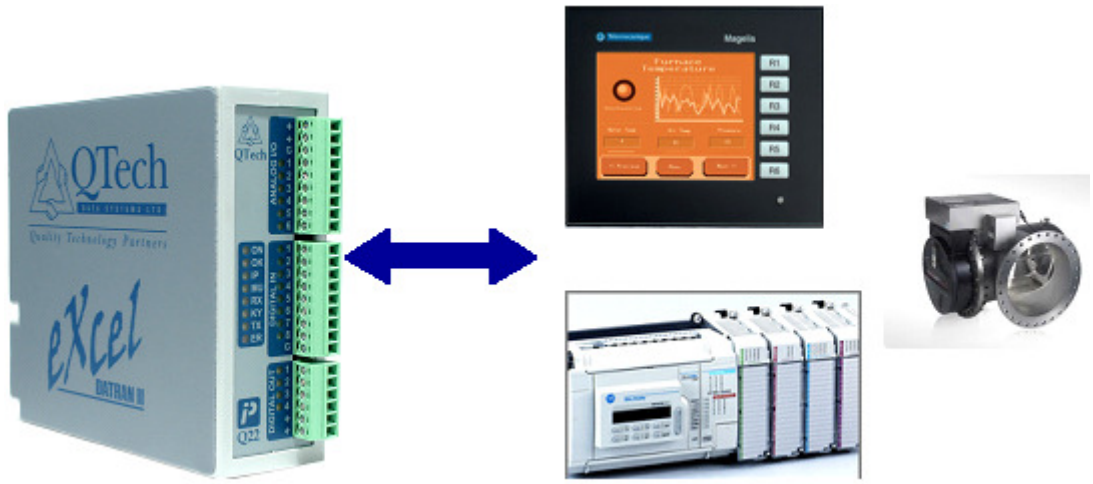
Application Note

DATRAN RTU Modbus Interface



Introduction

The DATRAN RTU Modbus interface is a powerful new feature that opens up a huge range of possibilities to interface many types of third party equipment, or “smart devices” into new or existing DATRAN RTU installations. Equipment such as:

- PLCs
- Chlorine Treatment Plants
- Touch Screen Displays
- Motor Drives
- UV Treatment Reactors
- Pump Station Controllers
- Industrial Sensors

Any of these devices can be connected to a DATRAN RTU to provide large numbers of I/O via a serial cable.

The DATRAN RTU is capable of either Modbus Master or Modbus Slave operation.

Prerequisites

- RTU to have a Q03 processor.
- Firmware v5.20 or greater, v5.22 or greater recommended.
- Q90 Configuration Software v3.26 or greater.
- Both Modbus master and slave support are optional extras that require an unlock code, purchased from QTech.

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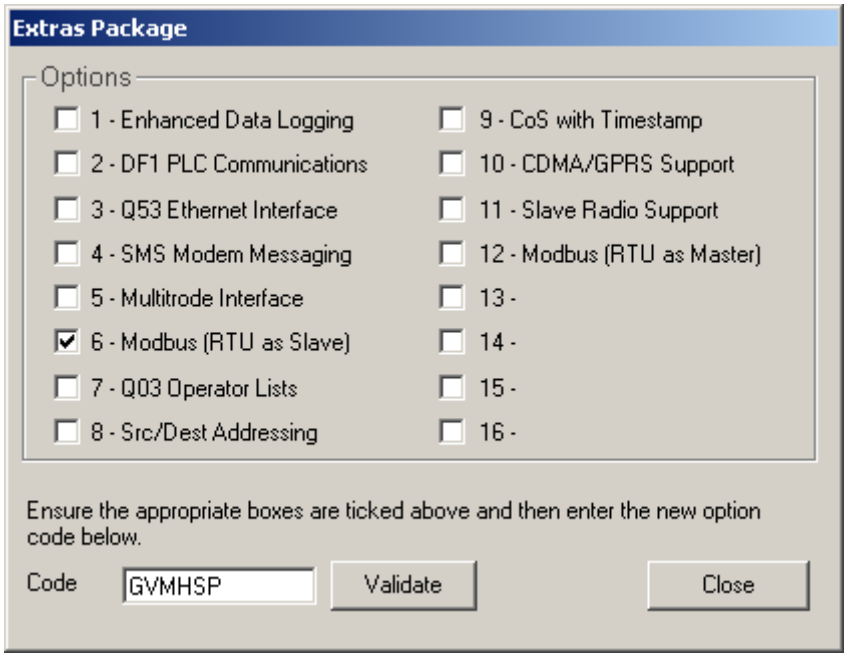
Version 1

Unlocking the RTU Functionality

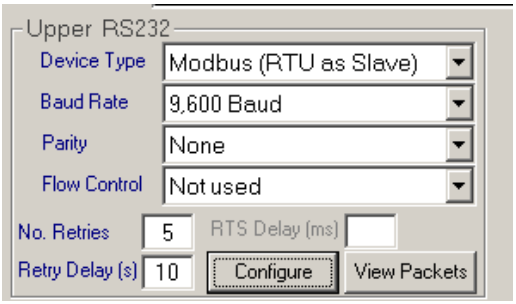
Once an unlock code has been obtained from QTech, it needs to be entered into the RTU to activate it. This is done using the Q90 Diagnostics and Configuration tool. Once Q90 is connected to the RTU use the Configuration drop-down menu and choose “Extras Package”.



Once the “Extras Package” window opens, tick the boxes for the extras you have purchased, enter the code and click “Validate”. If the code is correct, the functionality will be unlocked.

Configuring the RTU as a Modbus Slave

With the correct functionality unlocked, the “Modbus (RTU as Slave)” will appear as an option in the drop-down list for configuring either the Q03 Serial Port or the Q22 Serial Port, if fitted.



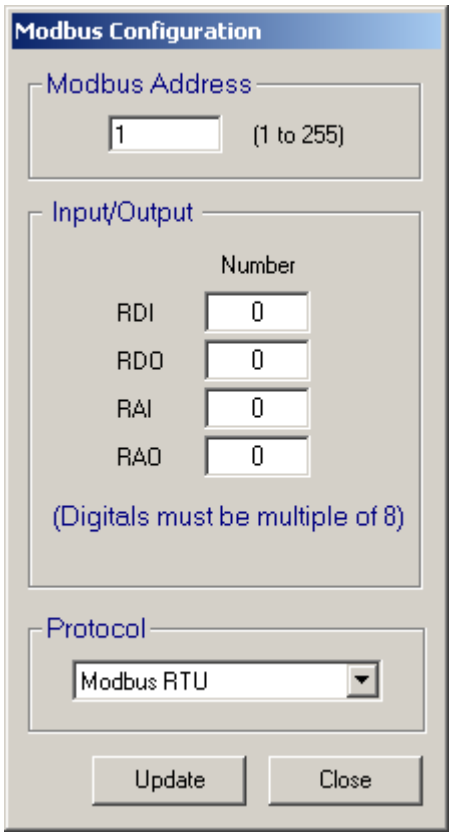
Once the details of baud rate, parity and flow control are entered, the “Configure” button is used to access the Modbus specific configuration.

Modbus Address:
The RTU Modbus Address is separate from the DIP switches that set the RTU's radio address. Choose the Modbus Address for the RTU in this box.

Input / Output:
This is where the user specifies how much of each category of I/O the system will be passing between the Modbus Master and the RTU. As shown, digital inputs must be in multiples of eight.

Protocol:
The RTU uses Modbus RTU as the default Modbus protocol. It can also use Modbus TCP if desired. To establish an Ethernet Modbus solution an external Q53 Serial-to-Ethernet converter must be used.

Once the settings have been configured as desired, the "Update" button is used to apply the changes. This will automatically create a pseudo-expansion module in the RTU IPB configuration with this I/O count. The Modbus interface is given an arbitrary IPB address of 241 for I/O mapping purposes.



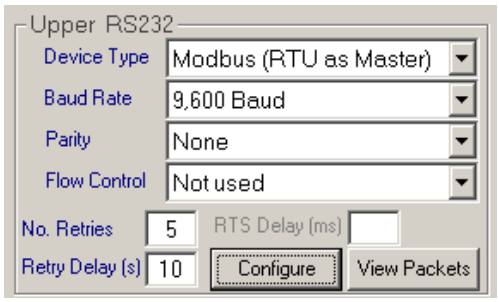
Modbus Address Registers vs. DATRAN I/O names.
The RTU Modbus interface utilises 4 different types of Modbus register. These are (Analog) Holding Registers, (Analog) Input Registers, (Digital) Coils and (Digital) Status Registers. Coils and Holding Registers are Read / Write while Input Registers and Status Registers are Read Only.

Note that in Modbus Terms, Read vs Write or Input vs Output is always talked about from the perspective of the Modbus MASTER module. Therefore, when a Modbus value gets sent from a Master to a Slave, it would be considered a "Write" where if the Value was sourced at the slave and was provided to the master it would be considered a "Read". This differs from DATRAN terminology, which always refers to I/O from the perspective of the Base Station. RAIs are values that come in from field equipment where RAOs are values that are pushed out from the base station. Because of this, Modbus Read/Write registers are used as RDI/RAIs when the RTU is a Modbus Slave, but are used as RDO/RAOs when the RTU is configured as a Modbus Master.

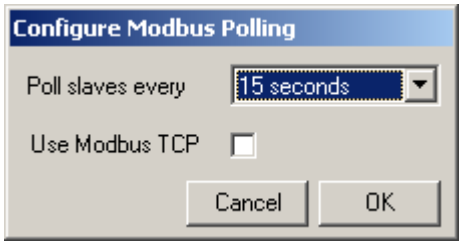
Modbus Register Name	Modbus Address Range	Modbus Alt Address Name	RTU Registers (Modbus Slave)	RTU Registers (Modbus Master)
Coils	00001 to 00250	%M0000 to %M0249	RDIs	RDOs
Status Registers	10001 to 10250	%I0000 to %I0249	RDOs	RDIs
Input Registers	30001 to 30250	%IW0000 to %IW0249	RAOs	RAIs
Holding Registers	40001 to 40250	%MW0000 to %MW0249	RAIs	RAOs

Configuring the RTU as a Modbus Master

With the correct functionality unlocked, the “Modbus (RTU as Master)” will appear as an option in the drop-down list for configuring either the Q03 Serial Port or the Q22 Serial Port, if fitted.



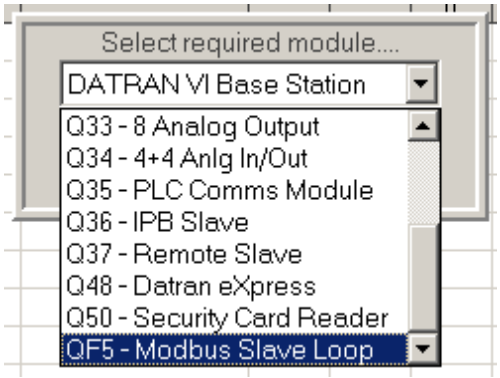
Once the details of baud rate, parity and flow control are entered, the “Configure” button is used to access the Modbus specific configuration.



The only configuration options available at this point are how often the RTU should poll the slaves and whether the RTU should use the Modbus RTU or Modbus TCP protocol.

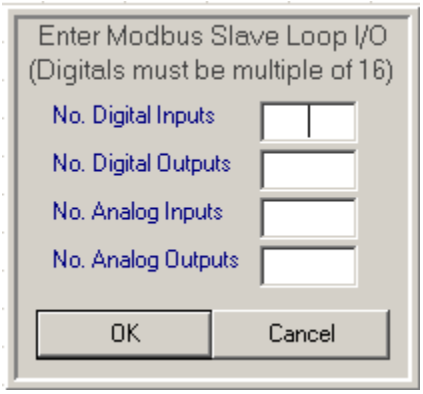
Individual slaves are then added via the IPB “Add Module”, just as if one were configuring a Q23 or similar expansion module.

The user will be asked to enter a module address. This will be the Modbus Address of the Modbus slave module.



Once a slave address is selected, the user will need to select QF5 – Modbus Slave loop from the bottom of the available module types list.

Once the QF5 option is selected, the user needs to enter the required I/O count into the configuration window shown below. Digitals must be in multiples of 16. Analogs can be any number.



Modbus I/O Mapping into DATRAN.
The RTU will map I/O from the Modbus interface as a continuation of its own I/O table. The order I/O from different modules appears in the data table is determined by the DATRAN IPB address of each module, with the native RTU I/O always appearing first.

When the RTU is configured as a Modbus slave, the Modbus Interface is assigned a virtual IPB address of 241. When the RTU is a Modbus master, each slave is mapped into the I/O table according to its Modbus address.

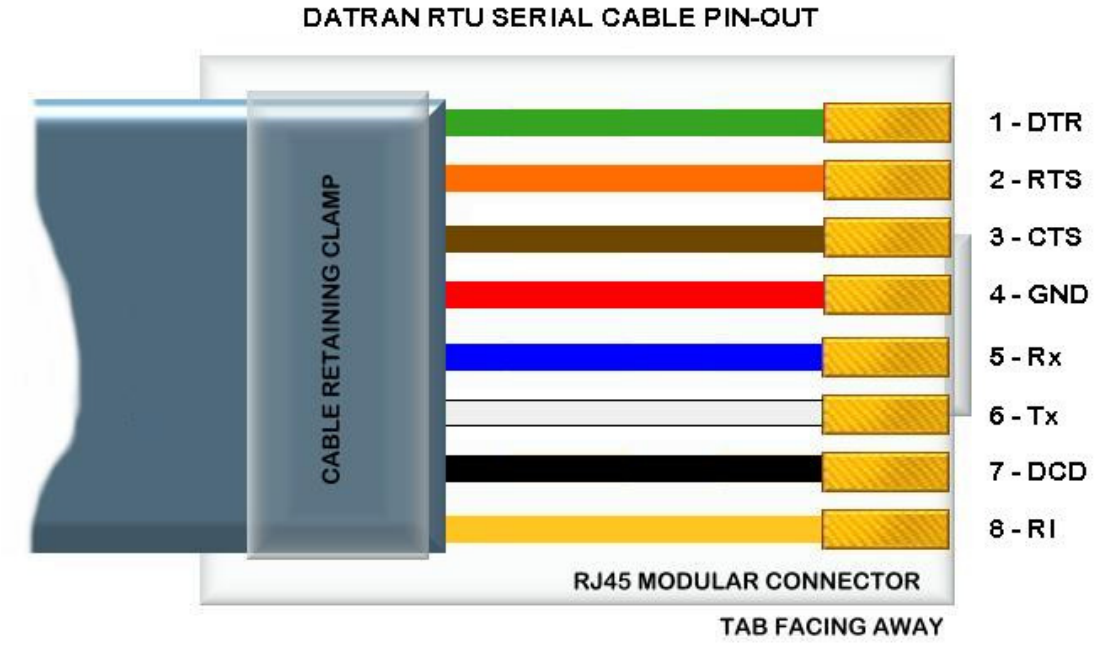
The following example of the mapping of some digital inputs for a specific installation demonstrates this. Displayed below is the digital input mapping for a site consisting of a DATRAN II eXcel with Q23 expansion module when configured as a Modbus slave with 16 Modbus digital inputs.

I/O Description	DATRAN I/O Reference
RTU Native Digital Input #1	RDI 1
RTU Native Digital Input #2	RDI 2
RTU Native Digital Input #3	RDI 3
RTU Native Digital Input #4	RDI 4
RTU Native Digital Input #5	RDI 5
RTU Native Digital Input #6	RDI 6
RTU Native Digital Input #7	RDI 7
RTU Native Digital Input #8	RDI 8
Q23 Expansion Module Digital Input #1	RDI 9
Q23 Expansion Module Digital Input #2	RDI 10
Q23 Expansion Module Digital Input #3	RDI 11
Q23 Expansion Module Digital Input #4	RDI 12
Q23 Expansion Module Digital Input #5	RDI 13
Q23 Expansion Module Digital Input #6	RDI 14
Q23 Expansion Module Digital Input #7	RDI 15
Q23 Expansion Module Digital Input #8	RDI 16
Modbus %M0000	RDI 17
Modbus %M0001	RDI 18
Modbus %M0002	RDI 19
Modbus %M0003	RDI 20
Modbus %M0004	RDI 21
Modbus %M0005	RDI 22
Modbus %M0006	RDI 23
Modbus %M0007	RDI 24
Modbus %M0008	RDI 25
Modbus %M0009	RDI 26
Modbus %M0010	RDI 27
Modbus %M0011	RDI 28
Modbus %M0012	RDI 29
Modbus %M0013	RDI 30
Modbus %M0014	RDI 31
Modbus %M0015	RDI 32

DATRAN RTU Serial Port Pin-Out

While there are a wide range of options provided by many manufacturers for the physical layer, such as Ethernet, RS232 and RS485, it is important to note that the *native* support for Modbus on a DATRAN RTU is via RS232.

Ethernet and RS485 can also be utilised however, using the appropriate media converter. The pin-out for an RTU RS232 cable using the RJ45 port is as follows:



QTech can supply a serial cable with each Modbus (Slave or Master) RTU firmware, but we can not guarantee the connectivity will suit your application.

Please terminate the cable to suit, having confirmed with the manufacturer of the device you are interfacing to.