

# **Marble Modbus**

# **User Manual**

**091025**

**Revision 1.02**

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## Revision History

- 1.01 - 091017 Tentative Draft – Work In Progress
- 1.02 - 091025 New Modbus engine, Added group polling and auto scanning

## Operation

Marble Modbus is a master application that has specific facilities for the range of Surface Control Interface, SCI, cards. In the absence of a suitable third party offering, it was created to test these products. Whilst it is able to leverage extra features from the SCI range, it also acts as a useful display/logger/diagnostic tool for general Modbus systems.

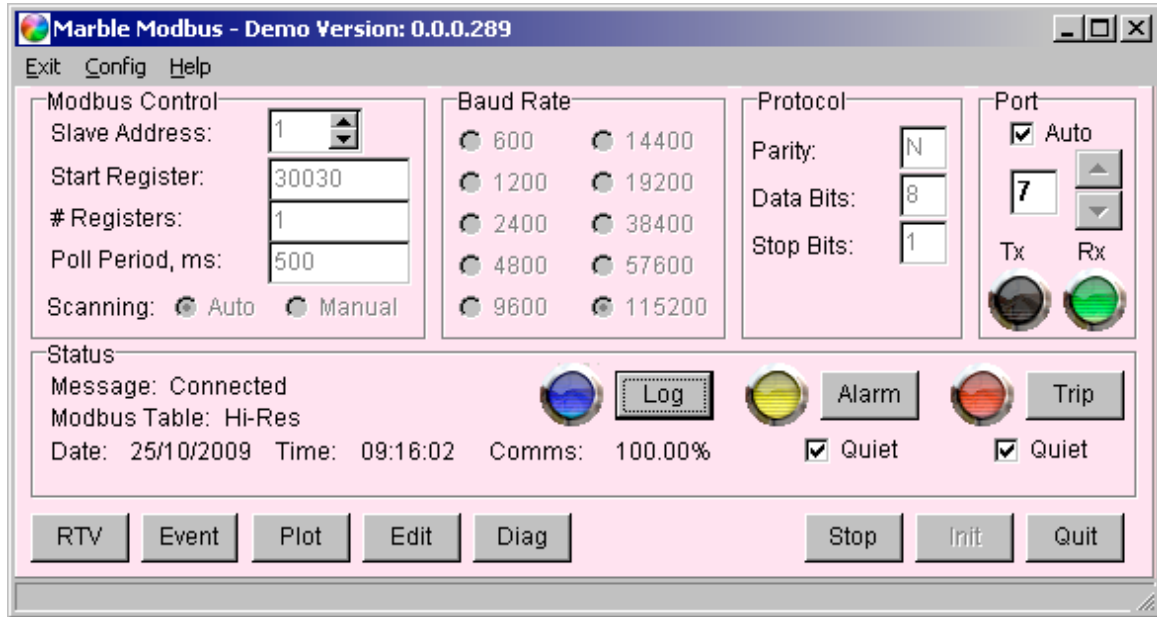


Figure 1 – Marble Console

## Communication

Communication is via the serial protocol RS485 Port of the SCI.

## Display

Any two registers, of the thirty possibly available, may be plotted, with a maximum of 10,000 points. Log files may be saved to disk and the saved files may be re-loaded and the two pre-selected registers plotted.

## Disk Operations

The native file-format is binary, out of consideration for space. A file converter allows a saved file to be converted to a Comma-Separated-Variable, CSV, formatted file; this format allows the import to an Excel spreadsheet.

The binary file format is not compatible with that generated by applications accessing the RS232 Service port.

## Configuration

All settings appropriate for restoration are saved in the configuration INI file, "Marble.INI". Use the pull-down menu to select the Save/Load configuration file.

Other configuration names may be used, but “Marble.INI” is auto-loaded upon startup.

## **Control**

### **Port Selection**

#### **Comm Port**

Upon starting the application, a scan is performed of all available COM ports of the first 20 locations; the scan takes approximately 4 seconds. The up-down arrow selector only allows a choice from these validated ports.

#### **Auto-Run**

The “Auto” checkbox, if enabled and saved to the configuration file, will automatically initialise and run, upon evoking the application. Should the saved Port number be non-existent, the Auto-Run checkbox is unchecked and a manual selection from the available ports is offered.

#### **LED Indicators**

Two indicators are used, the red Tx LED will illuminate when a Request is made and the green Rx LED will illuminate when a response is received from the slave.

### **Baud Rate**

The baud rate selector is enabled whilst the Run/Stop button is displaying “Run”. A wide range of speeds is supported, with the slowest speeds accommodating extreme transmission distances.

### **Protocol**

This box needs little explanation and once set, is never changed. \*\*\*

### **Modbus Control**

#### **Slave Address**

This is the numeric address of the SCI’s Modbus port.

#### **Start Register**

Set to the first Register number, not the address, which is one less.

#### **#Registers**

This should be set to 30, to collect all the registers from the IP2 or Hi-Res tables.

#### **Poll Period**

This value should never be less than 500ms and is ideally tuned to match the update rate of the slave. Polling faster than required creates unnecessary communication traffic. With very slow baud rates, the chosen polling period may be too short, in which case the “Poll Period” is successively increased in 100ms increments until the period is adequate. The message, “Poll period too short”, is displayed in the Status box until this adjustment is complete.

#### **Scanning**

Two radio buttons control the scanning method.

**Auto**

This option intelligently sorts the Modbus table registers into groups of contiguous blocks and then cycles through the blocks, thus minimising the network traffic.

**Manual**

This allows the user to programme a specific register, or group of registers. This method is most useful under a test scenario.

**System Status****Init**

Initialises selected port at the correct speed and protocol.

**Start/Stop**

Allows the system to stop/start communications with the attached SCI.

**Quit**

Quit application.

**Messages**

Status messages are displayed when salient events occur.

**Modbus Table**

This displays the currently active table.

**Comms**

This is a portrayal of the communication performance. The averaging technique provides a dynamic indicator of the system's health as a percentage.

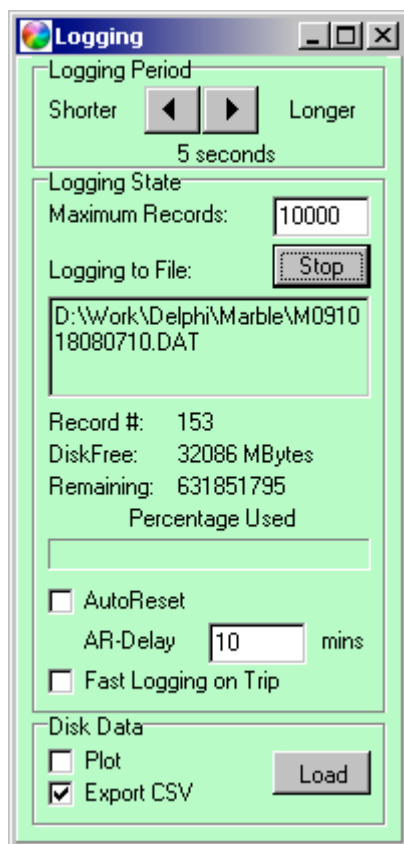
**LEDs**

Two LEDs, yellow and red, display the SCI's Alarm and Trip status respectively. Whilst the associated buttons will temporarily clear the state, a remote method of clearing the SCI is not yet implemented.

"Quiet" tick boxes are associated with each function, when ticked the audio alert is inhibited.

## Logging

Figure 2 - Logging Control Panel



### Log Period

The Log period may be set from 1s to 1275s, (~21mins).

### Auto- Reset Switch

This switch must be asserted to permit the Fast Log on Trip feature. This setting is available via the VT100 configuration page.

### Auto-Reset Period

This period will also set the duration of the fast logging. This setting is available via the VT100 configuration page.

### Fast Log on Trip

This setting will over-ride a slower log period with logging at the fastest rate 1 sample every 3s. A change will set the Apply button's text to red, indicating a pending change.

### Start/Stop

Pressing "Start" will evoke a Save-file dialogue, to request a suitable filename.

### LED Indicator

The associated LED on the main console will show blue when logging is in progress, black otherwise.

### Progress Bar

A horizontal bar indicates the percentage disk usage. Whilst this is academic if the log file resides on a hard disk, a USB memory key has finite space.

### Disk File Operations

This group allows a previously stored data file, (\*.DAT), to be loaded for either Plotter display, or conversion to a Comma Separated Variable format file, or both. Two destination options are available, by means of the respective checkboxes; both may be in force.

### Plot

This allows immediate viewing of the selected channels. A scrolling display can be used to scan the whole log, with the current section expanded in the plotter. This ability is set with the maximum number of points; a value of 200 points will give a clear view of the streaming data.

### Disk

This option will evoke a save file dialogue.

## Plotter

The Plotter has a detachable control console, to allow selection of the sources for the two graphs and setting of the number of plotted points. When the set number of plotted points is reached, the display will scroll, keeping the latest points and discarding the oldest.

### Maximum Plotted Points

The number of plot points may be increased, but can not be reduced to less than the already plotted number, without stopping the plot and clearing the values. The arrows provide a range from 20 to 10,000. Please note that an excessive number will severely load the PC and as a general guideline, CPU activity should be kept under 25% for this application.

This section has a number of controls associated with it and the ability to measure, zoom and pan the display. The two plots are colour-coded to assist usage; red is used to denote the left-hand axis, plot and selector; similarly, blue for the right.

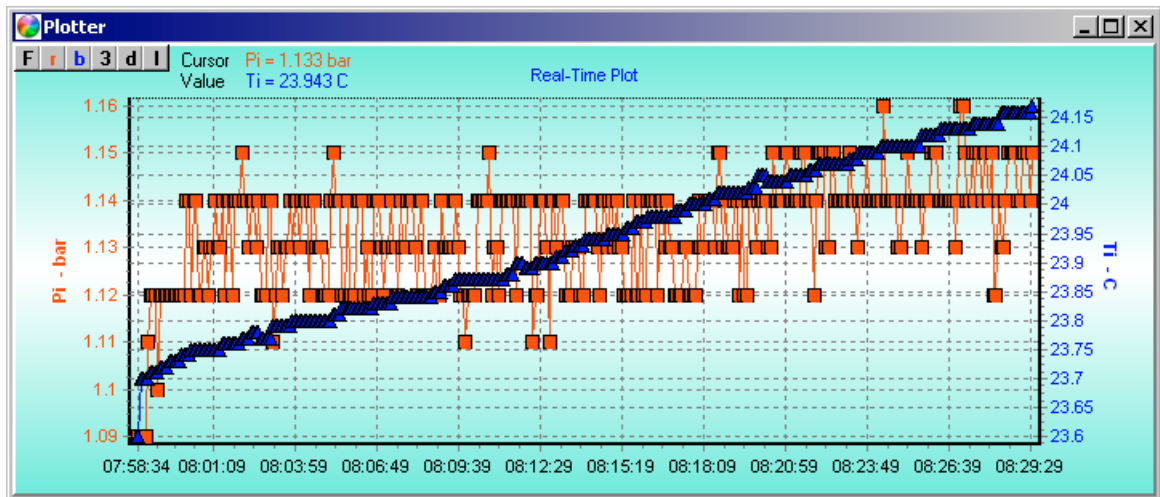


Figure 3 - Plotter Display

### Display Buttons

These are the small square buttons at the top-left of the Plotter display region.

#### R/r

This allows the left-hand display, (red), to be selectively enabled/disabled.

#### B/b

This allows the right-hand display, (blue), to be selectively enabled/disabled.

#### 2/3

Selection of 2D/3D display

#### D/d

Enable/Disable plot markers, (dots).

#### L/l

Enable/Disable plot lines.



## Plot Display

The plot may be maximised to full-screen to portray best resolution and also copied to the clipboard, for pasting into a report or other document. A plotted point indicates a new data value; the line graph remains at that level until a new value is obtained.

## Cursor Measurement

The mouse may be positioned over specific data points and when the left-hand button is depressed, the values of that point for each channel is displayed next to "Cursor Value". Note that only the value for that channel's data-point is valid. The other channel will display the value of that channel, were its data-point also at that location.

## Display Zooming

The plotted display may have a region of interest enlarged, by drawing a rectangle with the mouse, around the specific area. Depress the left-button at top-left of rectangle and move the mouse to enclose the region, then release the mouse button. The area will be zoomed to present the detail. Zooming may be performed repeatedly and the original display restored by performing the converse action, i.e. drawing the rectangle backwards.

## Display Panning

The display may be moved, "panned", by moving the mouse whilst depressing the right-button.

## Channel Selection

Separate selectors are required for each channel, allowing a choice only when Plotting is halted. Each channel is clearly marked with its source.

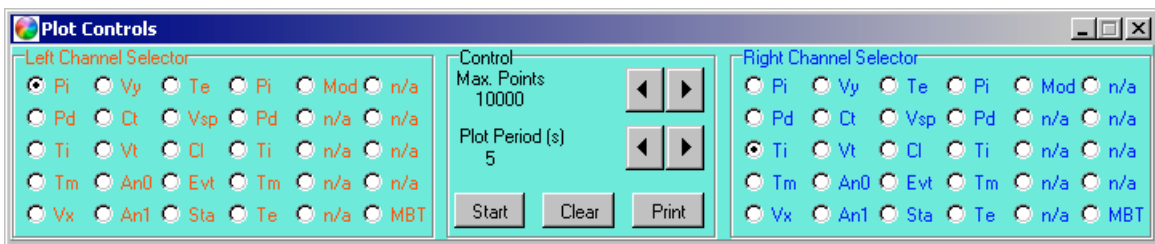


Figure 4 - Plot Channel Selector

## Plotter Settings

Controls and buttons are greyed-out when it is inappropriate to select them.

### Maximum Points

Selected via the left<>right arrow buttons.

### Plot Period

Selected via the left<>right arrow buttons.

### Start/Stop

This button toggles plotting.

## Clear

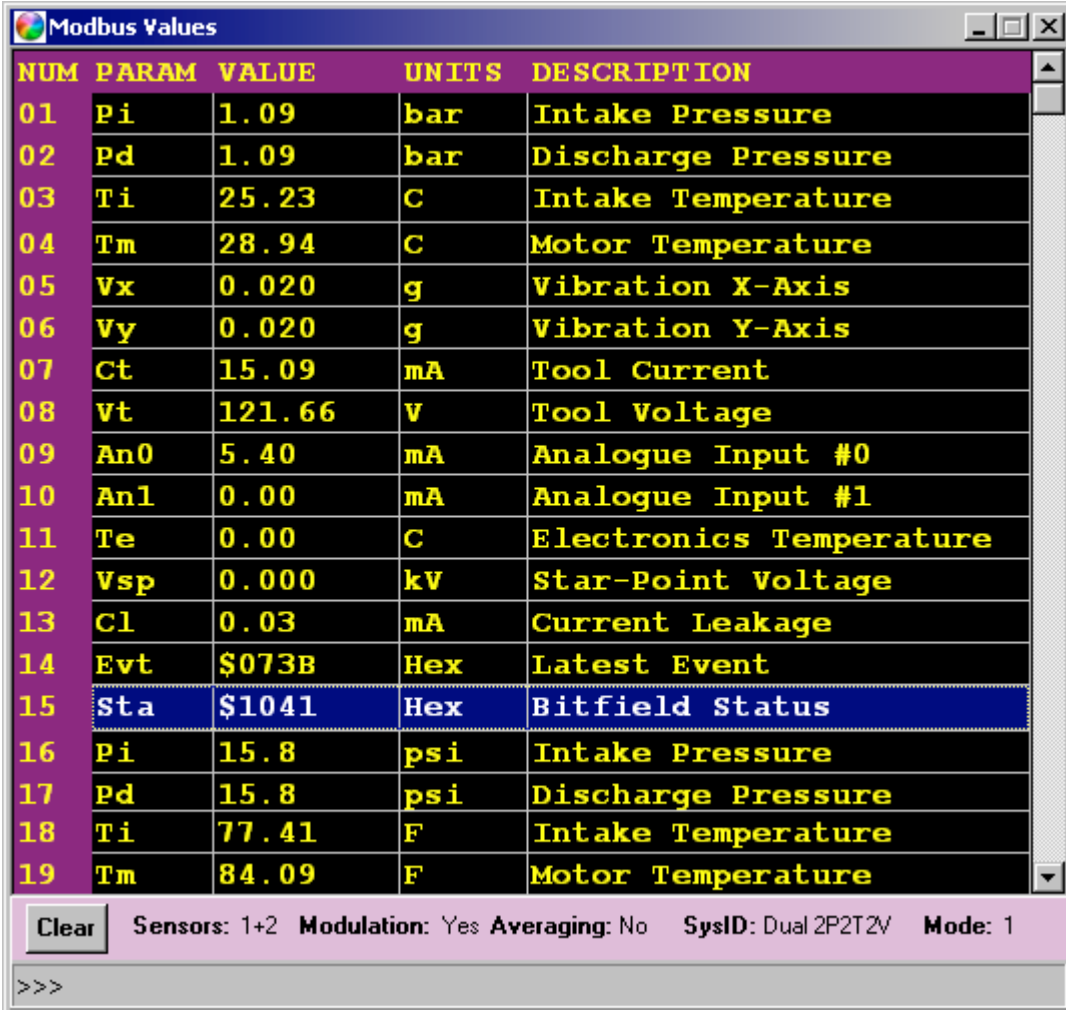
Plotting must be halted in order to clear the display.

## Print

Opens a Print dialogue to allow printing.

## Modbus Values

This display formats the data into actual values, with the appropriate scaling applied. Additionally, a full description is displayed for each channel. The remaining entries may be examined by scrolling down, using the right-hand side bar.



NUM	PARAM	VALUE	UNITS	DESCRIPTION
01	Pi	1.09	bar	Intake Pressure
02	Pd	1.09	bar	Discharge Pressure
03	Ti	25.23	C	Intake Temperature
04	Tm	28.94	C	Motor Temperature
05	Vx	0.020	g	Vibration X-Axis
06	Vy	0.020	g	Vibration Y-Axis
07	Ct	15.09	mA	Tool Current
08	Vt	121.66	V	Tool Voltage
09	An0	5.40	mA	Analogue Input #0
10	An1	0.00	mA	Analogue Input #1
11	Te	0.00	C	Electronics Temperature
12	Vsp	0.000	kV	Star-Point Voltage
13	Cl	0.03	mA	Current Leakage
14	Evt	\$073B	Hex	Latest Event
15	Sta	\$1041	Hex	Bitfield Status
16	Pi	15.8	psi	Intake Pressure
17	Pd	15.8	psi	Discharge Pressure
18	Ti	77.41	F	Intake Temperature
19	Tm	84.09	F	Motor Temperature

Clear   Sensors: 1+2   Modulation: Yes   Averaging: No   SysID: Dual 2P2T2V   Mode: 1

>>>

Figure 5 - Engineering Value Data

Downhole diagnostic data, passed via the Status bit-field, is displayed in the bottom panel.

## Editor

The Modbus Table Editor allows the table selection from pre-defined tables, which are published and therefore in the public domain. The information is presented with the current data in a tabulated display on the left-hand side of the panel and the control and editing functions on the right.

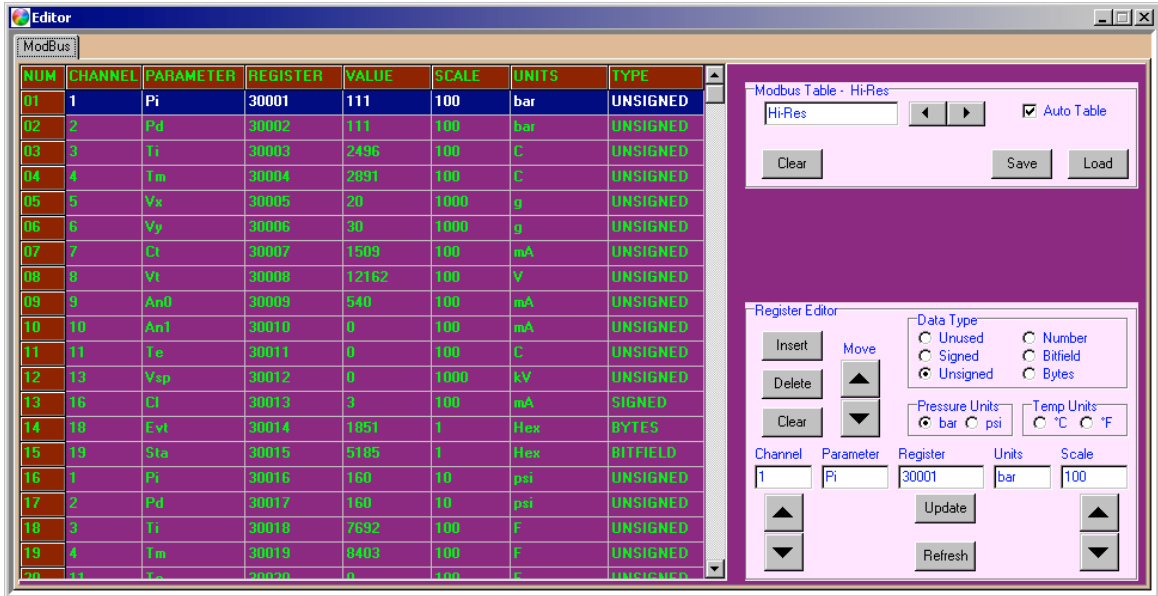


Figure 6 - Modbus Table Editor

### Modbus Table

This section allows the choice of the available panels, or to load a previously saved table from disk.

### Table Selector

The left-right arrow buttons allow selection of any of the in-built Modbus Tables.

### Auto Table

When ticked, this checkbox will automatically load the appropriate table to that utilised by the attached SCI. Note, this feature will only work with an SCI. The setting is stored in the configuration file, Marble.INI.

### Clear

Pressing this button clears the whole table and is useful when requiring a clean slate, or to confirm the loading of a new table.

### Save

This command saves the current Modbus Table to a disk-file.

### Load

Conversely, this restores a Modbus Table residing on disk.

### **Modbus Table Display**

The left-hand side of the panel is a scrollable display of the Table's contents. An entry may be selected by a mouse-click and the following actions in the Register Editor may be performed on that row's data. A maximum of 30 entries is allowed for each Modbus Table.

### **Register Editor**

The upper half of this section allows an entry to be Inserted, Deleted, or Cleared. The up/down control allows the selected entry to be raised or lowered. This allows a table to be constructed, by editing an existing one, without re-entering all the fields.

The fields from the selected entry are displayed in the editing boxes, although only the Register address may be directly edited.

The Channel up/down control allows selection of the desired input parameter and the units and scaling may be altered. Two special Metric/Imperial unit selections for pressure and temperature are provided. The user is responsible for ensuring that the scaling will accommodate the data range.

The register Type is selected using a radio-button control.

The Update button transfers the data into the selected register.

## Diagnostics

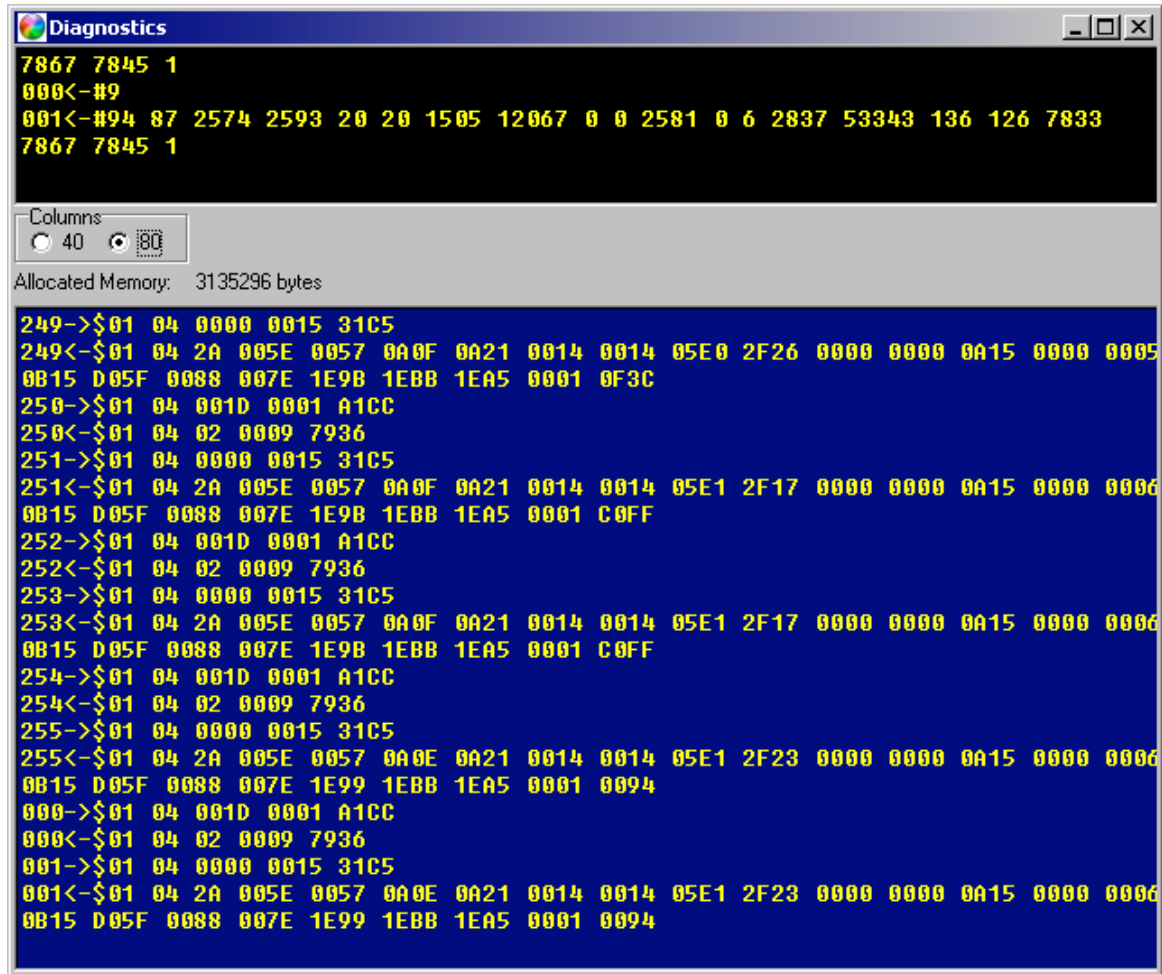


Figure 7 - Diagnostic Panel

### Columns

The diagnostic screen may be resized from 40 to 80 characters width.

### Allocated Memory

The Allocated Memory value is for internal use and monitors memory leaks and genuine allocation to the Plotter buffers. With plotting disabled, it should hover around a certain value.

### Value Panel

The upper panel displays the raw decimal values, denoted by '#', stripped from the response packet.

### Transaction Panel

The lower panel displays the master's request, Query, packet and the slave's response, along with any exceptions that are experienced. A packet number is assigned to each, "->" and its respective Response, "<-". These are hexadecimal values, denoted by '\$'.

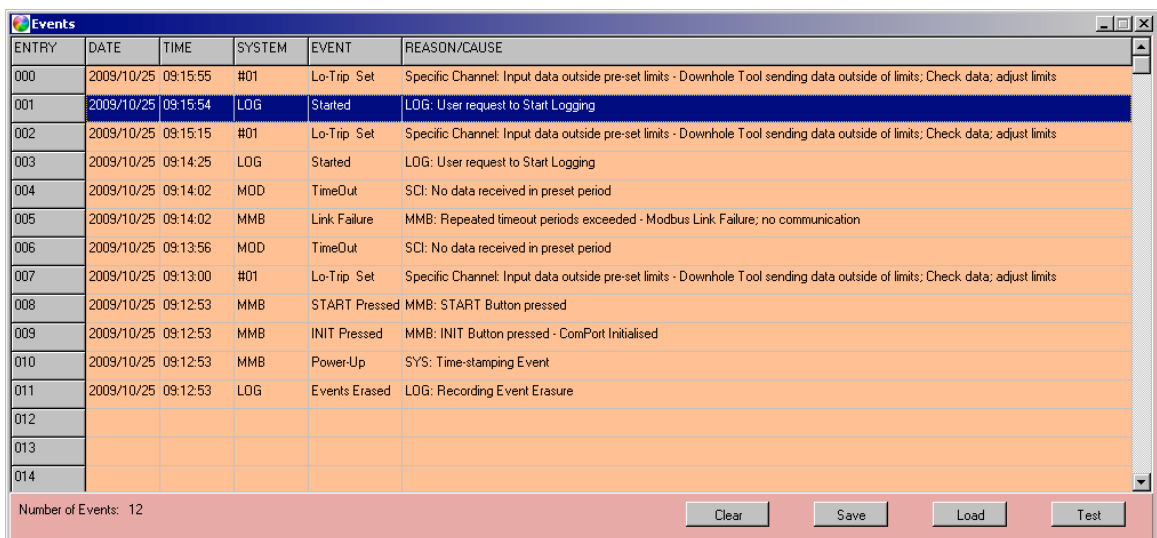
## Events

The Event Log holds a maximum of 1000 entries, which may be scrolled through, using the side scroll-bar. The most recent event is posted in position "00". A new event will cause the preceding events to be shuffled downward.

System events are tabulated and time-stamped in the Event Logger. This records events originating from the Marble application, (MMB) and more usefully, from the attached Surface Control Interface, SCI.

Event locus and type data is stored in a Data Log file, although in a fast burst of events, some will be missed, especially with slower logging periods.

The Event Log display below shows a period when the slave was intentionally disabled, thus highlighting the Timeout and Link Failure events.



ENTRY	DATE	TIME	SYSTEM	EVENT	REASON/CAUSE
000	2009/10/25	09:15:55	#01	Lo-Trip Set	Specific Channel: Input data outside pre-set limits - Downhole Tool sending data outside of limits; Check data; adjust limits
001	2009/10/25	09:15:54	LOG	Started	LOG: User request to Start Logging
002	2009/10/25	09:15:15	#01	Lo-Trip Set	Specific Channel: Input data outside pre-set limits - Downhole Tool sending data outside of limits; Check data; adjust limits
003	2009/10/25	09:14:25	LOG	Started	LOG: User request to Start Logging
004	2009/10/25	09:14:02	MOD	TimeOut	SCI: No data received in preset period
005	2009/10/25	09:14:02	MMB	Link Failure	MMB: Repeated timeout periods exceeded - Modbus Link Failure; no communication
006	2009/10/25	09:13:56	MOD	TimeOut	SCI: No data received in preset period
007	2009/10/25	09:13:00	#01	Lo-Trip Set	Specific Channel: Input data outside pre-set limits - Downhole Tool sending data outside of limits; Check data; adjust limits
008	2009/10/25	09:12:53	MMB	START Pressed	MMB: START Button pressed
009	2009/10/25	09:12:53	MMB	INIT Pressed	MMB: INIT Button pressed - ComPort Initialised
010	2009/10/25	09:12:53	MMB	Power-Up	SYS: Time-stamping Event
011	2009/10/25	09:12:53	LOG	Events Erased	LOG: Recording Event Erasure
012					
013					
014					

Number of Events: 12

Clear Save Load Test

**Figure 8 - Event Log**

Modbus exception responses are decoded and the appropriate error message is posted in the Event Log, this provides a useful diagnostic tool.

## Save/Load

Event logs may be stored and subsequently retrieved for examination, allowing inspection of logs received from the field. It is advisable to press the Console's STOP button whilst loading and viewing a stored log. Upon loading from disk, the existing entries are erased and the stored contents are placed at the bottom of the log. Unused locations are filled with "Invalid Event" messages. This is to differentiate between an active log and that loaded from a disk-file. Please note that the earliest two entries are unavailable.

## Test

A Test function allows Events to be generated, with a "SYSTEM" identification of "TST".