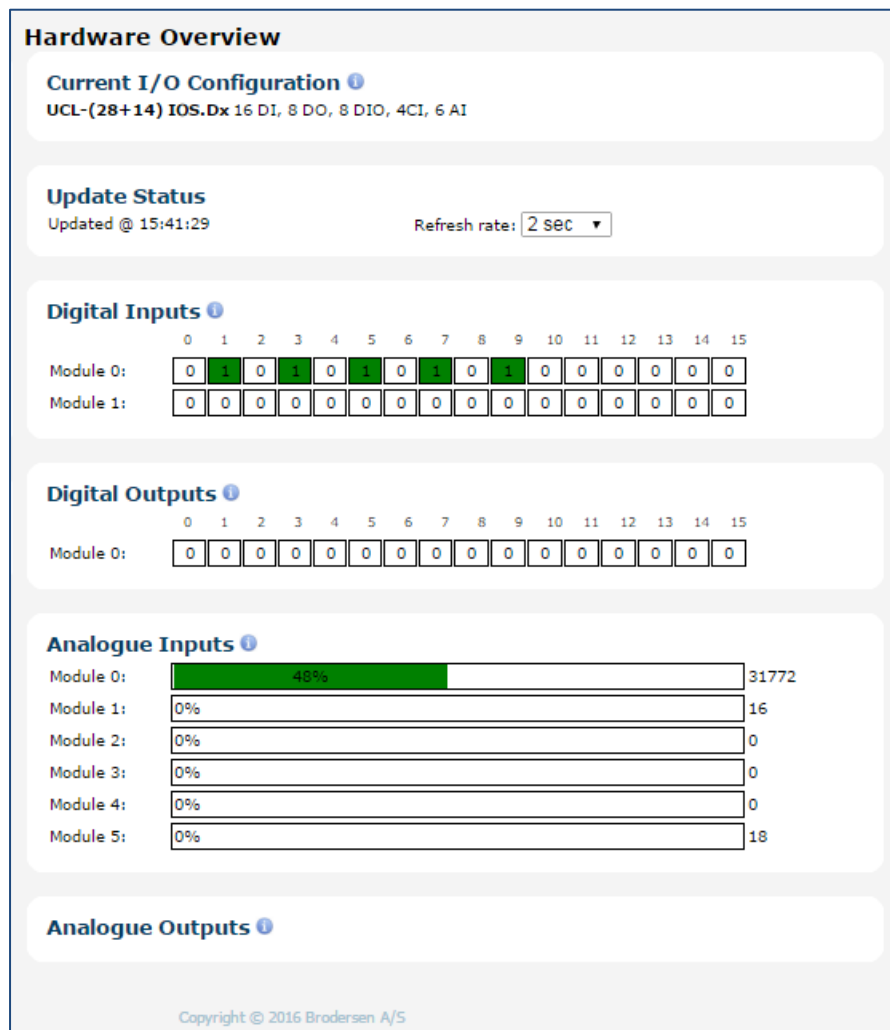


The Drivers installed section lists the installed drivers in your RTU32M. The full Modbus Suite and IEC60870 or DNP3 Slave Drivers are installed in all RTU32M. Additional drivers are installed if their Driver License is ordered with the RTU32M.

Drivers installed	
Modbus Master/Slave	Licensed
IEC 60870-5-101 Slave	Licensed
IEC 60870-5-104 Client	Licensed
IEC 60870-5-104 Server	Licensed
DF1 Master	Licensed
DNP3 Master	Licensed
DNP3 Slave	Licensed
IEC 61850 Client	Licensed
IEC 61850 Server	Licensed

4.7 Hardware Overview

The hardware overview page shows you the current I/O configuration status. It lists the I/O modules and allows you to read the status of each input or output. In the example below, a RTU32N is equipped with 42 IO points and the status of various analog and digital IO values can be seen. Note: the hardware overview is disabled in the early release firmware for the RTU32M (available 3Q 2018).





4.8 User Overview

The User Overview page is a simple user configurable local HMI that allows physical and virtual IO points to be read/written from/to the RTU32M. The page is edited using the 'Edit Config File' menu (and selecting 'CustomUI.ini' to be opened). The example below shows a simple User Overview for a RTU32N with 42 IO points. The descriptive text associated to each IO point can be edited by the user eg. 'A-DI ch0' could be changed to 'Pump 1 Running' or 'Gate 1 – Alarm Status'...

Note: the user overview page is disabled in the early release firmware for the RTU32M (available 3Q 2018).

User Overview

Update Status
Updated @ 16:51:45

Refresh rate: 1 sec ▾

RTU32-42IO Hardware Overview (Edit Config File>CustomUI.ini)

RTU32S DI

DI:0.0	A-DI ch0	0	Off
DI:0.1	A-DI ch1	1	On
DI:0.2	A-DI ch2	0	Off
DI:0.3	A-DI ch3	1	On
DI:0.4	A-DI ch4	0	Off
DI:0.5	A-DI ch5	1	On
DI:0.6	A-DI ch6	0	Off
DI:0.7	A-DI ch7	1	On
DI:0.8	B-DI ch8	0	Off
DI:0.9	B-DI ch9	1	On
DI:0.10	B-DI ch10	0	Off
DI:0.11	B-DI ch11	0	Off
DI:0.12	B-DI ch12	0	Off
DI:0.13	B-DI ch13	0	Off
DI:0.14	B-DI ch14	0	Off
DI:0.15	B-DI ch15	0	Off
DI:1.0	E-DI ch0	0	Off
DI:1.1	E-DI ch1	0	Off
DI:1.2	E-DI ch2	0	Off
DI:1.3	E-DI ch3	0	Off
DI:1.4	E-DI ch4	0	Off
DI:1.5	E-DI ch5	0	Off
DI:1.6	E-DI ch6	0	Off
DI:1.7	E-DI ch7	0	Off
DI:1.8	F-FastDI ch0	0	Off
DI:1.9	F-FastDI ch1	0	Off
DI:1.10	F-FastDI ch2	0	Off
DI:1.11	F-FastDI ch3	0	Off

RTU32S DO

DO:0.0	C-DO ch0	0	OFF
DO:0.1	C-DO ch1	0	OFF
DO:0.2	C-DO ch2	0	OFF
DO:0.3	C-DO ch3	0	OFF
DO:0.4	C-DO ch4	0	OFF
DO:0.5	C-DO ch5	0	OFF
DO:0.6	C-DO ch6	0	OFF
DO:0.7	C-DO ch7	0	OFF

RTU32S AI

AI:0	D-AI ch0	48	%	<div>48%</div>
AI:2	D-AI ch1	0	%	<div>0%</div>
AI:4	D-AI ch2	0	%	<div>0%</div>
AI:6	D-AI ch3	0	%	<div>0%</div>
AI:8	F-AI ch4	0	%	<div>0%</div>
AI:10	F-AI ch5	0	%	<div>0%</div>



The example below shows how the descriptions, point names and colours used in the IO animation can be easily edited.

User Overview

Update Status
Updated @ 16:51:45 Refresh rate: 1 sec ▼

RTU32-42IO Hardware Overview (Edit Config File>CustomUI.ini)

RTU32S DI

DI:0.0	A-DI ch0	0	Off
DI:0.1	A-DI ch1	1	On
DI:0.2	A-DI ch2	0	Off
DI:0.3	A-DI ch3	1	On
DI:0.4	A-DI ch4	0	Off
DI:0.5	A-DI ch5	1	On
DI:0.6	A-DI ch6	0	Off
DI:0.7	A-DI ch7	1	On

Configuration Files

Configuration File Selection
Select file to edit: \Storage Card\Config\CustomUI.ini Open Save Cancel

File Contents

```
[CustomUI]
Views=2
[View0]
InitDisplay=InitDisplay
Name=RTU32S DI
Desc=Pump Station IO Overview (Edit Config File>CustomUI.ini)
Account=1
DI Desc=Digital Inputs
DO Count=8
DO Desc=RTU32S DO
AI Count=6
AI Desc=RTU32S AI
DI0=0,0,Pump 1 Running,On,Off,red,green
DI1=0,1,Pump 1 Fault,On,Off,red,brown
DI2=0,2,Pump 1 Auto,On,Off,red,brown
DI3=0,3,Pump 2 Running,On,Off,red,brown
DI4=0,4,A-DI ch4,On,Off,red,brown
DI5=0,5,A-DI ch5,On,Off,red,brown
DI6=0,6,A-DI ch6,On,Off,red,brown
DI7=0,7,A-DI ch7,On,Off,red,brown
DI8=0,8,A-DI ch8,On,Off,red,brown
DI9=0,9,A-DI ch9,On,Off,red,brown
DI10=0,10,A-DI ch10,On,Off,red,brown
DI11=0,11,A-DI ch11,On,Off,red,brown
```

User Overview

Update Status
Updated @ 17:22:05 Refresh rate: 1 sec ▼

Pump Station IO Overview (Edit Config File>CustomUI.ini)

Digital Inputs

DI:0.0	Pump 1 Running	0	Off
DI:0.1	Pump 1 Fault	1	On
DI:0.2	Pump 1 Auto	0	Off
DI:0.3	Pump 2 Running	1	On
DI:0.4	A-DI ch4	0	Off
DI:0.5	A-DI ch5	1	On
DI:0.6	A-DI ch6	0	Off
DI:0.7	A-DI ch7	1	On



4.9 Runtime Settings - Main Settings

The Runtime settings menu allows adjustment of the PLC runtime setup.

Main Settings

Communication

Port (Main) 502 ⓘ
Port (Binding) 9000 ⓘ
Port (Event Log) 911 ⓘ

☐ Use Serial Remote Access Protocol (SP5) ⓘ

Serial Settings COM1:9600,N,8,1,RE ⓘ
Node Address 1 ⓘ
Modem Init String AT E0 V0 &C1 S0=1 ⓘ

☐ Use Serial Remote Access Protocol (SP5) ⓘ

Serial Settings COM1:9600,N,8,1,RE ⓘ
Node Address 1 ⓘ
Modem Init String AT E0 V0 &C1 S0=1 ⓘ

Startup ⓘ

☐ No Start
☐ Cold Start
☒ Warm Start (Load RETAIN Variables)
☐ Hot Restart

Options

☒ Use UTC time for real time clock functions ⓘ
☐ Enable Multi Task ⓘ

Binding Protocol Timing

Heartbeat period (sec.) 3 ⓘ
Binding Timeout (sec.) 3 ⓘ

Apply Cancel

4.9.1 Communication

Configuration of basic start-up settings, communication ports and enabling of Remote Access SProtocols. Hold the cursor over the small icon ⓘ and you will get online help.

Port (Main)

The Main port is used for Brodersen WorkSuite communication for configuration and debugging. Default setting is 502. This port is also used for the ModbusTCP Server.

Port (Binding)

The Binding Port is used by the event based binding protocol, where two or more RTU32 and PC STRATON T5 runtimes can exchange data. Default setting is 9000.

Port (Event log)

The Event Log port is where the RTU32M System Log can be viewed - either by connecting using telnet or the Brodersen Event Viewer tool. Default setting is 911.

Enable Serial Remote Access Protocol (SP5)

This protocol is to be used for remote serial communication from the Brodersen WorkSuite and is particularly well adapted to communication systems with severe constraints such as radios and modems. e.g. if you have the RTU32M placed on a remote site connected via serial communication using multi-drop radio or line connection – or even dial connection, you are able to remotely connect to the RTU32M with the Brodersen WorkSuite and work online as if it was on your workshop table. The speed will however be slower depending on your actual serial communication speed. It is possible to attach this protocol to two communication ports.

**Serial settings**

The syntax is: [M]COM{n}:{b},{p},{d},{s},{h}[LL] and the parameters in brackets [] are optional:

[M] Use modem connection

{n} Number of the COM port to be used (1 ... 8)

{b} Allowed speeds: 300,600,1200,2400,4800,9600,19200,38400,57600,115200

{p} Parity: N,E,O (None,Even,Odd)

{d} Data bits: 7 or 8

{s} Stop bits: 1 or 2

[h] RTS/CTS handshaking where h is either RD,RE,RT:l:t or RC:l:t. In the COM port section you will find details of how to use these parameters.

[LL] Log all bytes received and transmitted into the system log (port 911)

The following example shows setting for communicating on COM1 port, at 19200 baud, with Even parity, 8 data bits and 1 stop bit:
COM1:19200,E,8,1

Here a modem usage is enabled: MCOM2:9600,N,8,1

Here logging is enabled: COM1:9600,N,8,1,LL

Node address

Node Address (or Unit number) identifies the RTU32 on a multi drop network. The default number for RTU32M on a peer to peer network is 1. The address must be a value from 1 to 32767.

Modem Init String

Here you enter the initialization string (AT commands) when using a modem.

RTU32M default is: AT E0 V0 &C1 S0=1

4.9.2 Start-up

The start-up option specifies how the PLC application is started when the RTU32M is powered up. The possible options are:

No Start – PLC application is NOT started when booting the RTU32.

Cold Start – PLC application is started without loading retained variables.

Warm Start – PLC application is started and retained variables are loaded (default) **.

Hot Restart – Only supported with battery backed RAM option and in Redundancy configuration!

** Note: RTU32M retained variables are stored to the SD card only if/when the 'STORERETAIN' function is called.

4.9.3 Options**Use UTC time for PLC real time functions**

If enabled, it instructs all PLC real time functions (e.g. DTCurDate, DTCurTime and day_time) to return time in UTC. UTC time is not adjusted according to daylight savings. If this parameter is disabled then time is returned in local time which is adjusted to daylight saving if this option is enabled.

NOTE: Drivers that are implemented via PLC Functions – like the IEC60870 Driver – will use the PLC time stamp for events! Other drivers may take standard windows time or whatever time is defined in the applicable standards.

Enable Multi Task

This is a licensed option and allows the RTU to run up to 4x independent logic tasks (global variables can be accessed from any/all tasks).

PLC Main Settings / Binding Protocol Timing (seconds)

When using binding on slower network connection like some optical fibre modems or GPRS/3G wireless connections, you will need to adjust the timing for the Binding driver.

The possible timing adjustments are:

Heartbeat period – how often a heartbeat is sending to check the binding link connection.

Binding Time-out – time-out on link check and general binding event.



4.10 Runtime Settings - Redundancy Settings

On this page you can set the rules for RTU redundancy.

Redundancy Settings

☐ Use Redundancy ⓘ

Partners RTU32

IP Address: 10 . 0 . 0 . 1 ⓘ
Main Port: 502 ⓘ
Port used for Replication: 9001 ⓘ

This RTU32

Port used for Replication: 9001 ⓘ
Second Live Link Port: Disabled ⓘ
Second Live Link Timeout: 500 ⓘ
Primary Partner: False ⓘ

Timeouts (milliseconds)

Connection to Partner: 1000 ⓘ
Active Runtime Detection: 1000 ⓘ
Passive Runtime Detection: 1000 ⓘ
Data Replication: 500 ⓘ
Gateway Exchanges: 5000 ⓘ
When Passive Starts: 10000 ⓘ

The redundancy option allows two RTU32 to run as partners where one is active and the other is passive. The main principle is that the active runtime, while performing VM cycles, send its real time data to the passive runtime. When the active runtime fails, the passive one switches to active mode, hot restarts on replicated data and takes care of following cycles
More information can be found in the RTU32 User Manual and in the RTU32 Redundancy Runtime User Manual.

4.11 I/O Board Settings

On this page you can:

- Read the actual I/O configuration on the RTU32M.
- Note: the settings for configuration of inputs and output parameters is managed from within WorkSuite. Future releases of firmware will allow access to these parameters via the web interface.

4.11.1 Current I/O Configuration

Here the module layout is listed. In the example below you will see that the module list includes a power supply, 8ch analog input, 20 ch digital input, 12ch digital output and a mixed I/O module with 10x DI and 10x DO.

I/O Board Settings																																																							
<div><div><ul style="list-style-type: none">System OverviewRuntime SettingsI/O Board SettingsSystem ConfigurationMaintenanceUtilitiesDNP3 Slave</div><div><h4>Current I/O Configuration ⓘ</h4><table><tr><th>Index:</th><th>Type:</th><th>HW Rev:</th><th>HW Date:</th><th>FW Version:</th><th>FW Date:</th><th colspan="2">Serial Number:</th></tr><tr><td>1</td><td>BP-51.105</td><td>A</td><td>12-03-2018</td><td>1.1.2.3</td><td>05-07-2018</td><td colspan="2">01C82247:94193667</td></tr><tr><td>2</td><td>BL-08AIC.D</td><td></td><td>25-01-2018</td><td>1.1.2.3</td><td>24-05-2016</td><td colspan="2">004629E8:E2122783</td></tr><tr><td>3</td><td>BL-20CI.D6</td><td></td><td>07-02-2018</td><td>1.1.2.3</td><td>08-05-2018</td><td colspan="2">004629E8:E2122884</td></tr><tr><td>4</td><td>BL-12DO.R1</td><td></td><td>24-04-2018</td><td>1.1.1.3</td><td>23-04-2018</td><td colspan="2">01C82247:94181587</td></tr><tr><td>5</td><td>BL-10CIO.P6</td><td></td><td>09-02-2018</td><td>1.1.2.3</td><td>08-05-2018</td><td colspan="2">004629E8:E2243970</td></tr></table></div></div>								Index:	Type:	HW Rev:	HW Date:	FW Version:	FW Date:	Serial Number:		1	BP-51.105	A	12-03-2018	1.1.2.3	05-07-2018	01C82247:94193667		2	BL-08AIC.D		25-01-2018	1.1.2.3	24-05-2016	004629E8:E2122783		3	BL-20CI.D6		07-02-2018	1.1.2.3	08-05-2018	004629E8:E2122884		4	BL-12DO.R1		24-04-2018	1.1.1.3	23-04-2018	01C82247:94181587		5	BL-10CIO.P6		09-02-2018	1.1.2.3	08-05-2018	004629E8:E2243970	
Index:	Type:	HW Rev:	HW Date:	FW Version:	FW Date:	Serial Number:																																																	
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5	BL-10CIO.P6		09-02-2018	1.1.2.3	08-05-2018	004629E8:E2243970																																																	



4.12 System Configuration - Network Settings

On the System Configuration>Network Settings page you can change the LAN port settings to fit your local network. You can assign fixed IP addresses or select DHCP to have the address set via a router. You can then gain access to the RTU32M with your browser, SFTP client or Brodersen WorkSuite in your LAN network. If you do not know about the IP addresses and Subnet masks in your local network, please contact your local network manager or IT department for help.

Network Settings

Ethernet LAN 1

eth0

Obtain an IP Address via DHCP ☐

IP address . . .

Subnet mask . . .

Default gateway . . .

Preferred DNS Server . . .

Alternate DNS Server . . .

Ethernet LAN 2

eth1

Obtain an IP Address via DHCP ☒

IP address . . .

Subnet mask . . .

Default gateway . . .

Preferred DNS Server . . .

Alternate DNS Server . . .

Hostname

Current hostname

You can also change the RTU Host Name. The default host name of the RTU32M is imx6ul-var-dart.

After entering new settings, click Apply to save. Note that the new settings are activated within a few seconds (you do not need to restart/reboot the RTU32M, or cycle power to the RTU).

4.13 Network Redundancy - Protocols

Modern substation automation systems use network redundancy to improve reliability and network changeover times. The RTU32M System Configuration>Network Redundancy page allows selection of network redundancy protocols HSR (High Availability Seamless Redundancy – where both LAN ports are used to ensure two network paths exist between adjacent nodes in a ring format), or PRP (Parallel Redundancy Protocol – where both LAN ports are used to communicate via independent/separated networks).

Network Redundancy Settings

Network Redundancy Protocols

Enable Network Redundancy ☐

Protocol ⓘ

HSR Version ⓘ

HSR/PRP Supervision ⓘ

IP address . . .

Subnet mask . . .

HSR Clone MAC ☐ ⓘ



4.13.1 HSR – High Availability Seamless Redundancy

- Select HSR
- Select the correct HSR version
- HSR/PRP supervision "Specifies the last byte of the multicast address used for HSR/PRP supervision"
- Enter the IP Address that will be common for both LAN interfaces.
- Enter subnet mask or use default
- HSR clone MAC address specifies whether the eth0 adapters MAC is used for both LAN adapters (this is supported by HSR only).

4.13.2 PRP – Parallel Redundancy Protocol

- Select PRP
- HSR/PRP supervision "Specifies the last byte of the multicast address used for HSR/PRP supervision"
- Enter the IP Address that will be common for both LAN interfaces.
- Enter subnet mask or use default
- HSR clone MAC is only supported by HSR

4.14 Network Redundancy - Bonding

Network Bonding allows both RTU LAN ports to act as a single interface to allow primary/standby modes or load balancing in network redundancy applications.

Network Bonding

Enable Network Bonding ☐

Mode Active-Backup ▼ ⓘ

Obtain an IP Address via DHCP ☐

IP address

Subnet mask

Default gateway

Preferred DNS Server

Alternate DNS Server

Active-Backup:
Only one slave is active. The other slave becomes active only if, the active slave fails.
This mode provides fault tolerance.

Balance-RR:
Transmit packets in sequential order from the first available slave through the last.
This mode provides load balancing and fault tolerance.

Balance-XOR:
Transmit packets based on [(source MAC address XOR'd with destination MAC address XOR packet type ID) modulo slave count].
This mode provides load balancing and fault tolerance.

Broadcast:
Transmits everything on both slave interfaces.
This mode provides fault tolerance.

The four bonding modes include;

- Active- Backup
- Balance – RR
- Balance – XOR
- Broadcast

4.15 Adding a USB - Ethernet Adapter

The RTU32M supports addition of a USB Ethernet Adapter (Important, use only the Brodersen USB Ethernet adapter). After inserting the USB Ethernet adapter, ETHERNET LAN 3 will be included on the Network Settings web page and it must be configured in the same way as LAN 1 and LAN 2.

4.16 Adding USB – RS232 Serial Adapters

The RTU32M supports addition of USB Serial Adapters to add serial ports (Important, use only FTDI USB adapters). After inserting the USB RS232 serial adapter, an additional com port will be created (eg. COM1 a /dev/ttyUSB1, then COM2 at /dev/ttyUSB2 etc.

4.17 Adding a USB - WiFi Adapter

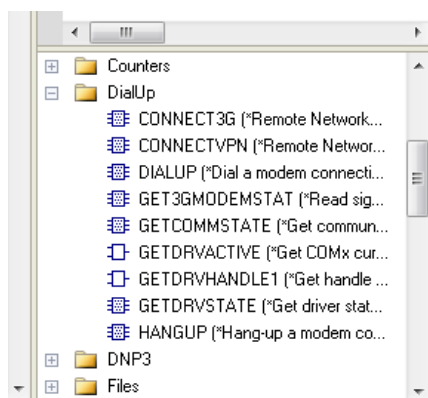
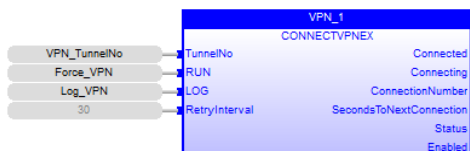
The RTU32M supports addition of a USB WiFi Adapter to add an access point (default mode) or managed node (Important, use only WLU6331 USB adapters). After inserting the USB Wifi adapter, ETHERNET LAN 3 will be included on the Network Settings web page. The adapter can be disabled, configured and the mode changed from the Network Access Web page..



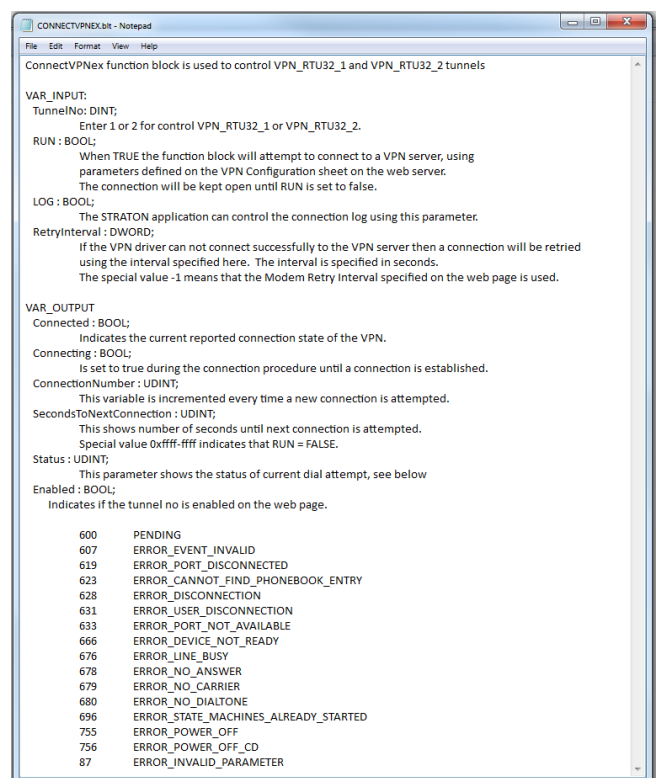
4.18 VPN Settings

The RTU VPN Client supports PPTP and L2TP (IPsec) for up to VPN Servers. The settings for each VPN server interface can be adjusted using the webpage.

In order to ensure the VPN client is working you will need to enter all credentials correctly. The webpage includes small help icons - just put the cursor on them and you will get details for each point. Controlling the connection of the VPN Client is done from the RTU logic application. Use the Function Block ConnectVPN found in the Dial-up function group to manage the VPN connections



Note: the VPN page is disabled in the early release firmware for the RTU32M (available 3Q 2018).





4.19 Time Settings for RTC – Real Time Clock

The time settings web page is used for configuring and adjusting the RTU32M real-time clock.

4.19.1 Time Settings

The RTU32M realtime clock can be configured from the Time Setting page.

You can define if the RTU should be synchronized via a NTP Server, or you can use other synchronization options like manual time setting or synchronization via utility drivers that include this functionality, such as IEC60870 or DNP3.

NOTE: The time shown on the webpage is running in software and is only updated when the page is refreshed.

When set for synchronizing to a NTP Server you must define the NTP Server IP address or domain name. If you use a domain name, you must ensure that you have defined a DNS Server address in the LAN1 configuration.

Update interval time can be set from 2 to 20160 minutes.

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Time Settings
To maintain the system time automatically, select **Synchronize to time server (NTP)**
To set time manually, select **Set time manually**

Time synchronization method

☒ Synchronize to time server (NTP)
☐ Set time manually

Time server (NTP)
To synchronize the RTU32 system clock with a time server, specify the name of a NTP server or multiple servers - Separate each server by a comma (',').
You can obtain a time server name from your ISP.
Time server name(s):
Update threshold (sec.):

Current time
Time in RTU32: ⓘ 02/07/2018, 07:51:36
Time in PC: 02/07/2018, 17:51:35

Time zone
Set the time zone for the system clock.
Time zone:

System Overview
VM Runtime Settings
I/O Board Settings
System Configuration
 Serial Port
 Network
 Network Redundancy
 Time
Maintenance
Utilities
DNP3 Slave

User name: admin
User group: Administrators
2018/01/28

CPU Temp: 53.2 °C
Load: 1.62 1.56 1.64
Memory Usage: 53.4 %
Board Temp: -273.2 °C

4.19.2 Base Station time zone

If you use local time you have to set the time zone correctly in order to get the correct time stamps. By default it is setup for UTC.



4.20 System Configuration – User Administration

The User Administration allows setup of user names and passwords. Each user is associated to a group of users – there can be up to 10 users in each group.

The three user groups have increasing levels of privileges and include;

Guests	Read only access
Superusers	Full access and configuration, except for the Security pages (read only)
Administrators	Full access and configuration access

User Administration

- System Overview
- Runtime Settings
- I/O Board Settings
- System Configuration
 - Network
 - Network Redundancy
 - Time
 - Services
 - User Administration
- Maintenance
- Utilities
- DNP3 Slave

Add User

User name:
Password:
Confirm Password:
User group: GuestsGuestsSuperusersAdministrators

Users

User name: admin User group: Administrators

User name: admin
User group: Administrators
2018/08/16

4.21 Maintenance – Firmware Update

The Firmware Update interface allows loading of updates to the RTU. Update files with a .swu extension are selected using the 'Choose File' button, then loaded to the RTU. The update script provides feedback to the user as the update progresses, as shown in the example below.

Firmware Update

Firmware file: No file chosen

Uploading swupdate-runtime_1.65.05.28.swu

Status Messages

Waiting for requests...

[network_initializer] : Main thread sleep again !

SWUPDATE successful !

[install_raw_file] : Installing file t5linux on /usr/bin/t5linux

[install_single_image] : Found installer for stream t5linux rawfile

[execute_shell_script] : Calling shell script /tmp/preinstall.sh : return with 0

Installation in progress

[network_initializer] : Valid image found: copying to FLASH

[extract_files] : Found file: filename preinstall.sh size 241 required

[extract_files] : Found file: filename t5linux size 2385060 required

[check_hw_compatibility] : Hardware compatibility verified

[check_hw_compatibility] : Hardware ionrtuc-2v1 Revision: 1.00

[parse_files] : Found File t5linux 1.65.5.28: t5linux --> /usr/bin/t5linux (ROOTFS) Version must be checked

[parse_scripts] : Found Script: preinstall.sh

[parse_hw_compatibility] : Accepted Hw Revision : 1.00

[extract_file_to_tmp] : Found file: filename sw-description size 373

Software Update started !

File uploaded successfully

Uploading file: swupdate-runtime_1.65.05.28.swu size: 2386432 bytes



4.22 Maintenance - Licensing

The RTU32M Licensing interface allows loading and activation of runtime license options. The RTU ID is used by the Brodersen factory to generate a unique license code that enables the required functionality. If you need additional drivers or other increased functionality that requires a license upgrade, please contact Brodersen or your authorized distributor and provide them with the RTU ID and details of the license requirements. You will then be sent a new license key that can be pasted in to the License Key field and then select 'Apply' to activate the new license options. The example below shows a RTU32M licensed with many driver and functionality options.

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Licensing

RTU ID: 171b89d2625d7b6d

Install key

License Key

Installed keys

License key 1: U2fedGVkX1+/JKDLmHPOUG9vsCQZVRGdCafgPRVgVFFieBIZaVhO6HmpYhO6X0BOyQvGIWkRelatfrFW6m3Q==

Licensed drivers:

IEC_60870-5-101_Master	IEC_60870-5-101_Slave
IEC_60870-5-104_Client	IEC_60870-5-104_Server
IEC_60870-5-103_Master	IEC 61850 Client
IEC 61850 Server	DNP3 Master
DNP3 Slave	WITS-DNP3 Slave
MQTT Client	DF1 Master
EtherNET/IP	ProfINET
SNMP Agent	SNMP Client
OPC UA Server	

Licensed features:

MultiTask Runtime	HSR/PRP
Unlimited IOs	

User name: admin
User group: Administrators
2018/01/28

CPU Temp: 53.2 °C
Load: 1.36 1.47 1.5
Memory Usage: 40.6 %
Board Temp: -273.2 °C

4.23 Maintenance - password

Here you can change the password for your main login.

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Change Password

The password is used to restrict access to the RTU32 Remote Configuration. This page will change the 'Admin' user account password.

Current password:

New password:

Confirm new password:

User name: admin
User group: Administrators
2018/01/28

CPU Temp: 53.8 °C
Load: 0.92 1.35 1.53
Memory Usage: 45.1 %
Board Temp: -273.2 °C

Note: the username and password is used for access to all Servers in the RTU32M – including HTTP Server, SSH Client and SFTP Server

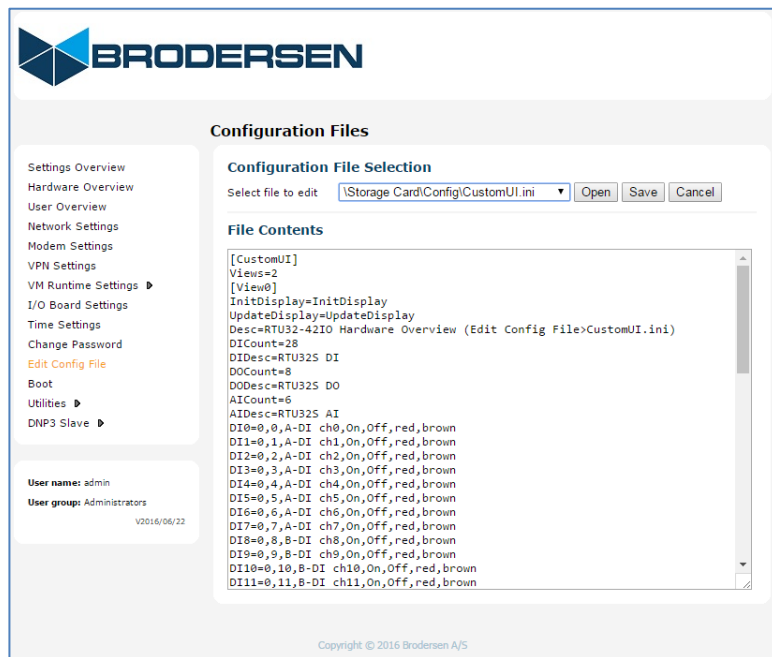


4.24 Maintenance - Edit Config File

The Edit Config File page is a simple text file editor used for making changes and adjustments in text based files in the RTU32M file system. The editor will automatically list all files with the extension “.txt”, “.dat” and “.ini” that are placed in the RTU
../etc/rtu32/config/.. folder.

By default, a number of files will be listed if you view “Select file to edit”. They are all files related to configuration of the RTU and reflect the actual settings on the webpages. These files should NOT be changed!

After opening a file, you can edit it like in any other text editor. Select save to save the configuration file on the RTU32M.



You may add your own files to the ../etc/rtu32/config/.. folder. You can create and place your own files using e.g. SFTP to a RTU32M. The WorkSuite supports functions for reading textual files and can for example be used for setting up variable values – set points, alarm levels etc. from the web interface.

The idea is that you can add your own file to the RTU32M that includes parameters used in a running PLC runtime application. Both the Brodersen WorkSuite and other developer tools provide options for read and write to text files.

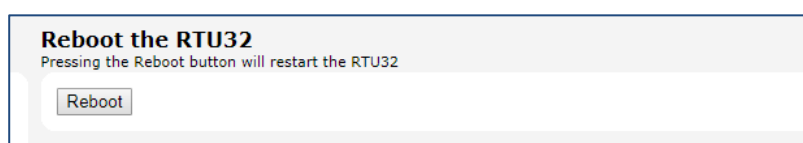
You can also save your application history or log book in a file. If you want to keep record of changes and updates of your application(s), you can enter it into to a text file and keep it on the RTU.

NOTE: For the normal user, the RTU32M system files need no changes – keep them unchanged. And do not edit the default text files placed in this folder, unless you are absolutely sure what impact it has.

Note2: the Edit Config File page is disabled in the early release firmware for the RTU32M (available 3Q 2018).

4.25 Maintenance - Reboot

After changing parameters on the configuration pages, you may be prompted to run the reboot function to activate the changes. After booting the RTU32M you can start working with Brodersen WorkSuite to create your application programs.





4.26 Utilities - Back Up and Restore

The backup and restore utilities allow a textual file that contains all of the RTU32M 'personality' information (all settings except for the logic application) to be transferred from/to the RTU. The file is named 'rtu32_settings.dat' and contains all of the configuration parameters used in the web pages (stored in a tab delimited format).

Backup and Restore Settings

Backup RTU32S settings
To save the current RTU32S settings to a file on this computer, click **Backup Settings**.

Restore RTU32S settings from a backup
To upload a backup, browse to the location of the file (.dat) and then click **Restore Settings**.
 No file chosen

If 'Backup Settings' is selected the RTU will generate a new rtu32_settings.dat file and the file will be uploaded from the RTU by the browser interface and stored in your PC's default download location.

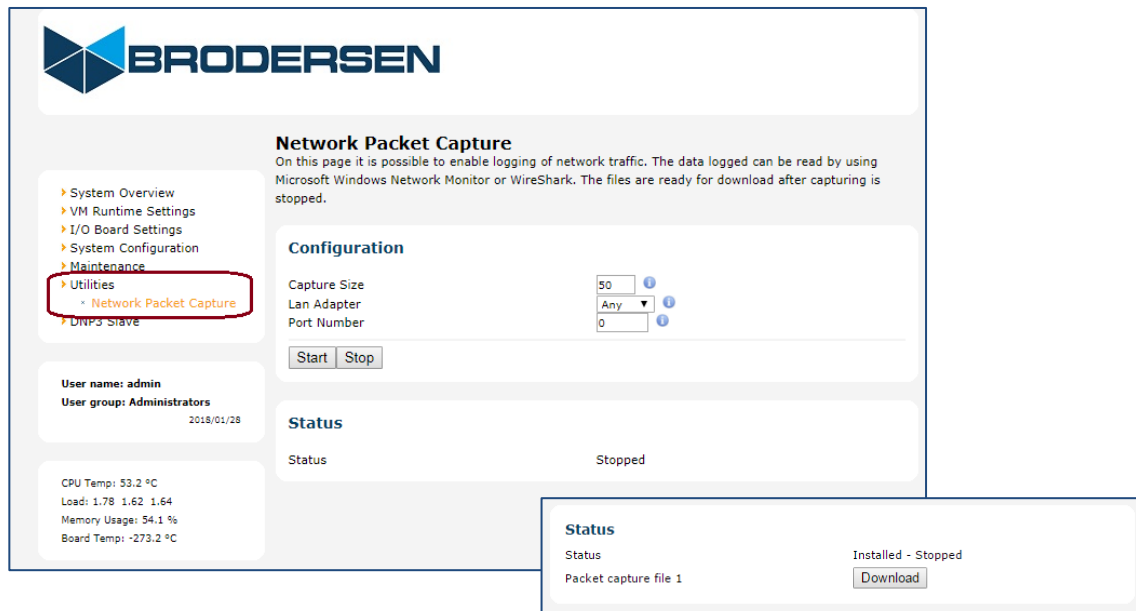
To restore a backup to the RTU32M, use the 'Choose file' button to browse and select the rtu32_settings.dat file that you wish to send to the RTU. Then select 'Restore Settings' to send the selected file to the RTU and the RTU will be restarted.

Note: the Backup and Restore page is disabled in the early release firmware for the RTU32M (available 3Q 2018).

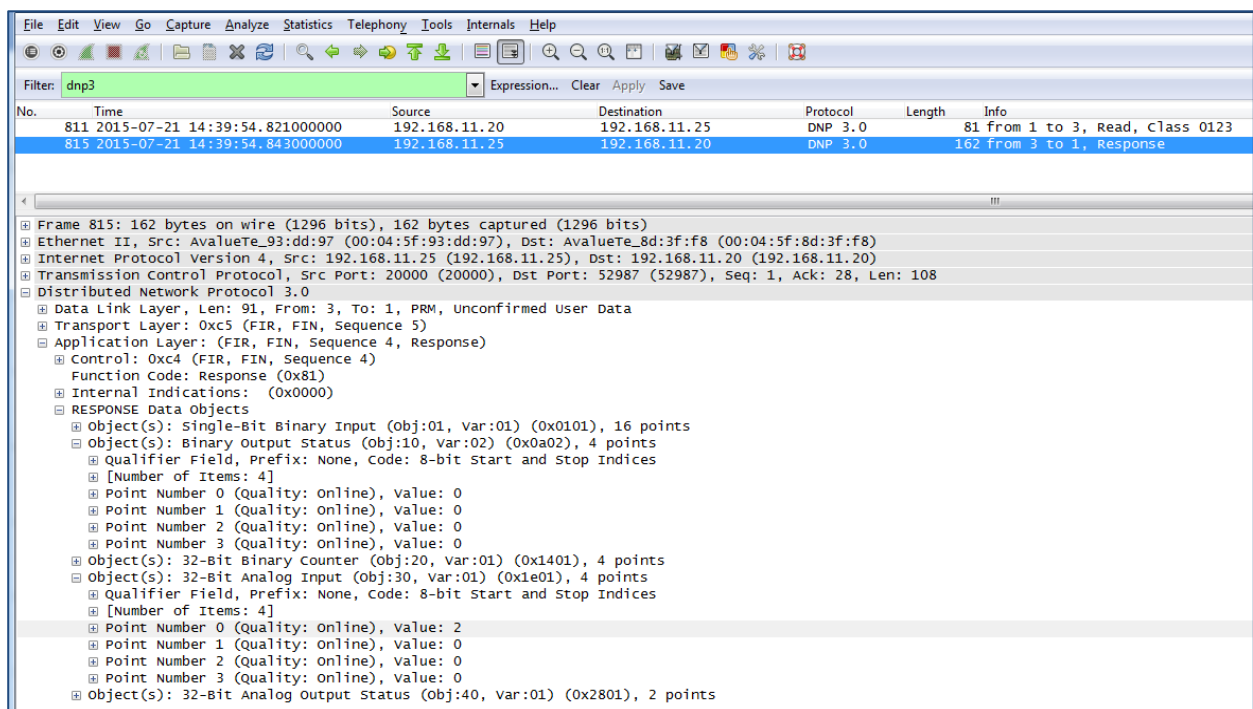


4.27 Utilities - Network Packet Capture

The Network Packet Capture utility allows IP traffic to be monitored and saved to a .pcap file. The file can then be uploaded to a PC and viewed by applications including WireShark. Capture begins when the start button is pressed and files are then ready for uploading when the capture is stopped.



Eg. example below shows a captured DNP3 integrity poll and the response from the RTU32M can be viewed in WireShark. A dnp3 filter has been applied to allow the message to be decoded.





4.28 DNP3 Slave – Configuration

The DNP3 Slave Configuration page allows slave setup parameters to be edited 'outside' of the RTU logic application. By default the 'Overwrite Link Settings' and 'Overwrite Link Settings' are disabled. If these fields are enabled, the RTU will read the DNP3 settings defined here, rather than the settings defined in the logic application. Note: these values are only read after a RTU restart/boot.

The screenshot displays the 'DNP3 Slave Driver Settings' configuration page. It includes sections for 'DNP3 Configuration', 'Serial configuration', and 'Network configuration'. The 'DNP3 Configuration' section has fields for Master Link Address (100), Slave Link Address (1), Connection Type (Network), Endpoint Type (Listening), and checkboxes for Overwrite Link settings and Overwrite Connection settings. The 'Serial configuration' section includes COM Port (COM1), Baud Rate (9600), Parity (None), Data Bits (8), Stop Bits (1), and an Enable logging checkbox. The 'Network configuration' section includes Slave IP address (127.0.0.1), Slave Port (20000), Master IP address (127.0.0.1), and Master Port (20000). A Notepad window titled 'dnp3s.ini - Notepad' shows the contents of the dnp3s.ini file, which are divided into 'Standard Parameters' and 'Extended Parameters'.

DNP3 Slave Driver Settings

DNP3 Configuration:

Master Link Address: 100

Slave Link Address: 1

Connection Type: ☒ Network

Endpoint Type: ☒ Listening

Overwrite Link settings: ☐

Overwrite Connection settings: ☐

Serial configuration:

COM Port: COM1

Baud Rate: 9600

Parity: None

Data Bits: 8

Stop Bits: 1

Enable logging: ☐

Network configuration:

Slave IP address: 127.0.0.1

Slave Port: 20000

Master IP address: 127.0.0.1

Master Port: 20000

Standard Parameters

```
[DNP3S]
linkoverwrite=0
connectionoverwrite=0
slave=2
master=100
type=1
endpointtype=0
portsettings=127.0.0.1:20000
masterportsettings=127.0.0.1:20000
comportsettings=COM1:9600,N,8,1
MaxAIEvents=200
MaxBIEvents=200
MaxDBIEvents=200
MaxCIEvents=200
MaxFCEvents=50
MaxAOEvents=50
MaxBOEvents=50
UnsolEn=1
UnSolC1=1
UnSolC2=1
UnSolC3=1
C1Min=3
C2Min=3
C3Min=3
C1EvtDly=4000
C2EvtDly=4000
C3EvtDly=4000
DeviceName=RTU32
LocationName=Test Site
LocationID=123
```

Extended Parameters

MaxAIEvents=200

MaxBIEvents=200

MaxDBIEvents=200

MaxCIEvents=200

MaxFCEvents=50

MaxAOEvents=50

MaxBOEvents=50

UnsolEn=1

UnSolC1=1

UnSolC2=1

UnSolC3=1

C1Min=3

C2Min=3

C3Min=3

C1EvtDly=4000

C2EvtDly=4000

C3EvtDly=4000

DeviceName=RTU32

LocationName=Test Site

LocationID=123

Since DNP3 slave version 3.1.55.910, the RTU32 Series supports both standard and extended versions of the dnp3s.ini file.

The standard version allows access to slave and master address, endpoint type and communications settings. The extended version includes additional application layer settings such as event buffer sizes, unsolicited reporting rules and device attributes, as shown below.

The extended dnp3s.ini file can be created/edited from the 'Edit Config File' web page, or generated and sent from a SCADA Host (using FTP or DNP3 File Transfer). Note: the RTU must be restarted for the dnp3s.ini file changes to be read. A restart can be triggered from logic, from the web page, or from the SCADA Host (using DNP3 warm reset or cold reset).

The screenshot displays the 'Configuration Files' page. It includes a 'Configuration File Selection' section with a dropdown menu showing the file path '\\Hard Disk\\Config\\dnp3s.ini'. The 'File Contents' section shows the contents of the dnp3s.ini file, which are divided into 'Standard Parameters' and 'Extended Parameters'.

Configuration Files

Configuration File Selection

Select file to edit: \\Hard Disk\\Config\\dnp3s.ini

File Contents

```
[DNP3S]
linkoverwrite=0
connectionoverwrite=0
slave=1122
master=30000
type=1
endpointtype=0
portsettings=127.0.0.1:20000
masterportsettings=127.0.0.1:20000
comportsettings=COM1:9600,N,8,1
MaxAIEvents=5000
MaxBIEvents=5000
MaxDBIEvents=200
MaxCIEvents=5000
MaxFCEvents=50
MaxAOEvents=5000
MaxBOEvents=5000
UnsolEn=TRUE
UnSolC1=1
UnSolC2=1
UnSolC3=1
C1Min=25
C2Min=25
C3Min=25
C1EvtDly=10s
C2EvtDly=10s
C3EvtDly=10s
DeviceName=Test Device
LocationName=Test Location
LocationID=54321
```



4.29 DNP3 Slave – Serial Tunneling

In applications where the RTU needs to be used to provide an IP-Serial gateway, one or two of the comm ports can be setup to pass data to/from an IP port. The 'Network Port' setting defines which IP port is used.

Eg. in the example below any DNP3 messages received on IP port 20005 will be retransmitted on serial port COM1. Any DNP3 messages received on COM1 will be retransmitted on IP port 20005.

BRODERSEN

DNP3 Serial Tunnel Settings

Serial Tunnel One configuration:

Enable: ☐ ⓘ

COM Port: ⓘ

Baud Rate: ⓘ

Parity: ⓘ

Data Bits: ⓘ

Stop Bits: ⓘ

Enable logging: ☐ ⓘ

Network Port: ⓘ

Connection timeout: ⓘ

Serial Tunnel Two configuration:

Enable: ☐ ⓘ

COM Port: ⓘ

Baud Rate: ⓘ

Parity: ⓘ

Data Bits: ⓘ

Stop Bits: ⓘ

Enable logging: ☐ ⓘ

Network Port: ⓘ

Connection timeout: ⓘ

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Settings Overview
Hardware Overview
User Overview
Network Settings
Modem Settings
VPN Settings
VM Runtime Settings ▶
I/O Board Settings
Time Settings
Change Password
Edit Config File
Boot
Utilities ▶
DNP3 Slave ▶
DNP3 Slave Configuration
DNP3 Serial Tunneling

User name: admin
User group: Administrators
V2016/06/22

Note: the DNP3 Serial Tunneling page is disabled in the early release firmware for the RTU32M (available 3Q 2018).



5 Getting Started with the Brodersen WorkSuite tools (3.9.2)

5.1 Introduction

The Brodersen WorkSuite Package includes all software required to configure and program the Brodersen RTU32 Series of products – including RTU32, RTU32E, RTU32M, RTU32R and RTU32S.

The software components included in the package include:

- Brodersen WorkSuite PLC configuration and programming tool.
- WIBUKey driver for the USB license key dongle for WorkSuite.
- RTU32 Series tool package including:
 - o Event Viewer – the telnet tool used for monitoring the System Log(s) in RTU32 Series products.
 - o RTU32 Search tool for scanning and finding RTU32 products running on networks.
 - o RTU32 Series Remote Desktop tool
 - o RTU32 Update tool for managing software updates for many RTUs over network connections.

All software is installed in one installation process. The installation process will ask you what software to install and after making your selection, the installation process will run automatically and install and configure the all software, making it easy for you to begin working with configuration and programming of the Brodersen RTU32 Series products.

5.2 Installing the Brodersen WorkSuite Package

Go to our website www.brodersen.com and find the WorkSuite Installation Guide. It will guide you through all the installation details.

5.3 WorkSuite License

The WorkSuite tool requires a license to configure and program RTUs. Without a license the software package works in DEMO mode.

The license is locked to a USB hardware dongle that is included in the package. In the package you find also the WorkSuite License Certificate with a License id number required to enter in the License utility after installing the software.

The standard license offers the possibility to create an unlimited number of I/O points in the RTU application program. All variables associated to communications drivers are also counted as I/Os.

5.4 Compatibility with STRATON WorkBench

The Brodersen WorkSuite Package replaces all versions of STRATON WorkBench. The WorkSuite is backwards compatible with all STRATON versions and supports directly any older STRATON version 5.x, 6.x, 7.x and 8.x projects.

The Brodersen WorkSuite is a Brodersen OEM version of STRATON, but includes a range of new facilities:

1. One installation process for WorkSuite - installs all software including license key drivers and all drivers, functions and Brodersen Tools supported by the RTU32 Series products.
2. Eliminates the need to install special hardware libraries, tools etc. After the installation of the WorkSuite Package you are ready to go.
3. All drivers supported by the RTU32 Series of products are available in the WorkSuite and it makes the software version management must simpler for all parties.

Important Notes:

1. If you have existing licenses for STRATON WorkBench version 8.x, they are 100% compatible with the WorkSuite.
2. If you have an older Straton license, please contact Brodersen at sales@brodersen.com or your local representative for update prices. Please remember to include a copy of your current License Certificate.

5.5 User documentation and training/guideline videos

When installing the Brodersen WorkSuite package, User Guides and Manuals are installed as well. You get access to these documents from the Help menu within WorkSuite.



WorkSuite has also implemented a help function that means that you can get help by pressing F1. If no valid help opens, please check the PDF manuals available under the general WorkSuite Help menu or check our website www.brodersen.com for documentation.

We recommend that you use the Brodersen Training/Guideline Videos. They are found by visiting:

www.youtube.com/brodersensystems

Here you will find step by step guidelines with details of how to get started and how to setup drivers etc.



6 RTU32M I/O Setup in WorkSuite

6.1 General

It is highly recommended to take a training course on the RTU32 product series and the WorkSuite package. It will save you a lot of time and is a good investment because you will get familiar with the software and hardware and be able to quickly take advantage of all the RTU and WorkSuite powerful features. Contact your local distributor, or Brodersen for RTU/WorkSuite training exercises.

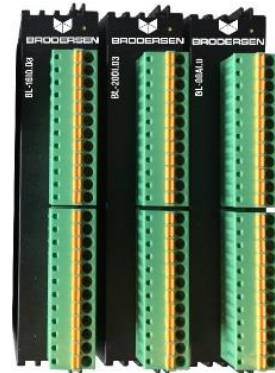
Besides the basic WorkSuite standard PLC programming environment and EN/IEC61131-3 programming languages, there are some functions and features which are specific for the RTU32M Product Series.

6.2 WorkSuite I/O Drivers for RTU32M

The WorkSuite I/O Drivers for the RTU32M are used to access the physical inputs and outputs. All RTU inputs are read online when the PLC runtime cycle is started and all outputs are written online at the end of the runtime cycle.

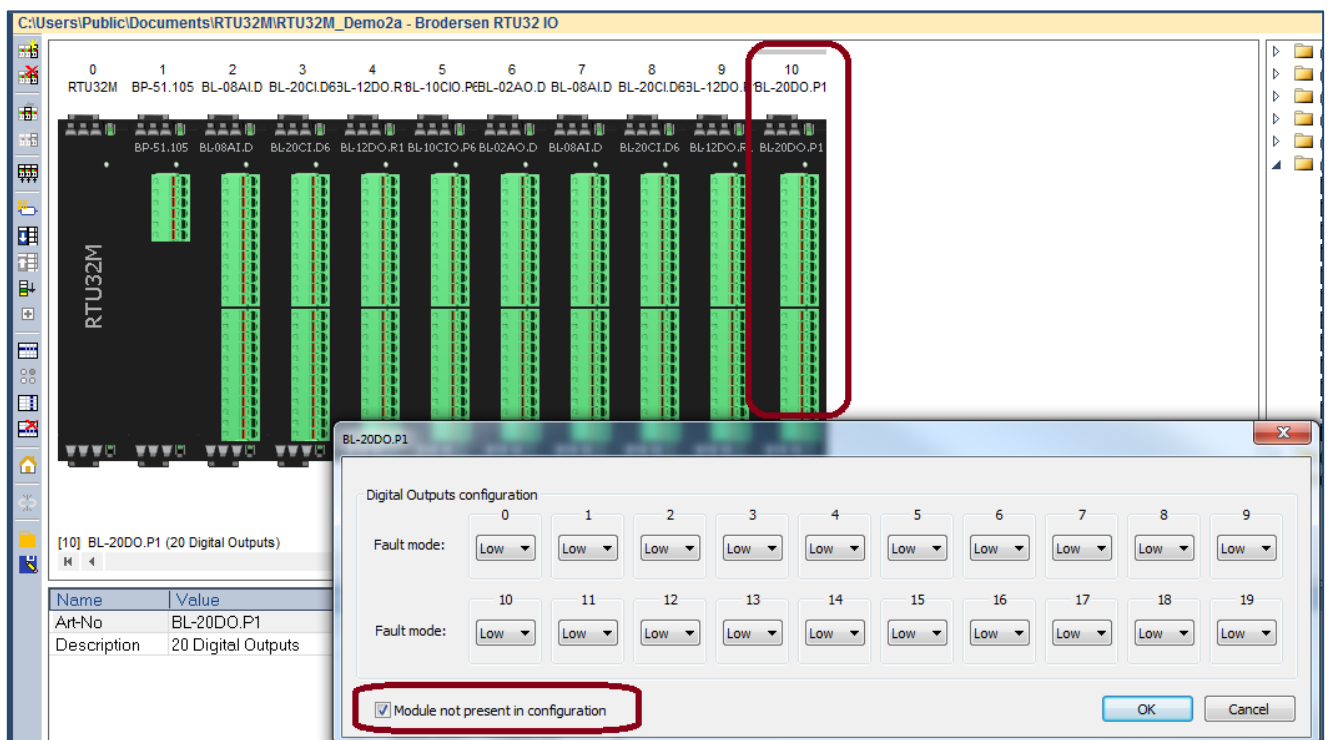
The RTU32M supports the Brodersen BL Series expansion I/O modules via its modular backplane bus.

All I/Os (including status flags/words) are stored in an independent memory mapped database in the RTU32M. The database is a mirror of the physical I/O. The WorkSuite I/O drivers handle the access to this database. You can program your logic application without any connected hardware.



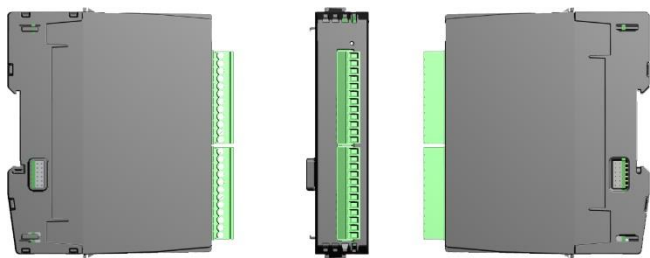
BL Series I/O

You must be sure that you have the correct I/O configuration and modules when you try to run and debug your application program on the RTU32M – or ensure that missing/future modules in your I/O configuration are set to ‘not present’ as shown below.





6.3 INTRODUCTION to BL I/O series



The Brodersen BL Series I/O modules can be used with RTU32M & RTU32M Series products. The modules are in two parts - the bottom part contains the backplane bus and top part contains the I/O board and logic. All LB2 modules can be hot swapped.

Each I/O modules has a 200 MHz CPU to process I/O, perform filtering, SOE, debounce, module clock and general module logic. Diagnostic variables are available for all modules - see the module datasheets for full info. Firmware updates are handled from Brodersen Worksuite.

Use only genuine Brodersen bus cables for connection to Brodersen RTUs and for extension of I/O module blocks. The LB2 bus connection cables are a special build, to handle the power requirements and shielding to run bus communications. The maximum overall length of a complete system is 5m. Each I/O module & Power supply module is calculated as 2cm. The cables are available in various lengths from 25cm to 200cm.

Each LB2 Bus supports up to 250 I/O modules.

LB2 Cables

Description	Part Number
100cm LB2 Cable	UCC-610/1
200cm LB2 Cable	UCC-610/2
25cm LB2 Cable	UCC-610/25
50cm LB2 Cable	UCC-610/50

IO MODULE BACKPLANE PARTS

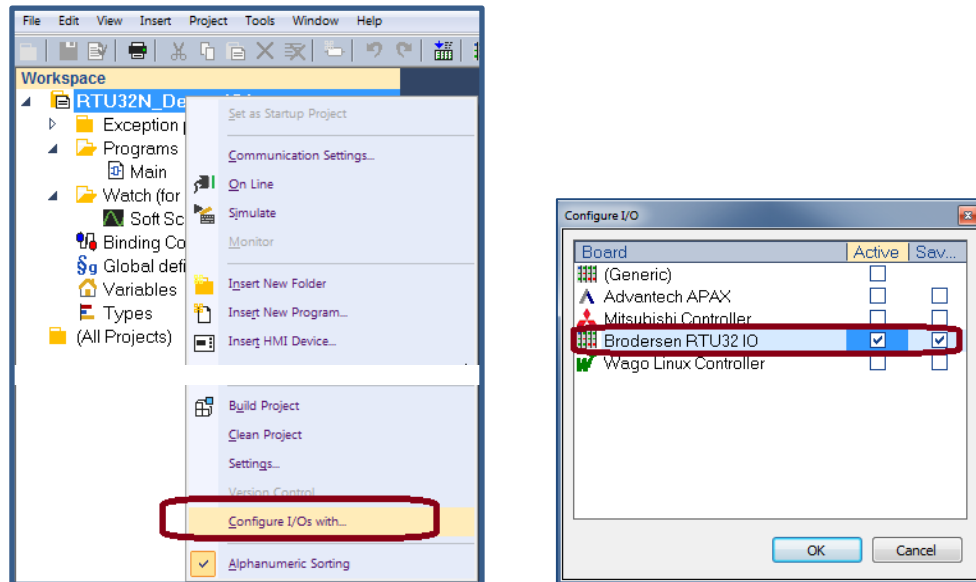
Description	Part Number
Bus I/O module Start	BB-1LS.10
BUS I/O module, Middle	BB-1LI.10
BUS I/O module, Expansion (End)	BB-1LE.10
BUS Power supply module, Start	BB-1PS.10
BUS Power supply module, Middle	BB-1PI.10
BUS CPU module, Start	BB-1CS.10
BUS CPU module, Middle	BB-1CI.10



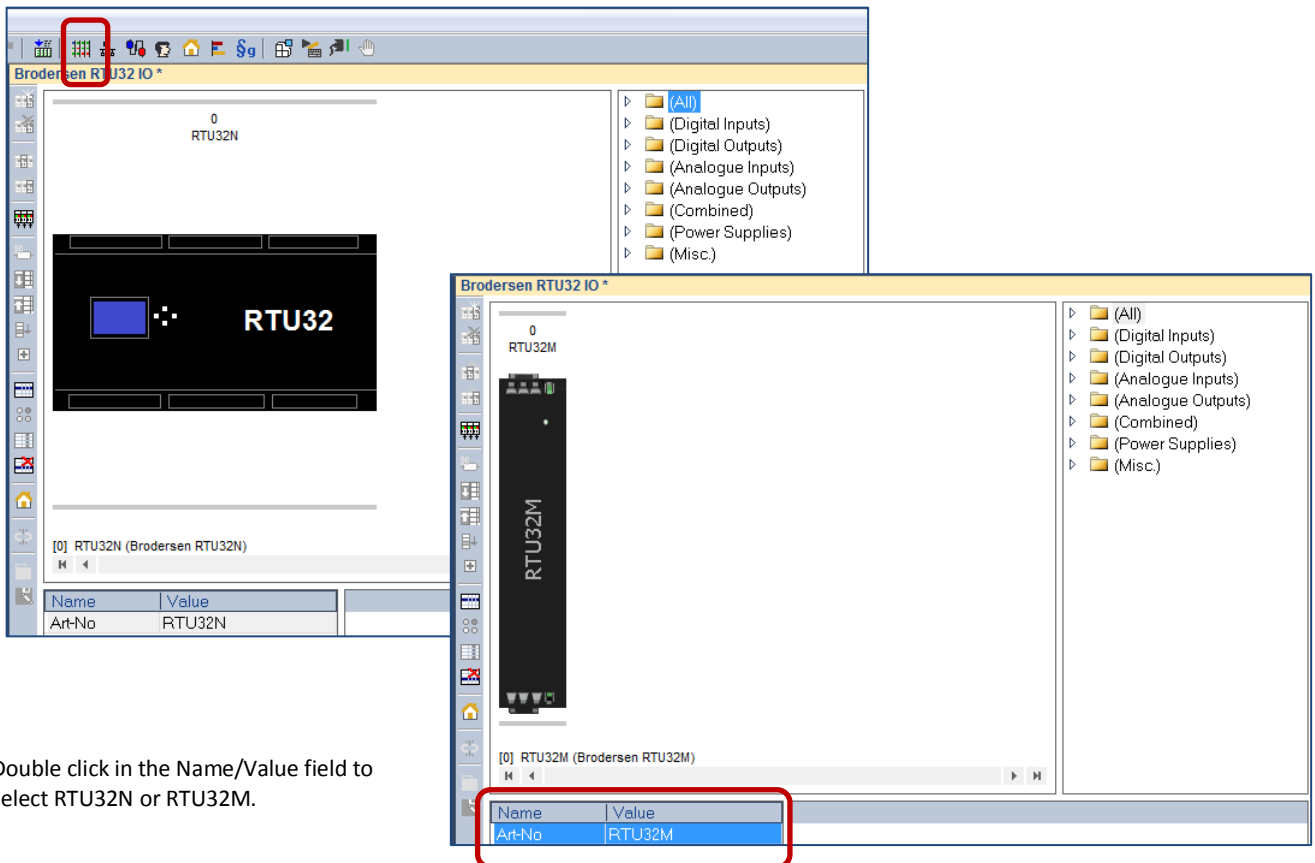
6.4 BL Series Module Configurator

All BL Series modules are configured in Worksuite.

After creating a new project, right click the project heading and select 'Configure I/Os with' and select the Brodersen RTU32IO options.



Then select the 'Open I/Os' icon in the top toolbar to access the Module Configurator.

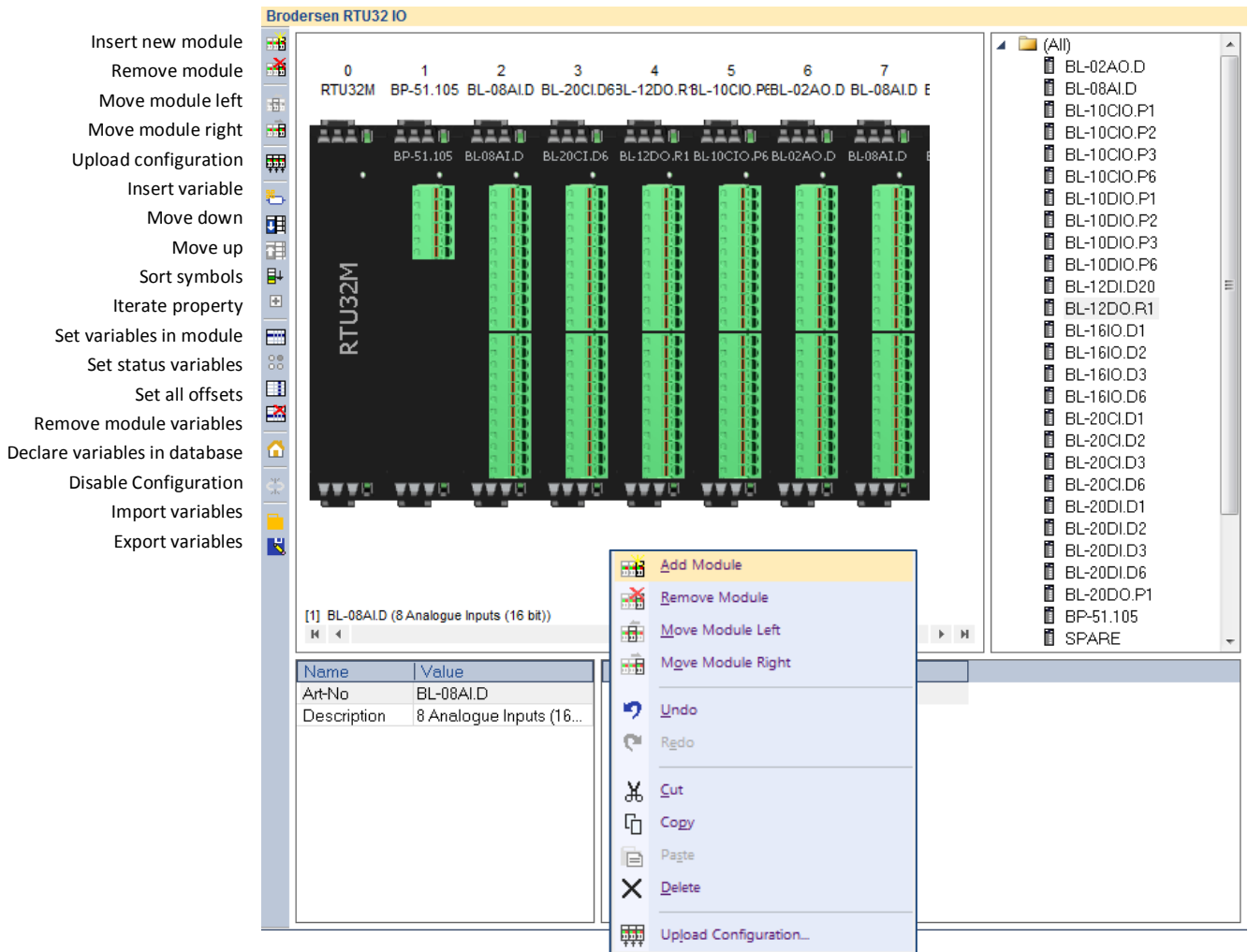


Double click in the Name/Value field to select RTU32N or RTU32M.



6.4.1 Managing BL Series I/O Modules

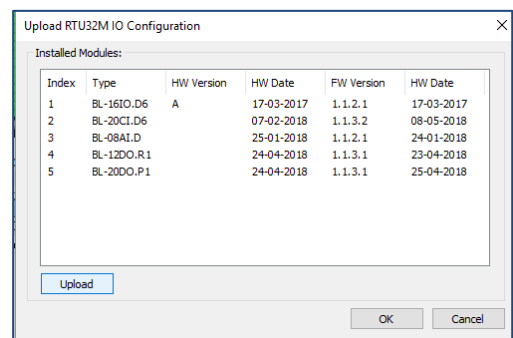
The Module Configurator allows creation and editing of the I/O module setup using a mix of toolbar icons and drag and drop menu items.



6.4.2 Inserting a module

Modules can be inserted in several ways.

- Drag and drop a module from the module list.
- Right click in the I/O module window and select ADD Module
- Copy existing I/O using Windows copy/paste commands.
- Right click in the I/O module window and select 'Upload Configuration' (uploads modules from the online RTU).



6.4.3 Moving a module


Modules can be moved left or right by placing the mouse cursor on the module – then press and hold the left mouse button to drag the module to the desired position, or press the right mouse button and select 'Move Module Left' or 'Move Module Right'.

6.4.4 Remove a module in Worksuite

Modules can be Removed/Deleted by placing the mouse cursor on the module - then press Delete on your keyboard, or press the right mouse button and select 'Remove Module'.



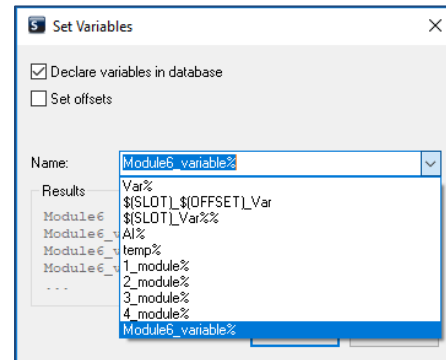
6.4.5 Add variables to a module

In the left pane of the I/O module window, the icon  'Set Variables In Module' opens the variables editor. Remember to check 'Declare variables in database' if the variables are to be used as Global Variables.

Use of syntaxes allows flexibility to engineer your own variable names.

Use the Drop Down list to select a suitable syntax, or make your own. For example, if the syntax \$(SLOT)_\$(OFFSET)_VAR is selected, the variables will be as shown below for an 8 channel analogue input module.

Symbol	Type	Channel
Slot 2_0_Var	Input WORD	0
Slot 2_1_Var	Input WORD	1
Slot 2_2_Var	Input WORD	2
Slot 2_3_Var	Input WORD	3
Slot 2_4_Var	Input WORD	4
Slot 2_5_Var	Input WORD	5
Slot 2_6_Var	Input WORD	6
Slot 2_7_Var	Input WORD	7



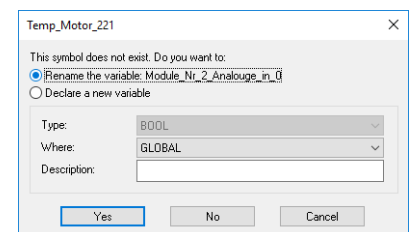
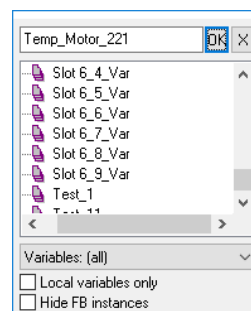
As another example, the syntax could be:
Module_Nr_\$(SLOT)_Analogue_In_\$(OFFSET)

This would create eight variables as shown below;
'Module_Nr_2_Analogue_In_1'
'Module_Nr_2_Analogue_In_2'
'Module_Nr_2_Analogue_In_3'
.....
'Module_Nr_2_Analogue_In_7'
'Module_Nr_2_Analogue_In_8'

6.4.6 Rename auto generated variables

In cases where variable names can't be easily generated through a syntax, they can be created/edited manually by placing the mouse cursor on the variable and using DoubleClick to access the variables editor.

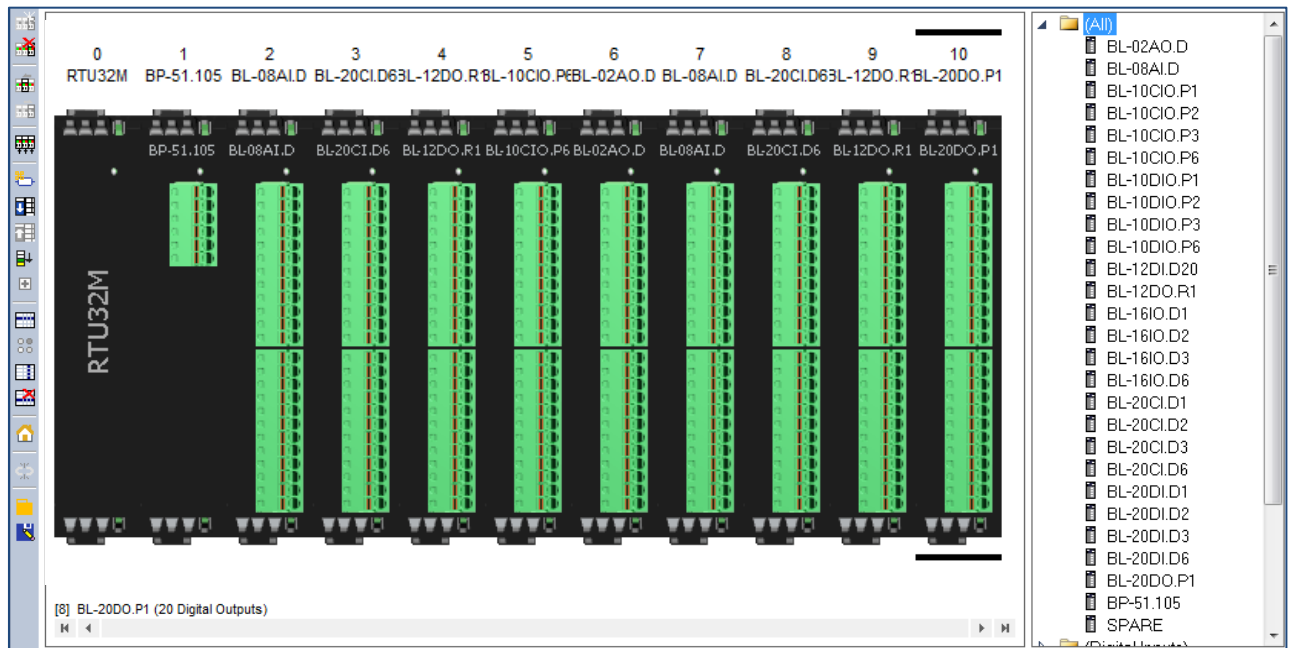
The user can then rename of the variable or create a new variable.





6.4.7 Configure Module Defaults

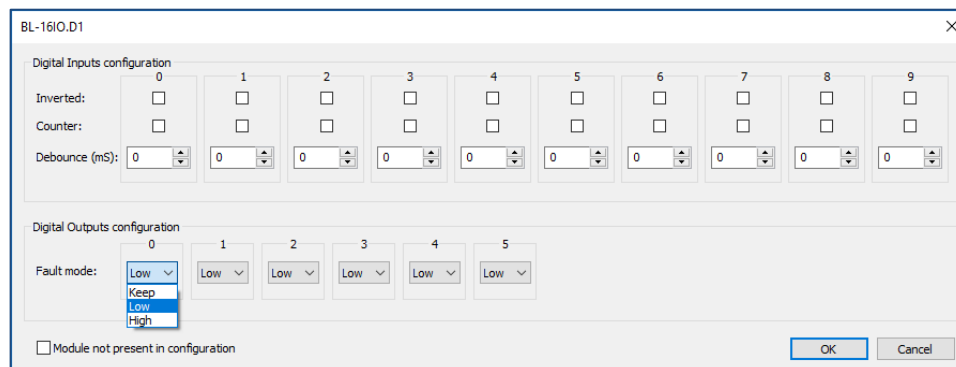
After creating or uploading a module array, module configurations can be modified from their default settings if required. Features and settings for each module can be found on their respective datasheets.



DoubleClick on a module in the I/ O configurator to access the module I/O editor.

6.4.8 Configure Combination DI/DO module example

In the example below a combination DI/DO module with 10 DI and 6 DO has been selected.



Configuration Fields - Inputs and Outputs:

- **Inverted:** Select if input is to be inverted.
- **Counter:** Select if input is a counter. Note: If an input is receiving a 5 Khz pulse/count, but not defined as a counter, the I/O bus will be spammed with 5000 pulses/sec!
- **Debounce:** Debounce in milliseconds, determines how long time the I/O must be high or low before it is detected as state change.
- **Fault Mode:** Fault mode is when the module loses contact with the CPU. It is necessary to select for all channels.
 - Keep (I/O module will keep last state)
 - Low (Output will be forced Low)
 - High (Output will be forced High)



6.4.9 Configure AI module example

In the example below an eight channel AI module has been selected.

Configuration Fields - Inputs:

- **Range:** Select input type for each channel in dropdown menu.
- **Filter:** select filter type for each channel in dropdown menu.
- **Delta change:** See AI module datasheet
- **Scale Min:** See AI module datasheet
- **Scale Max:** See AI module datasheet

6.4.10 Export/Import Module variables.

WorkSuite allows exporting and importing of variables for alternative methods of editing using document and spreadsheet software.

Export: Select the I/O module of interest and then select the Export Variables icon in the toolbar on the left to create a CSV export file.

The file includes Scale min, Scale Max, Variable name etc.

	A	B	C	D	E	F	G	H
1	NAME	TYPE	OFFSET	SCALEMIN	SCALEMAX	HWMIN	HWMAX	#F
2	4_module1	IX	0 0.0	65535.0	0	65535	-1	
3	4_module2	IX	1 0.0	65535.0	0	65535	-1	
4	4_module3	IX	2 0.0	65535.0	0	65535	-1	
5	4_module4	IX	3 0.0	65535.0	0	65535	-1	
6	4_module5	IX	4 0.0	65535.0	0	65535	-1	
7	4_module6	IX	5 0.0	65535.0	0	65535	-1	
8	4_module7	IX	6 0.0	65535.0	0	65535	-1	
9	4_module8	IX	7 0.0	65535.0	0	65535	-1	
10	4_module9	IX	8 0.0	65535.0	0	65535	-1	
11	4_module10	IX	9 0.0	65535.0	0	65535	-1	
12	4_module11	QX	0 0.0	65535.0	0	65535	-1	
13	4_module12	QX	1 0.0	65535.0	0	65535	-1	
14	4_module13	QX	2 0.0	65535.0	0	65535	-1	
15	4_module14	QX	3 0.0	65535.0	0	65535	-1	
16	4_module15	QX	4 0.0	65535.0	0	65535	-1	
17	4_module16	QX	5 0.0	65535.0	0	65535	-1	

Import: Select the Import Variables icon in the toolbar on the left to read in updates from a CSV file.

6.4.11 Firmware update I/O modules

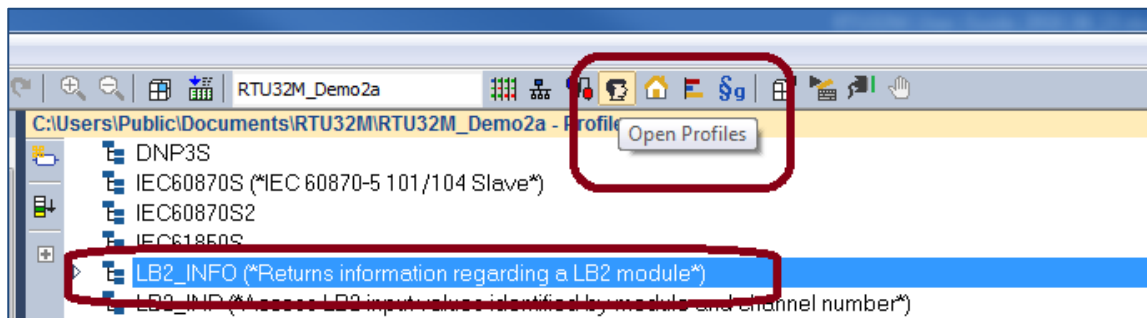
Firmware update of BL Series modules on the LB2 bus is done through the Firmware update utility in the Brodersen WorkSuite. The Firmware version is displayed in the Brodersen WorkSuite (and also in the Event Viewer utility program). Right-click on a module to invoke the update dialog.

Check www.brodersen.com for new firmware releases or contact support at support@brodersen.com



6.4.12 LB2_INFO Profile – monitoring module status

Module status information is available via the Profile Editor, using the LB2_INFO Profile (a future release will allow access to these parameters from the I/O Configurator).



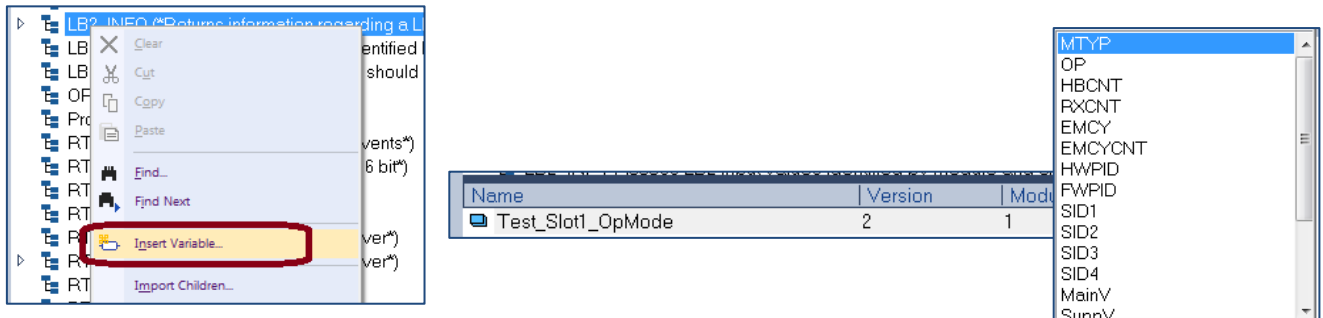
Profiles are a mechanism to add additional attributes to a point variable. The LB2_INFO profile allows access to module parameters and status information including:

Parameter Name	Variable Type	Module Type
OP:	BYTE	Current Operation Mode
		0 = No Module
		4 = Stopped
		5 = Operational
		6 = Operational with heartbeat timeout
		127 = Pre-operational
		150 = Missing
HBCNT:	DWORD	Number of heartbeat frames received
RXCNT:	DWORD	Number of frames received
EMCY:	LINT	Read last EMCY codes
HWPID:	DWORD	Module hardware ID
SWPID:	DWORD	Module firmware ID
SID1:	DWORD	Module serial ID1
SID2:	DWORD	Module serial ID2
SID3:	DWORD	Module serial ID3
SID4:	DWORD	Module serial ID4
MainV:	WORD	Main supply voltage (mV)
SuppV:	WORD	Internal supply voltage (mV)
IntC:	WORD	Internal temperature (C)
PwOn#:	WORD	Power on counter
WD#:	WORD	Watchdog restart counter
UpTim:	DWORD	Uptime in hours
TotUpTim: DWORD	Total uptime	

LB2_INFO Profile – Allows access to RTU32M Module Information



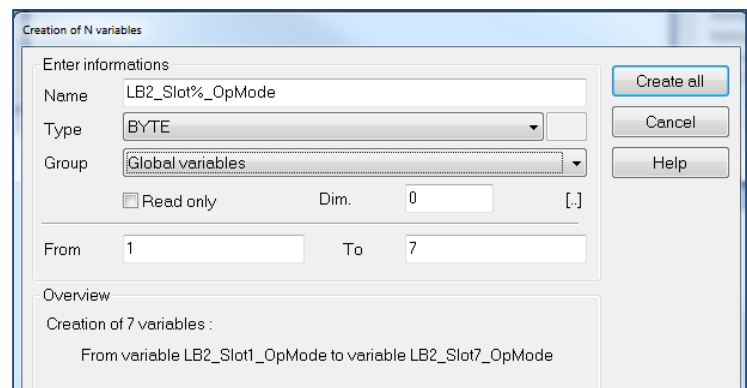
To use the Profile Editor – first create a variable by right clicking the LB2_INFO heading and selecting 'Insert Variable'. Eg. create a variable named 'Test_Slot1_OpMode', and give it a BYTE format, then select the 'OP' data type.



Load your application and check that the module returns the expected operating code (5 = operational).

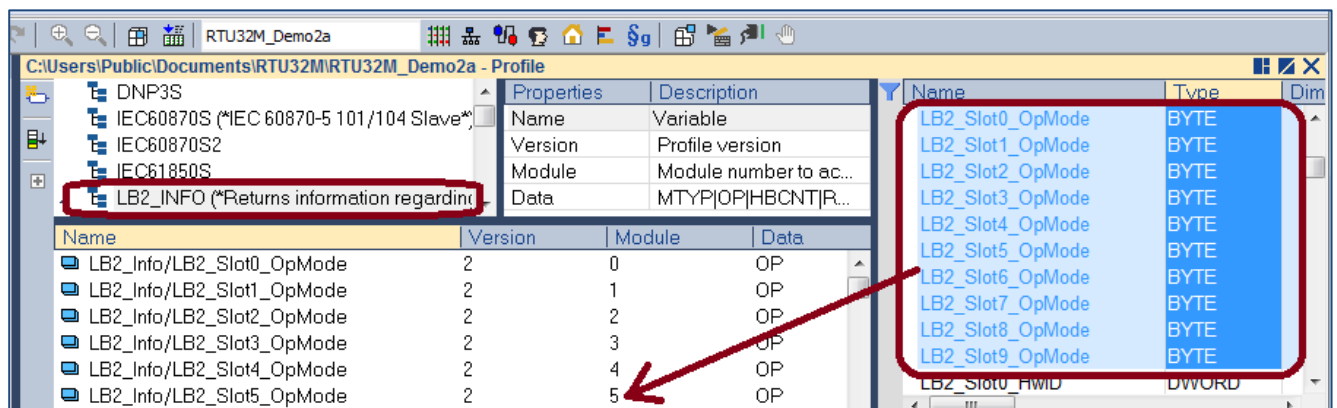
Note: you can create more local or global variables using the Wizard tool in the main variables editor eg. right click in the variables list and select 'Add Multi Variables'.

The example here creates 7x variables named LB2_Slot1_OpMode thru to LB2_Slot7_OpMode...



After creating each group of new variables they can then be dragged in to the Profile editor and assigned their parameters and setting using column change and iterate functions...

Then first ensure that the correct profile is highlighted, by selecting the header (LB2_INFO), then drag the new variables into the lower pane of the profile editor.

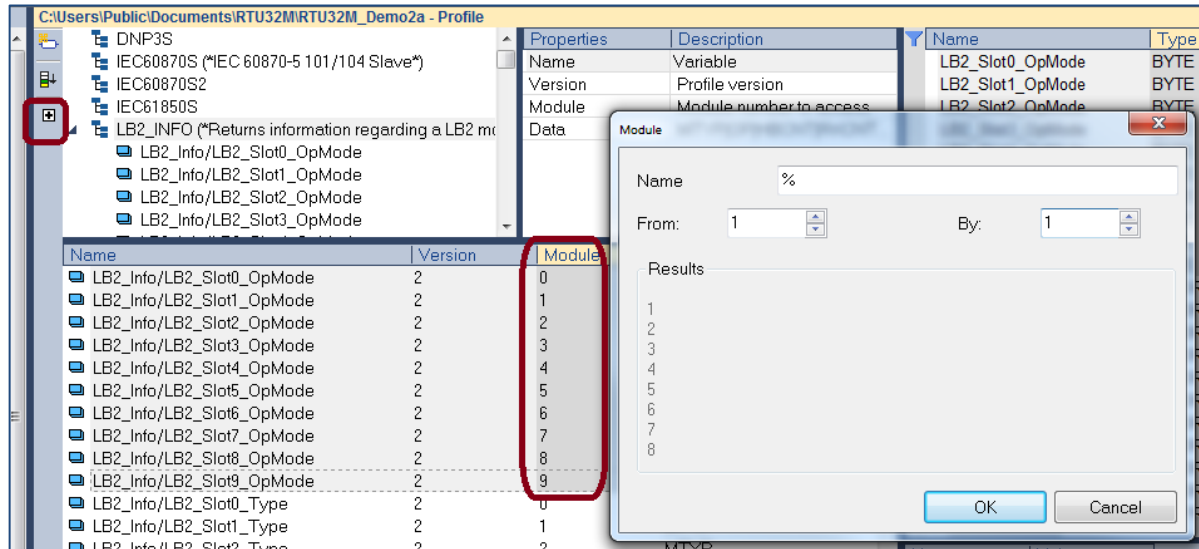


To make a column contents change of the Data column, select the first value, then use SHIFT-Double Left Click to bring up the selection window. Select OP for Operating mode to change all of the selected values at once.

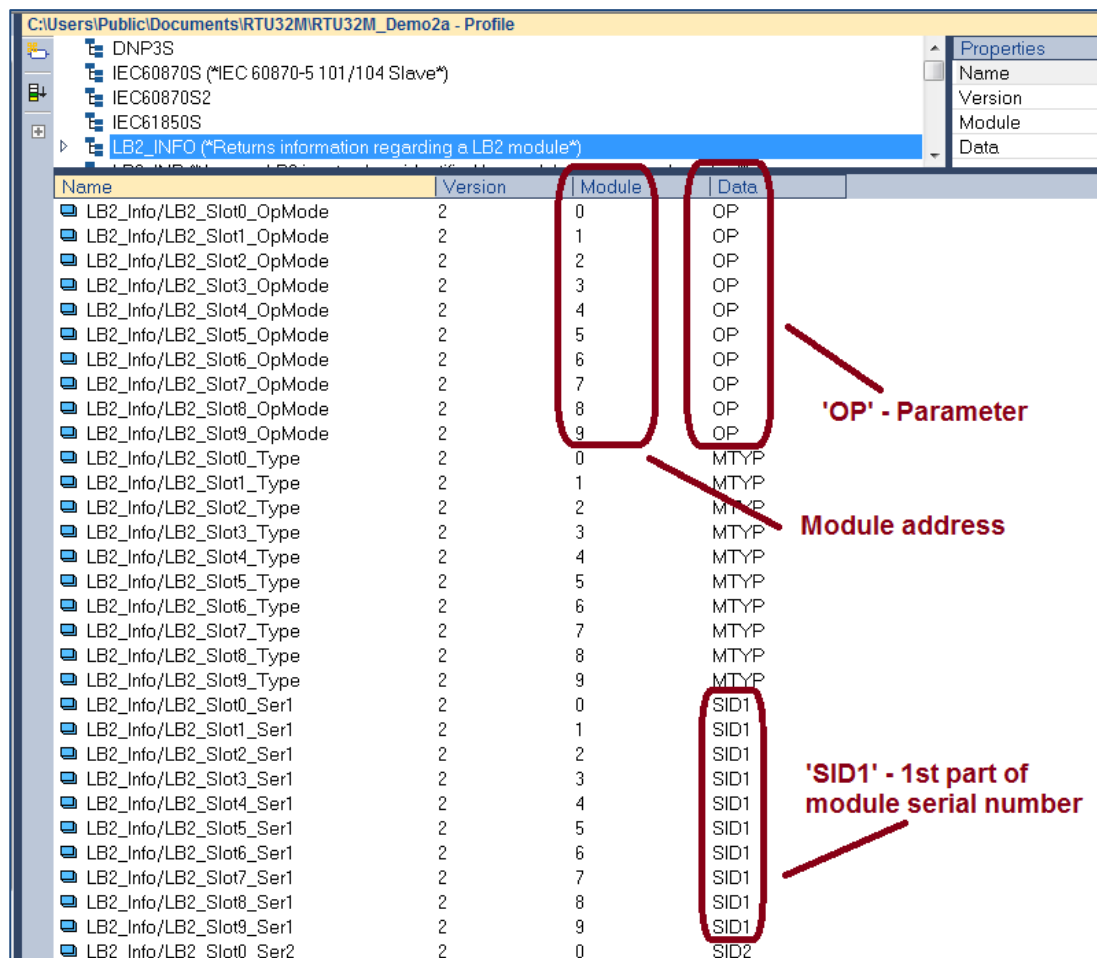
Name	Version	Module	Data
LB2_Info/LB2_Slot0_OpMode	2	0	OP
LB2_Info/LB2_Slot1_OpMode	2	1	OP
LB2_Info/LB2_Slot2_OpMode	2	2	OP
LB2_Info/LB2_Slot3_OpMode	2	3	OP
LB2_Info/LB2_Slot4_OpMode	2	4	OP
LB2_Info/LB2_Slot5_OpMode	2	5	OP
LB2_Info/LB2_Slot6_OpMode	2	6	OP
LB2_Info/LB2_Slot7_OpMode	2	7	OP
LB2_Info/LB2_Slot8_OpMode	2	8	OP
LB2_Info/LB2_Slot9_OpMode	2	9	OP



The iterate property button will allow you to rapidly increment the module address for each tag. First select the relevant tags in the module column by selecting the first value, then SHIFT-Left click the last value. Then select the 'Iterate Property' button and set the appropriate start/from value and increment/by value.



If you want to monitor additional module parameters and status information, repeat the above steps and create further variables, as per the example shown below.





Example Logic Application Page – showing various LB2_INFO parameters and status values.

RTU32M_Demo2a

[[C:\Users\Public\Documents\RTU32M\RTU32M_Demo2a - LB2_Info]]

LB2 Slot0_OpMode = 0 LB2 Slot0_Type = 0
LB2 Slot1_OpMode = 5 LB2 Slot1_Type = 28932
LB2 Slot2_OpMode = 5 LB2 Slot2_Type = 9220
LB2 Slot3_OpMode = 5 LB2 Slot3_Type = 1560
LB2 Slot4_OpMode = 5 LB2 Slot4_Type = 5124
LB2 Slot5_OpMode = 5 LB2 Slot5_Type = 16408
LB2 Slot6_OpMode = 150 LB2 Slot6_Type = 16
LB2 Slot7_OpMode = 150 LB2 Slot7_Type = 16
LB2 Slot8_OpMode = 150 LB2 Slot8_Type = 16
LB2 Slot9_OpMode = 150 LB2 Slot9_Type = 16

LB2 Slot0_HwID = 0 LB2 Slot0_SwID = 0 LB2 Slot0_UpTime = 0
LB2 Slot1_HwID = 93033 LB2 Slot1_SwID = 93034 LB2 Slot1_UpTime = 0
LB2 Slot2_HwID = 92971 LB2 Slot2_SwID = 93014 LB2 Slot2_UpTime = 0
LB2 Slot3_HwID = 92980 LB2 Slot3_SwID = 93010 LB2 Slot3_UpTime = 0
LB2 Slot4_HwID = 92984 LB2 Slot4_SwID = 93012 LB2 Slot4_UpTime = 0
LB2 Slot5_HwID = 92989 LB2 Slot5_SwID = 93011 LB2 Slot5_UpTime = 0
LB2 Slot6_HwID = 0 LB2 Slot6_SwID = 0 LB2 Slot6_UpTime = 0
LB2 Slot7_HwID = 0 LB2 Slot7_SwID = 0 LB2 Slot7_UpTime = 0
LB2 Slot8_HwID = 0 LB2 Slot8_SwID = 0 LB2 Slot8_UpTime = 0
LB2 Slot9_HwID = 0 LB2 Slot9_SwID = 0 LB2 Slot9_UpTime = 0

LB2 Slot0_Ser1 = 0 LB2 Slot0_Ser2 = 0 LB2 Slot0_IntC = 0 LB2 Slot0_PwOn = 0
LB2 Slot1_Ser1 = 2484680295 LB2 Slot1_Ser2 = 29893191 LB2 Slot1_IntC = 35 LB2 Slot1_PwOn = 32
LB2 Slot2_Ser1 = 3792840579 LB2 Slot2_Ser2 = 4598248 LB2 Slot2_IntC = 37 LB2 Slot2_PwOn = 23
LB2 Slot3_Ser1 = 3792840836 LB2 Slot3_Ser2 = 4598248 LB2 Slot3_IntC = 31 LB2 Slot3_PwOn = 150
LB2 Slot4_Ser1 = 2484680343 LB2 Slot4_Ser2 = 29893191 LB2 Slot4_IntC = 33 LB2 Slot4_PwOn = 163
LB2 Slot5_Ser1 = 3794024816 LB2 Slot5_Ser2 = 4598248 LB2 Slot5_IntC = 33 LB2 Slot5_PwOn = 193
LB2 Slot6_Ser1 = 0 LB2 Slot6_Ser2 = 0 LB2 Slot6_IntC = 0 LB2 Slot6_PwOn = 0
LB2 Slot7_Ser1 = 0 LB2 Slot7_Ser2 = 0 LB2 Slot7_IntC = 0 LB2 Slot7_PwOn = 0
LB2 Slot8_Ser1 = 0 LB2 Slot8_Ser2 = 0 LB2 Slot8_IntC = 0 LB2 Slot8_PwOn = 0
LB2 Slot9_Ser1 = 0 LB2 Slot9_Ser2 = 0 LB2 Slot9_IntC = 0 LB2 Slot9_PwOn = 0

LB2 Module Info.
MTYP: WORD Module Type
OP: BYTE Current Operation Mode
0 = No Module
4 = Stopped
5 = Operational
6 = Operational with heartbeat timeout
127 = Pre-operational
150 = Missing
HBCNT: DWORD Number of heartbeat frames received
RXCNT: DWORD Number of frames received
EMCY: LINT Read last EMCY codes
HWPID: DWORD Module hardware ID
SWPID: DWORD Module firmware ID
SID1: DWORD Module serial ID1
SID2: DWORD Module serial ID2
SID3: DWORD Module serial ID3
SID4: DWORD Module serial ID4
MainV: WORD Main supply voltage (mV)
SuppV: WORD Internal supply voltage (mV)
IntC: WORD Internal temperature (C)
PwOn#: WORD Power on counter
WD#: WORD Watchdog restart counter
UpTim: DWORD Uptime in hours
TotUpTim: DWORD Total uptime

Slot1_PS_06 = 2889 100.0 ANY_TO_R... IN Q IN1 Q PS1_SupplyVolts = 28.89
Slot1_PS_04 = 12050 1000.0 ANY_TO_R... IN Q IN2 Q PS1_OutputVolts = 12.05
Slot1_PS_05 = 268 ANY_TO_R... IN Q PS1_OutputCurrent = 268
Slot1_PS_03 = 21 ANY_TO_R... IN Q PS1_Load = 21



6.5 COM Port Settings

When using serial drivers the COM port parameters are defined as "COM1:9600,N,8,1". In addition, some specific control and debug parameters can be added for the RTU32M.

The COM port setting strings follow the normal WorkSuite conventions. COMa:b,c,d,e (e.g. COM1:9600,N,8,1).

- | | |
|---------------------|---|
| a) COM port number: | 1...3 |
| b) Baud rate: | 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 |
| c) Byte size: | 7, 8 (bit) |
| d) Parity | N, E, O (none, even, odd) |
| e) Stop bits | 1, 2 |

A range of additional parameters on the COM port settings are supported to control:

- Setup the COM port for modem dial support – enable the Modem driver.
- Hardware handshake signal on null modem driver.
- Provide communication log in the general RTU32M System Log.

The extensions for these functions and features are:

- When using the modem driver a 'M' is added (e.g. MCOM1:9600,N,8,1)
- RTS / CTS hardware handshake control on the null modem serial driver is supported and enabled by the options as follows:
 - 'RD' RTS is kept inactive (low) at all time.
 - 'RE' RTS is kept active (high) at all time.
 - 'RT:Leading:Trailing' RTS is inactive when receiving data, and becomes active when transmitting data. The RTS Leading setting defines the delay from activating the RTS to when the first character is transmitted. The RTS Trailing setting defines the delay from when the last character is transmitted to RTS is deactivated.
 - Leading and trailing time is in units of msec. - e.g. COM1:9600,N,8,1,RT:50:10
 - 'RC:Leading:Trailing' RTS is inactive when receiving data, and is activated when the RTU wants to transmit data. After activating RTS, the RTU will wait for CTS to become active, before start transmitting. The RTS Leading delay is still valid in this mode, and an adjustable delay from CTS activated to first character is then possible. However, by setting the Leading time to zero there is no unnecessary delay from CTS to first character (like a normal RTS / CTS function). After activating RTS the RTU waits up to 10 sec for the CTS signal. If timeout occurs, the transmission is discarded. The RTS Trailing setting defines the delay from when the last character is transmitted to RTS deactivated.
- Logging of serial data in the System Log.
 - 'LL' Log Link data. All bytes transmitted and received on the COM port, are logged in the internal log message system, and are available using telnet at port 911. This is primarily for debug purpose.
 - Examples: MCOM3:9600,N,8,1,LL
 - COM2:57600,E,8,1,RT:30:10,LL

Notes:

If you just connect a serial device, e.g. ModbusRTU communication via a Null Modem cable to the RS232 COM port, it is NOT required to add any special extensions.

Brodersen WorkSuite has a limitation of max 31 chars in the settings string.

If you enable the SP5 (Secure Protocol for remote communication) on the RTU32 Webpage, you must set the COM parameters settings for the specific port on the webpage. If the SP5 setting is enabled, the COM settings overrule any later settings in WorkSuite.

The serial port settings use the same syntax no matter where you configure it.



6.6 Modbus Drivers

The RTU32M PLC runtime supports function for several types of Modbus protocols:

- ModbusRTU Master and Slave
- ModbusASCII Slave
- ModbusTCP Client and Server

The drivers are setup using the Fieldbus Configurator in WorkSuite. Refer to WorkSuite training and programming examples. You will find support for ModbusUDP, and Function Block managed Modbus drivers in the WorkSuite help.

6.6.1 ModbusRTU Master

The RTU32M supports several Master/Client drivers. You can in fact setup as many Master drivers as you have COM ports available. The Modbus Master/Client is setup using the Fieldbus Configurator. See the WorkSuite help for details.

6.6.2 ModbusRTU Slave

The RTU32M supports only one Slave/Server driver. You must add a MBSLAVERTU function block in the program logic for the Serial Modbus Slave driver (MBSLAVERTUEX function is used if more than one slave/server is required – it allows separation of the slave/server addresses using their 'Server Id'). The MBSLAVERTU function defines the Modbus Slave address and port settings. You can find the function block in the "Advanced" function block folder. All variable assignments, addressing etc. are done in the Fieldbus Configurator. See WorkSuite for details.

6.7 IEC60870-5-101/103/104 Drivers

The Utility protocols IEC60870-5-101, 103 and -104 are implemented as a basic link driver in the RTU32M. The application layer which includes all the specific handling of request and events communication is managed in the RTU application program. A range of WorkSuite functions and example are provided for the different protocol functions and ASDU handling.

WorkSuite include drivers for:

- IEC60870-5-101 Master
- IEC60870-5-101 Slave
- IEC60870-5-103 Master
- IEC60870-5-104 Server
- IEC60870-5-104 Client

The basic link drivers include handles for the link driver where you can define buffers, link address etc. The fact that the serial link is similar to the IEC60870-5-103, provides the option to implement application layer support for this protocol as well.

To use the IEC60870 driver, you must use the RTU32 Series Code Generator tool. This is used for simple configuration of any IEC60870 Driver.

6.8 DNP3 Slave and DNP3 Master Drivers

The RTU32M supports both DNP3 Slave and DNP3 Master drivers. See the WorkSuite Help and Brodersen technical reference manuals for details on setup and app notes for application examples.



6.9 Watchdog

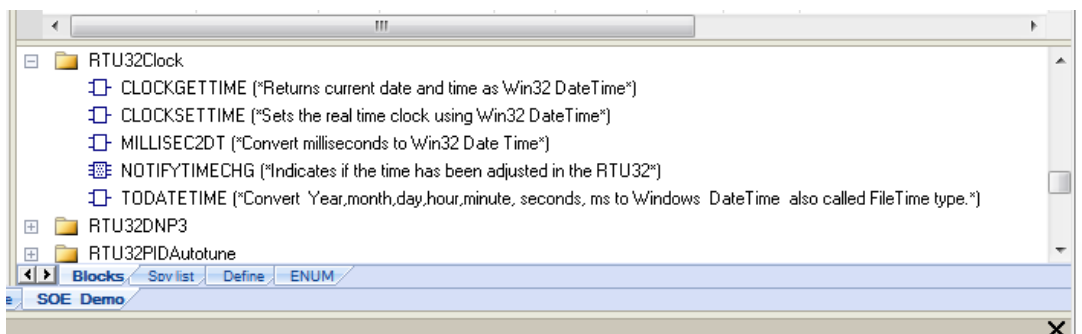
The RTU32M has two built-in watchdog functions – all managed by a separate CPU on the interface board.

The system watchdog is monitoring all internal processes including the OS and communication processes between consoles and databases. In case of error, the watchdog will wait 30sec for the error to be either self-healed or the process to be restored. If this is not happening the watchdog will boot the RTU.

The application watchdog is monitoring the RTU/PLC runtime applications including all related tasks such as drivers. If any of the related tasks fail, stop or freeze for more than 10sec, the application watchdog will boot the RTU.

6.10 Real time / Real time Clock

The RTU32M has a hardware real time clock controlled by the operating system. It provides the RTU32M millisecond resolution in order to make accurate time stamps. From the RTU application program you have access to the real time clock via some special functions as shown below. You can both read and set the clock.



On the configuration webpages you can also define how to synchronise the clock. Options for manual setup and SNTP Server synchronisation are possible. If you use utility drivers to synchronise the RTC you must disable SNTP on webpage by setting it to manual sync.

6.11 Modem Functions

WorkSuite provides a range of modem control Functions. The DialUp library includes:

- Functions to control and monitor A PSTN/GSM modem dial-in/out

6.11.1 Dial functions for GSM and PSTN Modems

Dial functions for communication with serial drivers over PSTN and GSM modems are provided.

The low level modem handling (send AT commands, connect detection etc.) is done by firmware. However, it is up to the application programmer to decide which protocol driver should be activated, when and where to dial, and respond to the modem connection state. A number of WorkSuite functions are available for this:



6.12 Data Logging

WorkSuite provides functions for logging data into one or more file(s) in the RTU32M. In general 2 functions are available:

1. LOGCSV Function - a dedicated RTU32 Series logging function. You can find an example of this being used in the WorkSuite Demo examples installed together with your WorkSuite Package. This data log function handles the read/write functions in a background scan and does not interfere with the general PLC cycle. You will find details of the LOGCSV file function below.
2. LogFileCSV – simple function for logging data into a CSV-file. It uses a standard file write function and it is not recommended to use for data logging as a standalone Function.

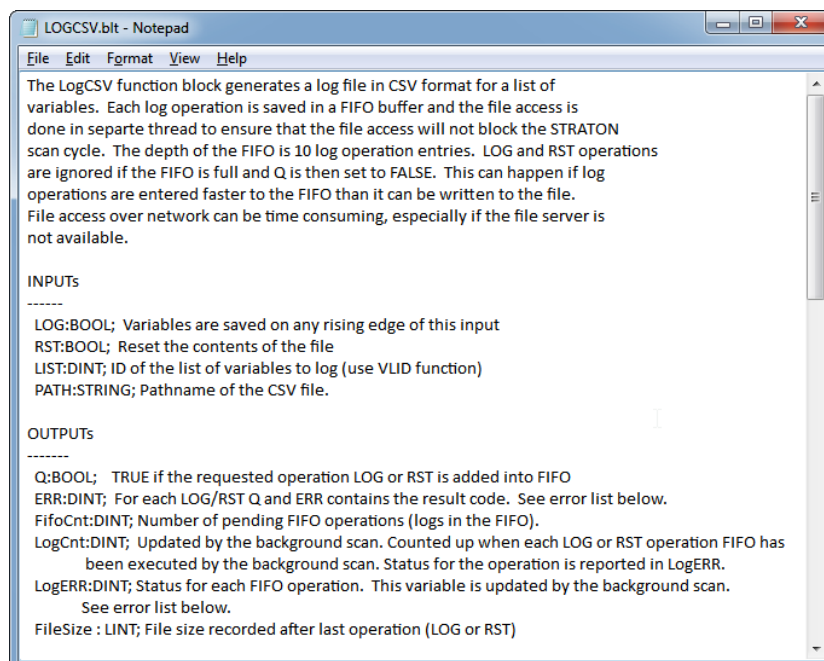
LOGCSV Function

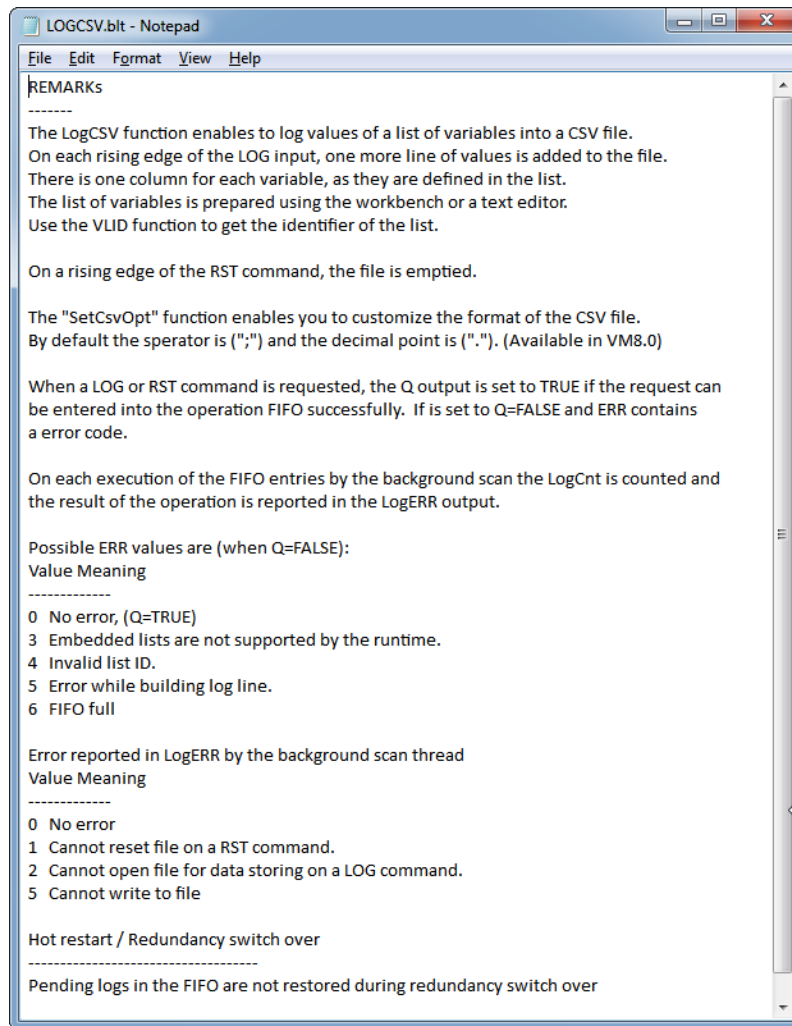
The LOGCSV Function is found in the Brodersen Function library folder.



The LogCSV function block generates a log file in CSV format for a list of variables. Each log operation is saved in a FIFO buffer and the file access is done in a separate thread to ensure that the file access will not block the PLC runtime cycle. The depth of the FIFO is 10 log operation entries. LOG and RST operations are ignored if the FIFO is full and Q is then set to FALSE. This can happen if log operations are entered faster to the FIFO than it can be written to the file.

Note: File access over network can be time consuming, especially if the file server is not available.

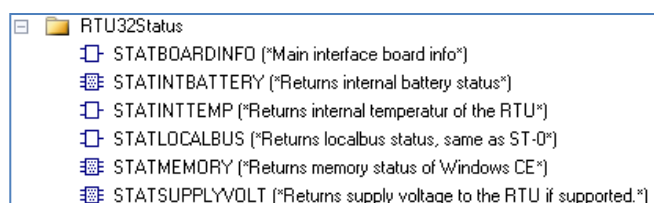




In the RTU32Example projects in WorkSuite you will find a WorkSuite Demo project LOGCSV_Demo with a log UDFB (User Defined Function Block) block named TMultiFileLog. With this UDFB you will be able to control the number of files to log and limit file size. This allows management of log files in a ring buffer, ensuring that your log files will not fill up the available storage memory.

6.13 Status information functions

RTU32 Series products with firmware version 1.55 and newer have hardware status information available.

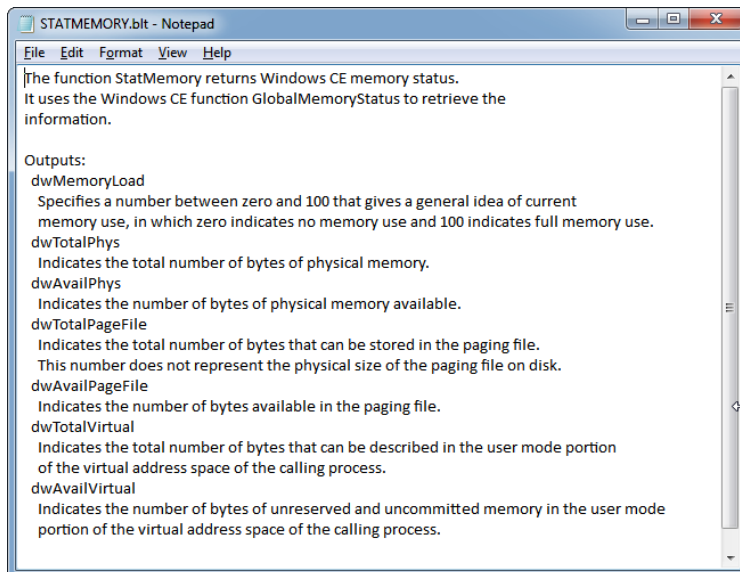


Although most of these status functions are supported in the RTU32N/RTU32M firmware, only some of the status functions are available/relevant in the RTU32M (ie. many are available directly from the RTU32M modules). The following sections list the functions supported by the RTU32M.



6.13.1 RTU Memory Status (STATMEMORY)

The function StatMemory returns the RTU32M memory status.



The commonly used monitoring functions are dwMemoryLoad, dwTotalPhys and dwAvailPhys.

The dwTotalPhys tells you how much RAM program memory is available in the RTU. The rest of the RAM memory up to around 64MB is used for storage (file system etc.).

The dwAvailPhys tells you how much available program memory you have in your RTU. The rest is used by the Operating System and your PLC application.

The dwMemoryLoad tells you in percent the actual RAM program memory load. With a medium PLC runtime application you will see a load of approx. 50%. Only applications with multiple driver connections and a lot of logic will require larger amount of memory. The maximum load recommended on a RTU is 90%.

Inst_STATMEMORY	
STATMEMORY	
dwMemoryLoad	46
dwTotalPhys	126115840
dwAvailPhys	67203072
dwTotalPageFile	0
dwAvailPageFile	0
dwTotalVirtual	0
dwAvailVirtual	0

Typical memory status in a running RTU32M



6.13.2 RTU Project Information (STATPROJECT)

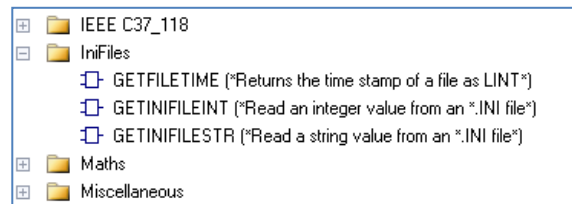
The STATPROJECT function block returns information about the active project, as shown below.

Inst_STATPROJECT	
STATPROJECT	
Name	
BuildTime	
RuntimeStart	
Version	

STATPROJECT (Inst_STATPROJECT)	
Name	'RTU32M_Demo2a'
BuildTime	'2018/08/24 01:18:13'
RuntimeStart	'2018/08/24 01:18:27.472'
Version	33

6.14 Reading Text Files from WorkSuite

To provide the functionality to read variables and strings from an external file in the RTU32M, a few simple read file functions are supported. The functions are found in the IniFiles folder of the WorkSuite logic blocks



Note: You have to place the text file in the RTU32M file system manually – use SFTP to do this and use the Storage Card location (SD Flash). A SSH client SFTP interface (such as BitVise) can be used to explorer the RTU32M files – enter in the address field, like: <ftp://192.168.0.1/>.

The file structure must be the same as other RTU .ini files (such as SNMP.txt and RTU32.ini). The structure is simple and looks like this:

```
[ABC]
def=123
ghi=456
```

ABC is called the section and def the item. NOTE: all are case sensitive. The functions available are:

- GetFileTime
With this function you can check the time of the file so you only read the variables in case of changes.
- GetIniFileInt
Read an Integer value from a section and item.

GetIniFileStr

Read a String variable from a section and item.

GetFileTime (*Returns the time stamp of a file as LINT*)	
IN	FileName:STRING
OUT	Q:LINT

GetIniFileInt (*Read an integer value from an *.INI file*)	
IN	Section:STRING Item:STRING Default:DINT FileName:STRING
OUT	Q:DINT

GetIniFileStr (*Read a string value from an *.INI file*)	
IN	Section:STRING Item:STRING Default:STRING FileName:STRING
OUT	Q:STRING

The idea with these functions is that you can place your 'dynamic' variables outside the RTU runtime application program. You can then use the same application program for several sites and manage the differences for each site in the file.

You can edit the file from the web editor with your browser or directly send a new file to the RTU32M with FTP. More help is found in WorkSuite by pressing F1.



7 Distributed Event Binding Protocol / Redundancy Binding Communication

7.1 General

The Distributed Event Binding protocol is a proprietary protocol for fast time stamped event based data transfer directly from one Brodersen RTU runtime to another. The Binding protocol is communicating directly from one RTU32 to another RTU32 in a LAN/WAN network. It can run regardless of any other application. In a network with several Brodersen RTUs you can use the Global Binding Editor to bind any global declared variables together. Binding can be used between any type of RTU32 Series product and even with STRATON PC runtimes (soft PLCs).

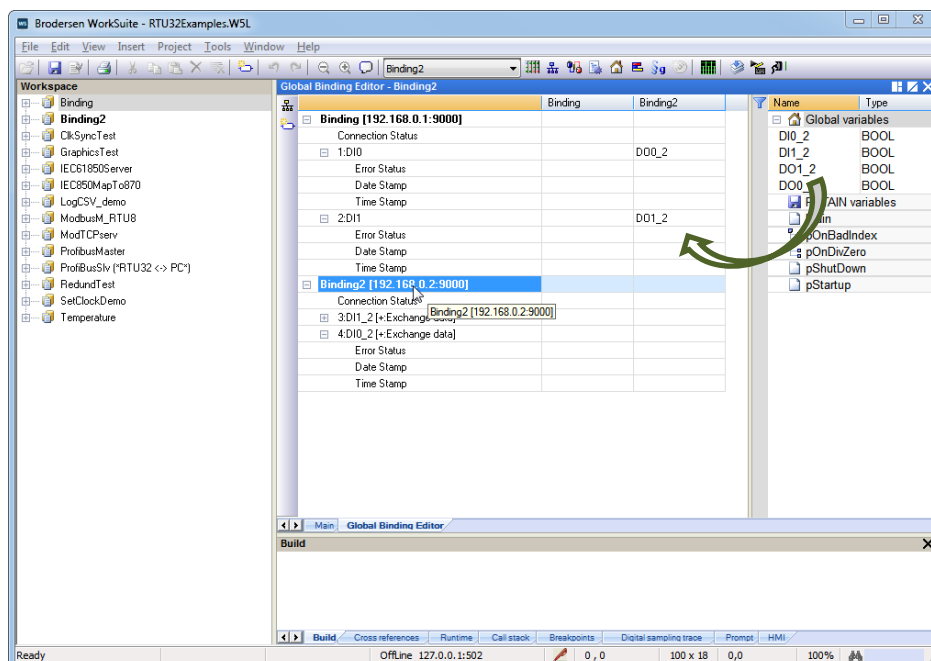
Redundancy Binding is used in a redundancy network connection using 2-6 separate network segments. Both the unit publishing variables (producer) and the unit subscribing variables (consumer) has to be equipped with 2-6 Ethernet network interfaces. Each network connection must be setup on the units as separate network segments using different TCP/IP subnet masks. The compiler also takes care of handling the sorting out of timing issues of any changes in values. This means that you on the subscriber side always will get the correct value. The first received event will be reported at the subscriber side and the same event with the same time stamp received on other network interfaces will be ignored.

7.2 Network settings in RTU32 (redundancy binding)

If you want to run redundancy Binding using the RTU32 you must configure all Ethernet interfaces. No additional settings are necessary as the networks is seen as direct accessible parallel networks. Routing to the networks is done as default. If you ping an address on any of the one of selected network segments, the ping request will find its way to the correct segment automatically.

7.3 Procedure for setting up binding/redundancy binding in WorkSuite

You need to configure all the RTU32 (and PCs with STRATON runtime) before starting to bind (link) I/Os together. I/Os and variables to bind must be declared as Global variables. Use variable naming that makes sense for you. You could for example call all input variables published for binding *BindInput_DI0* and *BindInput_DI1*, and you could call outputs *BindOutput_DO0*. After defining the variables for use in both comms direction for all relevant projects (RTUs), you must start the Global Binding Editor (find it in WorkSuite under the Tools menu). Note that in WorkSuite you will need all Projects used for binding in the same project list.



You assign the IP addresses to each project. If using redundancy Binding, you add up to maximum 6 x "IP:TCP port" to the address of the RTU. If two network interfaces are used for binding (dual redundant binding), the two IP addresses are defined with a separator "|" – like 192.168.1.222:9000|192.168.2.21:9000"

As shown above, the OUTPUTS from Publishing RTU project are linked to the subscribing RTUs INPUTS.

After configuration you download ALL projects to the relevant RTUs. Use the "Download All Projects..." in the Project menu,

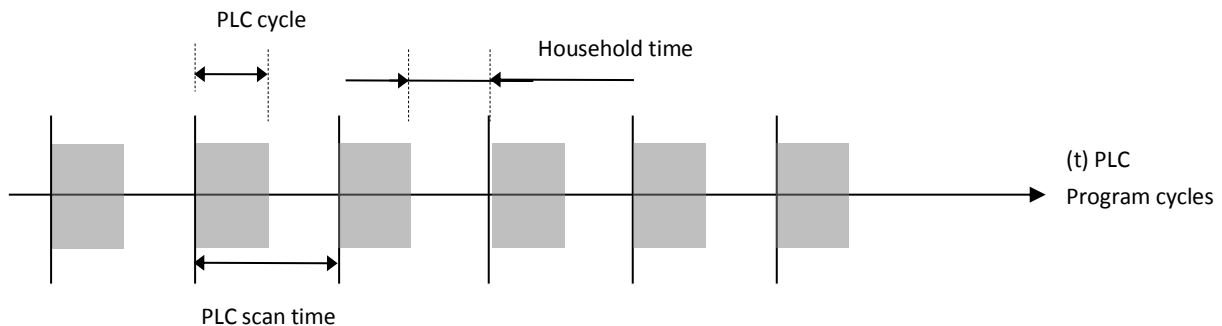


8 RTU32M cycle / scan time

All tasks run independent of each other. The two I/O cycles are running as fast as possible to ensure that the basic RTU32M I/O database reflects the physical I/Os – both internal I/O and I/O on the expansion modules. The PLC runtime program cycle time depends on the size of the application program, and can vary from less than 1 msec to >100 msec. At runtime application start, all inputs are read from the I/O database and at the end of each cycle the outputs are written to the I/O database.

8.1 RTU scan time

The RTU scan time can be set to 0 (zero) which automatically assigns some time for operating system household activities between each runtime program cycle. In this case the program runs as “fast” as possible. The automatic assignment of household execution time ensures all necessary operating system processes can be maintained with a good margin.



If you set the PLC scan time to a fixed value, you can in some cases obtain a better general scan time for your application program. But it is IMPORTANT to realise that you are then responsible to leave time for household operations.

IMPORTANT NOTICE: *If you leave too short time for household operations, the firmware will automatically ensure that your PLC program does NOT compromise necessary household time. It also means that you will get a slower scan cycle time than adjusted. If your RTU/PLC application includes many TCTP/IP based connections over LAN connections, it is recommended to fix the scan time to a value leaving more time to the OS household than automatically assigned.*

8.2 LB2 Bus and Internal I/O Bus scan time

The scan time of the RTU32M internal I/O is running as fast as possible (in micro seconds).



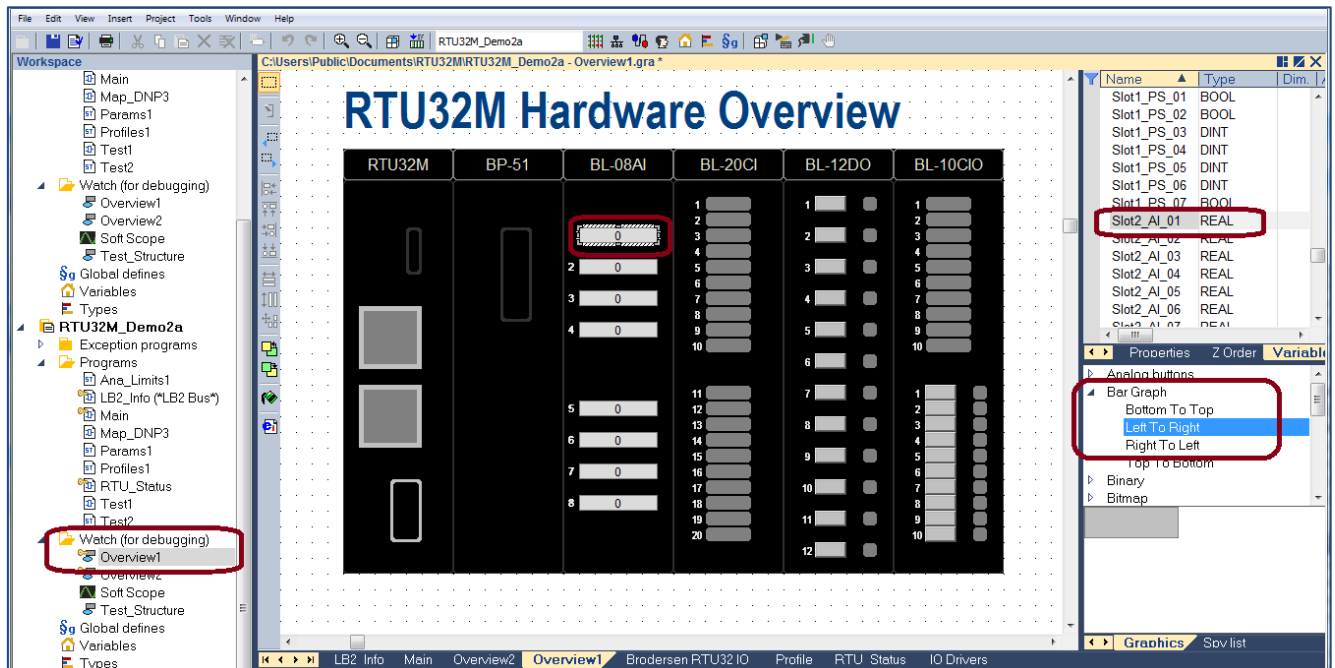
9 RTU HMI

9.1 Creating and Viewing RTU Graphics

The RTU32 Series support simple HMI functions developed in WorkSuite. You can easily add graphic displays to your application and monitor data online from your PC using the WorkSuite HMI Viewer, or publish the page as an html document for remote viewing.

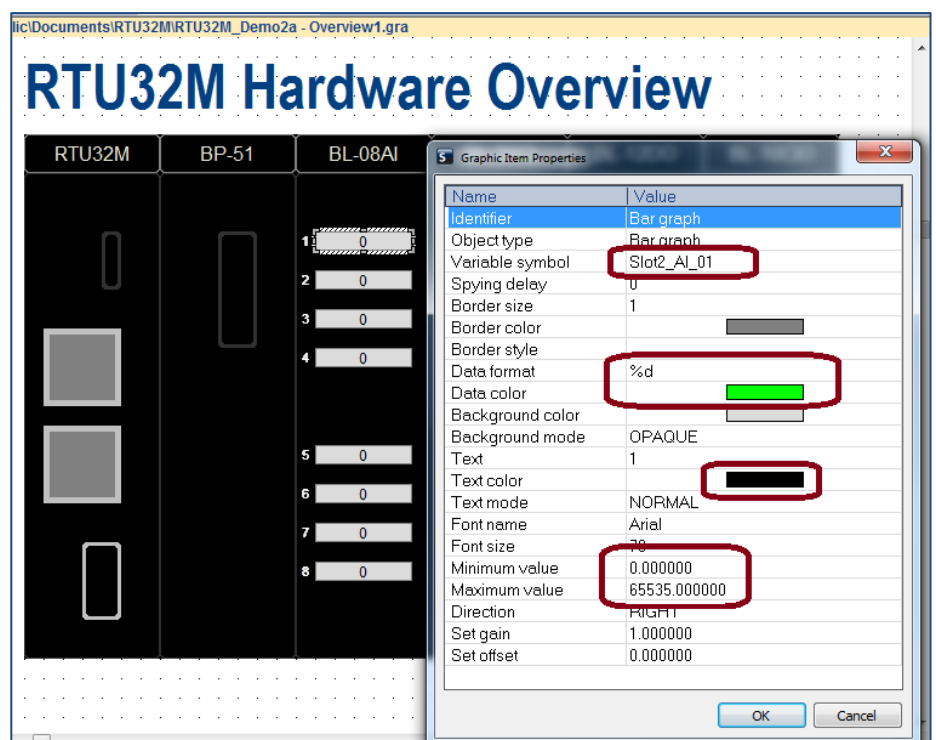
Example – Hardware Overview:

The page below can be built using the standard WorkSuite graphic tools.



The page can include static text, shapes and a range of items that provide the animation.

The example here shows the setup of a horizontal bar graph that moves from left to right and uses the value from the variable named 'Slot2_AI_01' to show the value as both a text value and a scaled bar.

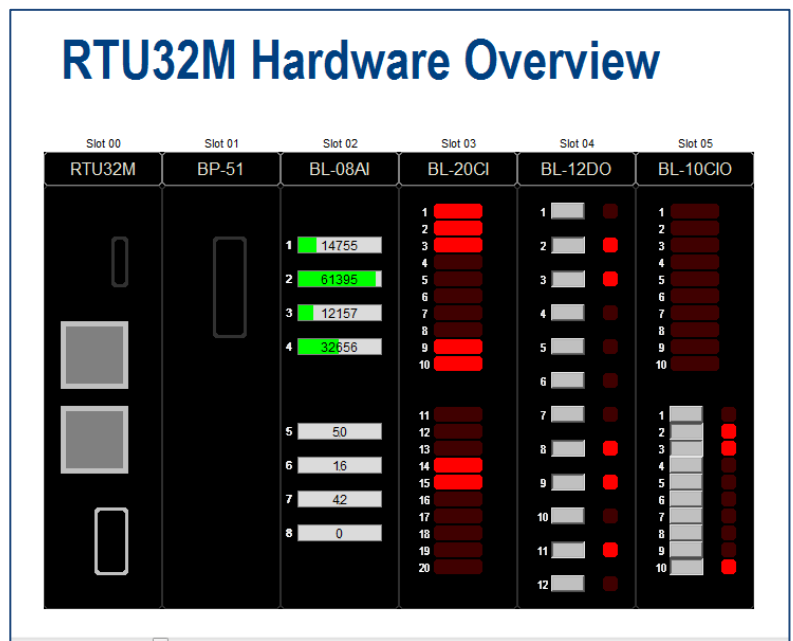
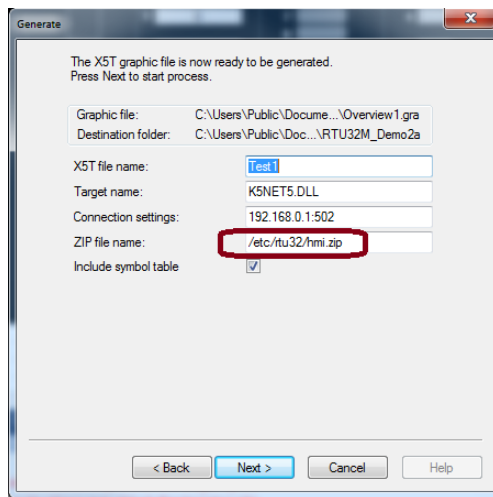
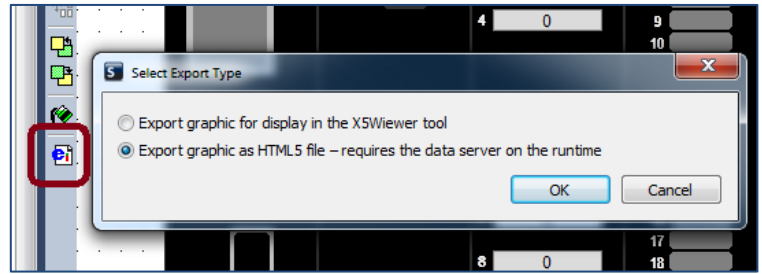




The pages can be viewed when simulating or debugging a logic application and can also be published for use by the X5 HMI Graphics Viewer (a free client application shipped with WorkSuite), or published as a .htm file for use within web browser applications such as Internet Explorer and Chrome.

The X5 Viewer installs in the same location on your PC as WorkSuite eg. Programs>Brodersen>WorkSuite.

The WorkSuite generate tools create a .zip file for use by the X5 Viewer and a .htm file, based on your Export selection .



The published files look the same when viewed in the X5 Viewer or a browser, as shown above.

Note: the initial release of the RTU32M supports reading only of variables for the .htm version (both read and write for the X5 version) and requires manual transfer of the published file to the RTU32M '/www/pages' folder. A future update will provide further functionality and manage the download process for the .htm version.

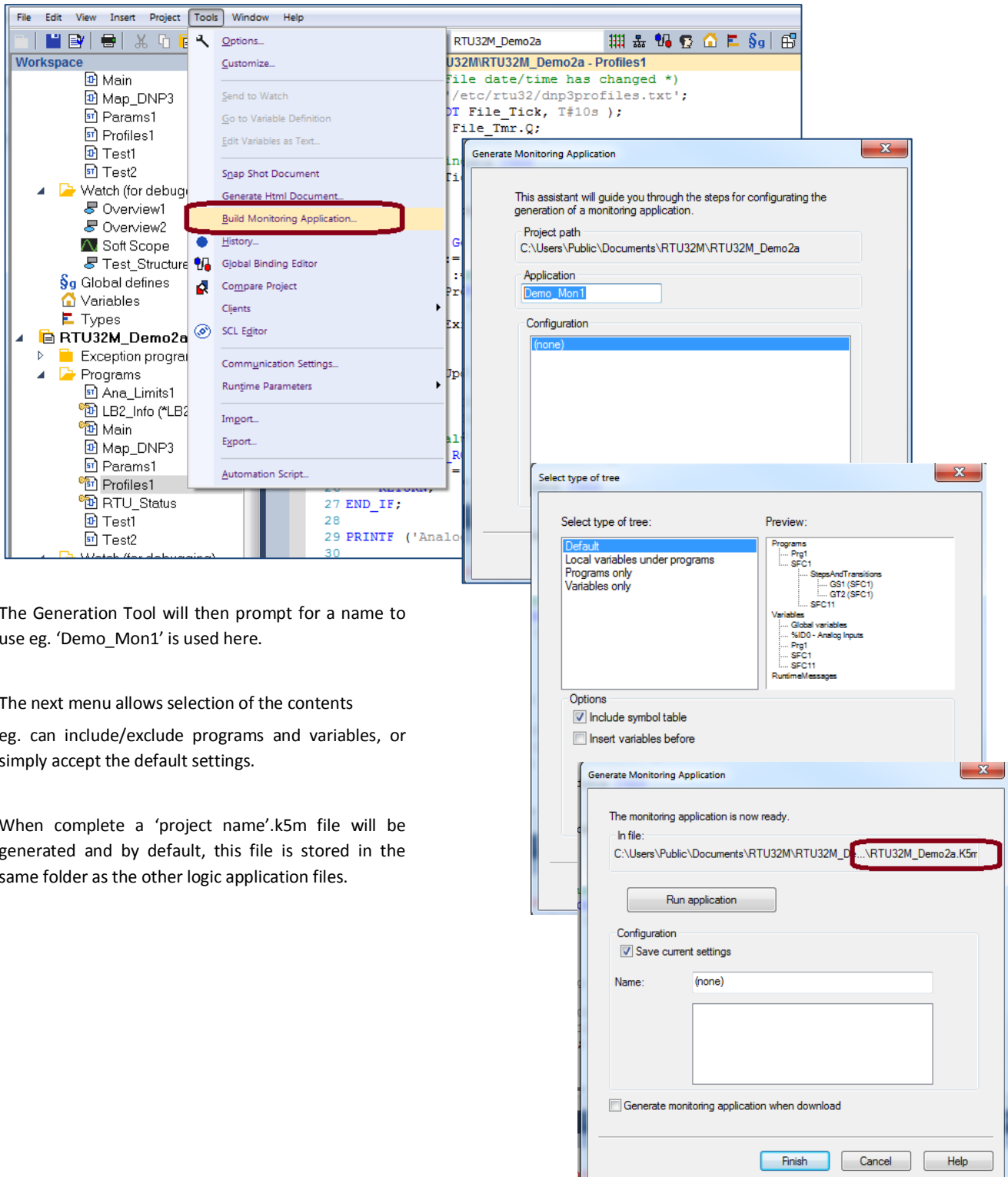


10 RTU Monitoring Applications

10.1 Creating and Viewing RTU Monitor Applications

WorkSuite allows publishing of the RTU32 Series logic applications as pages that can be viewed online using the Monitoring tool.

From the Tools menu select 'Build Monitoring Application'.



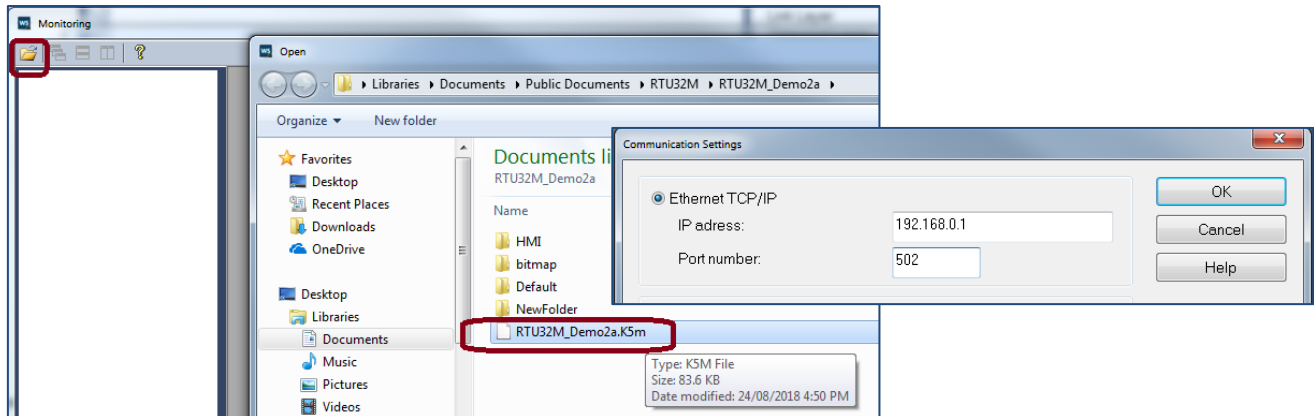
The Generation Tool will then prompt for a name to use eg. 'Demo_Mon1' is used here.

The next menu allows selection of the contents eg. can include/exclude programs and variables, or simply accept the default settings.

When complete a 'project name'.k5m file will be generated and by default, this file is stored in the same folder as the other logic application files.



The monitoring application can be viewed using the 'W5Monitoring.exe' application that is located in the same folder as the WorkSuite application eg. Program Files(x86)\Brodersen\WorkSuite3.9.2. Use the folder icon to select the monitoring application.



You will then be prompted for the RTUs communications settings. The example above shows setup of the IP address and port number.

Once connected, you can view variables (local/global and complex/structured tags), programs and runtime information as shown below.

Name	Value	Tag
Analogue_Point		
Analogue_Point[0]		
_ID	74148	
_Name	'DNP3_AI00'	
_PointDesc	"	
_PointNum	0	
_PointType	9	
_Class	2	
_ObjType	286	
_ObjVar	0	
_EventType	2	
_EventDev	1	
_DevDB	5	
_Hyst	0	
_PersIn	0	
_PersOut	0	
_ZeroTh	0	
_OutRgChk	0	
_TuneAlwd	FALSE	
_HighLimit		
_HighLimit[0]	8001	
_HighLimit[1]	8002	
_HighLimit[2]	8003	
_HighLimit[3]	8004	
_HiLimPrID		
_HiLimEn		
_HiLimStd		
_HiLimTuned		
_HiLimEvt		
_LoLim		
_LoLimPrID		
_LoLimEn		
_LoLimStd		
_LoLimTuned		
_LoLimTuned[0]	TRUE	
_LoLimTuned[1]	FALSE	
_LoLimTuned[2]	FALSE	
_LoLimTuned[3]	FALSE	
_LoLimEvt		
_SunPrID	-1	
_MonPrID	-1	
_TuePrID	-1	
_WedPrID	-1	
_ThuPrID	-1	
_FriPrID	-1	
_SatPrID	-1	

```
[1] 2018/08/24 07:57:44.324 - Analog Profiles - new update file received [ RTU32M_DEMO2A ]
[2] 2018/08/24 07:57:44.335 - Analog Profiles Updated (3 tags, including 156 parameters) [ RTU32M_DEMO2A ]
[3] 2018/08/24 07:57:44.336 - Point Parameters - new update file received [ RTU32M_DEMO2A ]
[4] 2018/08/24 07:57:44.358 - Point Parameters Updated (26 tags, including 572 parameters) [ RTU32M_DEMO2A ]
[5] 2018/08/24 07:57:44.358 - Analog Limits - new update file received [ RTU32M_DEMO2A ]
[6] 2018/08/24 07:57:44.381 - Analog Limits Updated (6 tags, including 288 parameters) [ RTU32M_DEMO2A ]
```



11 RTU32 Utilities and System Event Log

11.1 General

Brodersen provide some utility programs for the RTU32 Series on the RTU32 CD included in each package. The tools include:

- Software Bulk Update Tool
- RTU32 Search Tool
- Event Viewer for RTU32 maintenance and configuration and Event Viewer for RTU32 system log monitoring
- Remote Display Tool

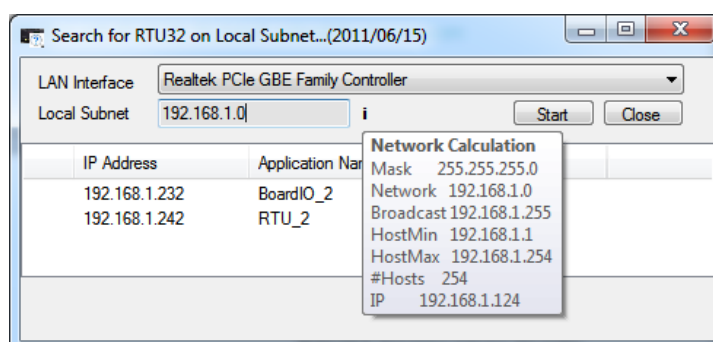
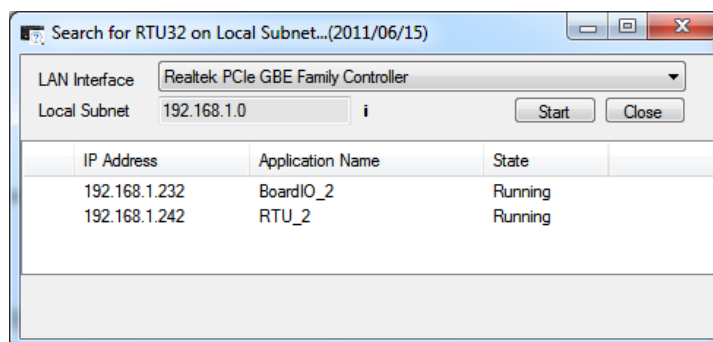
11.2 RTU32 Software Bulk Update Tool

See the Bulk Update Tool User Guide on CD for details.

11.3 RTU32 Search Tool

The RTU Search Tool is used to find RTUs on an Ethernet network. It will search using the network card/interface you define under the LAN Interface. Be careful that you select the right one before you start the search procedure.

The Local Subnet will automatically detect the network details and if you place your cursor on the “i” you will get network details.



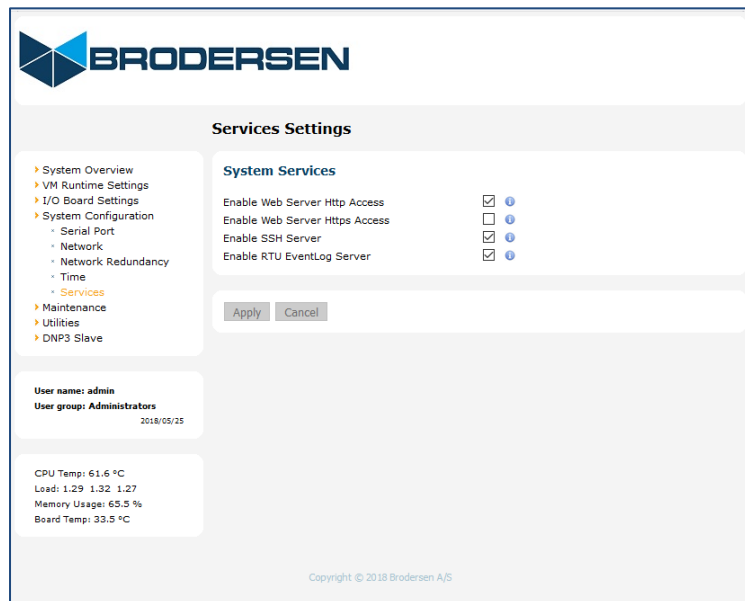
When you start the search process, the network will be scanned for Brodersen RTUs. Only RTUs with their RTU PLC runtime running will answer. If you select an RTU on the list of RTUs found on the network and right-click, you will be able to open either the Webpage or the Event Viewer (status Log info).



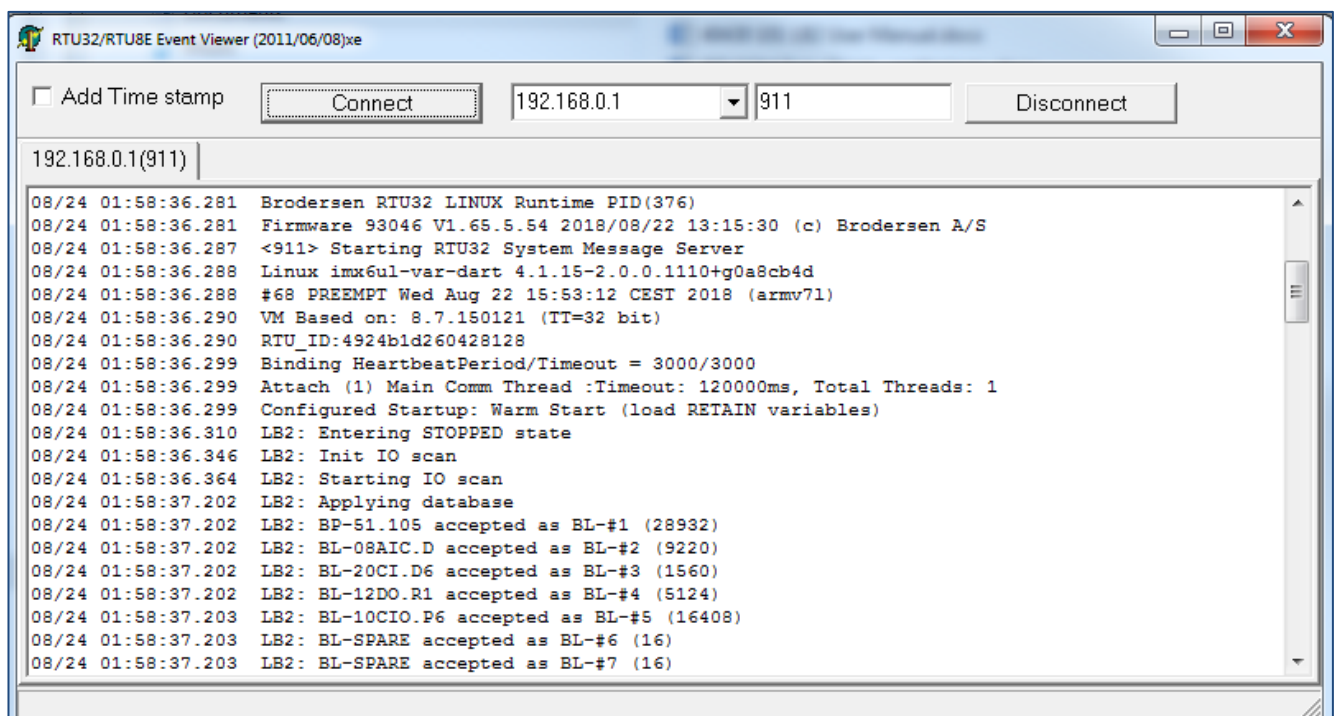
11.4 System Log/Event Viewer

The system log provides you with information about started processes in the RTU32M, errors and status information. You can also view debug or information text from your WorkSuite application program which will be printed in the system log. COM port communications can be logged if you add the right parameters to the COM port setup (LL extension) – see COM port settings for details.

The System Log can be viewed by using the Brodersen Event Viewer utility or a standard Telnet window. The RTU EventLog Server is enabled by default in the System Configuration>Services menu.



The event logs look like this in the Event Viewer:



The RTU32 allows a maximum of 20 continuous connections and the log FIFO includes a maximum of 100 messages.



12 RTU32M Technical Description

12.1 General

The RTU32M Compact RTU/PLC is based on a 32bit i.Mx6 CPU architecture running an Embedded Linux operating system. An industrial power supply is integrated to support industrial supply levels. The basic RTU32M includes a range of communication and other interfaces. The RTU32M provides interfaces like LocalBus and LB2 Bus for expansion I/O and integrated I/O.

The RTU32M software is stored on an internal Flash or micro SD card. During start-up, the operating system and applications are moved to RAM where it is executed. Retained variables are stored in NV RAM.

Using the Ethernet network for primary communication provides all the advantages of existing TCP/IP networking communication facilities. Fast, reliable and secure communication is the main features and all networking components (software, routers, switches, etc.) are available. In addition, serial ports for interfacing to application specific protocols (e.g. Modbus, Fieldbus, utility and traffic proprietary protocols etc.) are available.

Detailed technical information about the RTU32M hardware is provided in the RTU32M Data Sheet and in the RTU32M Wiring and Mounting Instruction manual.

12.2 PLC Runtime

The WorkSuite programming tool fully supports EN/IEC61131 and is used for developing PLC programs in the RTU32M. The application program kernel is implemented and runs in the Windows Embedded CE real-time task. WorkSuite offers complete PLC functionality as found in both normal PLC runtimes and in SoftPLCs, and supports all features needed in today's industrial environment. WorkSuite supports programming languages including Structured Text, Function Block, Ladder, Instruction List and Sequential Function Chart. The VM PLC runtime supports cold restart, hot restart and on-line changes.

The Brodersen WorkSuite is used for configuration protocols, programming and debugging. It supports several tools for multi-program handling and documentation. It is also a powerful tool for complete system design and programming, providing unique functions for event based communication. The Global Binding Editor makes it possible to publish and subscribe variables in a large network with minimum communication load. The events are time stamped and can also be used directly in ZenOn SCADA HMI applications.

Programming, debugging and upload and download of application programs can be done remotely via Ethernet or RS232.

The RTU32M application kernel is used in many products and applications worldwide. More details about WorkSuite including training and help can be gained by contacting your local Brodersen distributor or Brodersen support.

12.3 Software Versions

The Settings overview page in the RTU32 includes the software version for the actual build.

RTU32 Version Information	
RTU32 Firmware Version	1.65.5.40
RTU32 Firmware Date	2018/06/15
RTU32 Firmware ID	93046
VM Runtime Version	<u>8.7.150121</u>
RTU32 Linux Image Date	2018
RTU32 Linux Version	4.1.15-2.0.0.1069+g0a8cb4d
RTU32 Linux Build Version	1

If you contact Brodersen or your local distributor / system integrator for support, it is important that you have the **RTU32M Version Information** ready together with the serial number of your device(s).



Appendix 1 – RTU32M Factory Reset

RTU32M complete Reset

You can make a complete reset of the RTU32M that will reset it back to factory default settings. Note that during reset process all settings in the RTU32M are lost.

To make a complete reset you will need a small screwdriver, pointed pen or paperclip for activating the reset button.

On the front panel of the RTU32M you will find a small 3mm hole located between the SD card and LAN 1. Behind this is a small push button that is used in the reset process.

Procedure:

Power down the RTU32M.

Use a small pointed device to push/activate the reset button while you apply power to the RTU32M. Keep the reset button pressed for a minimum of 9 seconds before it is released.

The RTU32M logic application will be erased and the RTU32M will then start-up with factory default settings. LAN IP address = 192.168.0.1 and password at default setting.