MULTITRODE®

Leaders in Pump Station Management Technology™

PROTOCOL Translator

Installation Manual

Revision Table

Rev	Detail of Change
01	Initial issue
02	Added extended MTxPC status inc. telemetry inputs. Drawings amended.

This document is in support of the Multitrode Translator.

Version 1.0.9

This document is valid for MultiTrode Translator firmware version 1.09 or newer.

Multitrode reserves the right to update this document without notification.

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1 Introduction

Congratulations on the purchase of the advanced Multitrode Translator. In order to gain maximum benefit from the use of the Multitrode Translator it is recommended that a good understanding is developed of both the MODBus and DNP3 protocols. It is not the intention of this manual to cover these protocols in detail but only to explain the basic installation of the unit.

1.1 Multitrode Translator

The Multitrode Translator gathers information from a Multitrode MonitorPRO or Remote Reservoir Monitor by issuing continuous “assembled status” requests. This information is mapped to and stored in a pair of native databases (one for MODBus, one for DNP3) which can then be accessed by a Master using the appropriate protocol. Local inputs on the Multitrode Translator are also placed into these databases. The Master may request control operations and/or point writes to control the Multitrode device via the Multitrode Translator. Control operations that relate to Multitrode devices will be acknowledged immediately by the Multitrode Translator and the appropriate Multitrode command issued at the earliest possible time. The success or failure of a control operation is determined by subsequently reading status information for the relevant point.

The MonitorPRO is a state-of-the-art pump station supervisor, which has been specifically designed to provide a high level of motor protection, capable of monitoring and protecting pumps by measuring pump currents and voltages. The MonitorPRO, in conjunction with the MT2/3PC Pump Controllers have many desirable features. Together they provide a complete pump station management system, which is not only more efficient than conventional systems, but also provides a smaller, more-cost-effective and more reliable solution.

The MultiTrode Pump Controller (MTxPC) is an advanced microprocessor based pump controller designed to control two or three pumps depending on model chosen. It is specifically designed for use in water and sewage pumping stations and provides automatic level control, pump alternation, pump protection logic and level alarms.

These two products form the Remote Terminal Unit [RTU] that is connected to a Master SCADA system via landline or radio. The existing SCADA system works by using a MultiTrode proprietary protocol working into special SCADA software. However, via the Multitrode Translator both MODBus or DNP3 protocols are supported.

The Multitrode Translator is:

- MODBus RTU mode compliant and
- DNP3 Level 2 compliant.

2 Feature Rich

- Selectable protocol interface between MODBus (RTU) and DNP3. Each port is independently selectable allowing translation to both protocols simultaneously.
- 10-30VDC power supply.
- 6 multi-functional high speed (100Hz) digital inputs.
- 2 10-bit highly scalable and accurate analog inputs.
- Built-in FSK modem for direct connection to radio.
- RS232 high speed port for direct connection to a PC or digital radio.
- Compact DIN rail mounted module.
- LED status indication.
- Transparent mode is supported allowing straight through port to port communication.

2.1 MODBus

- Supports MODBus RTU mode with nine standard commands
- Digital inputs are configurable to masquerade as analog input saving point counts in SCADA systems.

2.2 DNP3

- Level 2 compliant DNP3 operation.
- Over and above Level 2 compliance the Multitrode Translator has the following highly useful features:
- Configurable Class assignments to DNP3 object types.
- Configurable Deadbands on analog inputs.
- Over and above the level 2 compliance, Multitrode's "Store & Forward" functionality is included.
- Over and above the level 2 compliance, Multitrode's "Reservoir Comfail" functionality is included.

3 Multitrode Translator Installation

3.1 Connections

The various connections made to the Multitrode Translator are shown in the sections that follow.

3.1.1 Power

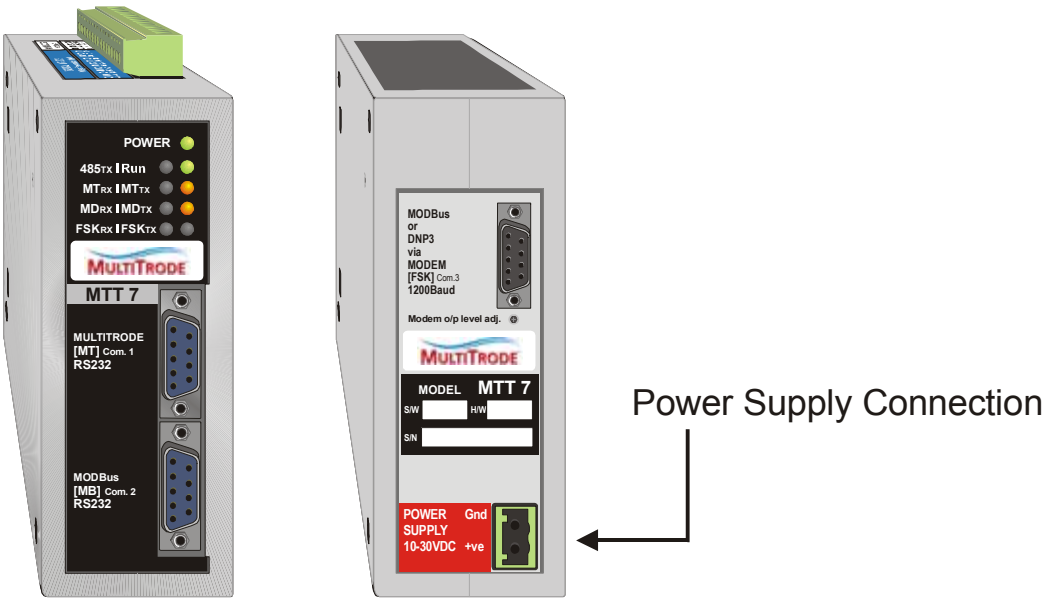

Figure 1 Power Supply Connections

The power supply input requires the connection of a 10-30VDC supply. The supply is polarity sensitive and will not function if the supply is connected incorrectly. The supply is diode protected and therefore no damage will occur if the supply is connected in reverse.

The LED marked POWER indicates that the power supply inside the Multitrode Translator is functioning. This LED should always be illuminated when the unit is operating correctly.

The Multitrode Translator requires approximately 100mA at 12VDC. However, if a radio is connected to the FSK port the additional current required for the radio needs to be factored into the power requirements of the power supply. A maximum of 1.5A may be drawn through the FSK port to power the radio.

3.1.2 Multitrode, MODBus & DNP3 Comm Ports

All communications are interrupt driven, allowing rapid response times and high speed communications on multiple channels.

RS232 ports are provided via 9 way male “D” connectors on the front of the Multitrode Translator.

- Com. 1 – MULTITRODE port (fixed).
- Com. 2 – MODBus or DNP3 port selected via port configuration.

The baud rate for the RS232 Com. ports is programmable under configuration control to a maximum of 38.4 kbps.

The RS232 ports are wired as a DTE and provide the following signals:

Pin	Function
1	No connection must be made
2	RxD – Receive data
3	TxD – Transmit data
4	No connection must be made
5	Ground
6	No connection must be made
7	No connection must be made
8	No connection must be made
9	No connection must be made

Table 1 RS232 Port Connection

It is recommended that only the supplied cables be used or damage may result.

3.1.3 Radio (FSK) Com. Port

Radio communication can be troublesome if not correctly set-up.

It is recommended that a Radio Engineer be consulted.

A 9-way female "D" connector provides connection to a radio system. The header is specifically designed to connect direct to a MAXON® SD125 radio module. Other makes of radios can be catered for by modification of the interconnecting cable. Radio communication is via a 1200 baud voice frequency signaling using Bell 202 FSK standard. Transmit level can be adjusted to suit different radio types:

Pin	Function
1	Audio Out
2	Audio In
3	Press To Talk [PTT] - Open drain output
4	Ground.
5	Supply out to radio note 1
6	Squelch [SQL] input
7	No connection
8	No connection
9	No connection

Table 2 FSK Port Connection

NOTE:
The radio powered via this connector (pins 4&5) is the same voltage as that supplied to the Multitrode Translator and has a maximum current capability of 1.5A. Should a high powered radio be used it should be powered from a separate external power supply. Therefore, when choosing a power supply for the Multitrode Translator, consideration must be given to the power supply requirements of the radio as well.

Audio Out	This signal provides the audio output signal to the radio and is typically 250mV$_{P-P}$ (max drive 40mA). This level is adjustable via trimpot.
Audio In	This signal provides the audio input signal from the radio. This level should ideally be approximately 250mv P-P. However maximum signal level should not exceed 500mV P-P. The input is protected against over voltage and can work down to 10mV.
Press To Talk [PTT]	The PTT signal is an open drain output providing 200mA drive at up to 40V. This output is pulled to ground when the Multitrode Translator wishes to transmit via the radio. If the PTT output is applied the FSK$_{TX}$ LED will be illuminated. (NOTE: An external snubber diode is required if this output is used to drive relay circuitry.)
Ground	The ground signal is connected directly to the supply ground.
Supply OUt	The supply out signal is connected directly to the Multitrode Translator supply input. This supply is designed to power interface circuits or low power radio modules and should not be used to drive high powered radio transmitters.
SQUELCH [SQL] Input	Squelch is a signal supplied by the radio to the Multitrode Translator to indicate that it has detected a carrier and that data being received is valid data transmission. On some makes of radio the squelch level can be adjusted. This level should be adjusted to minimize false data reception.

WARNING:
If a radio's supply is connected directly to this port, care should be taken to ensure that the radio does not draw more than 1.5A and that it can be supplied by the voltage used for the Multitrode Translator.

3.1.4 Digital and Analog Inputs

The top panel of the Multitrode Translator provides 16 screw terminals for connection to analog and digital inputs.

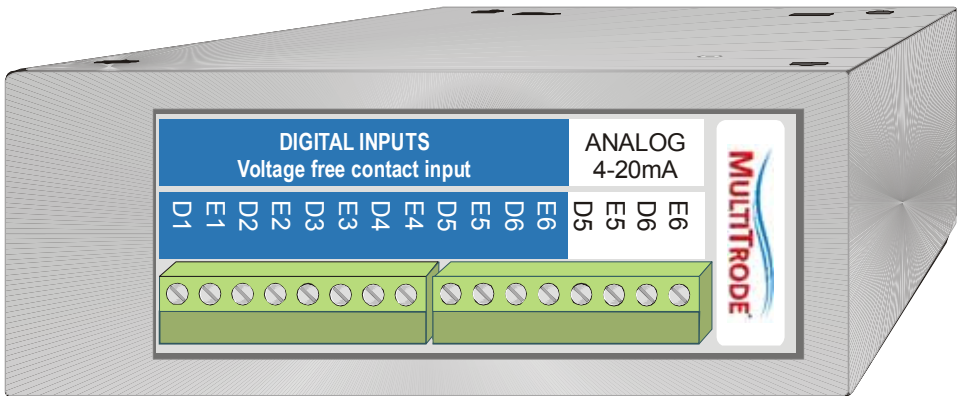

Figure 2 Multitrode Translator TOP PANEL Connections

These are split into two by eight (8) way screw terminal connectors allowing easy connection of wiring to the unit.

Standard connections for the connectors are as follows:

Pin	Function
1	Digital Input 1 +ve
2	Digital Input 1 –ve
3	Digital Input 2 +ve
4	Digital Input 2 –ve
5	Digital Input 3 +ve
6	Digital Input 3 –ve
7	Digital Input 4 +ve
8	Digital Input 4 –ve

Table 3 Input Connector 1

Pin	Function
1	Digital Input 5 +ve
2	Digital Input 5 –ve
3	Digital Input 6 +ve
4	Digital Input 6 -ve
5	Analog Input 1 +ve
6	Analog Input 1 Gnd
7	Analog Input 2 +ve
8	Analog Input 2 Gnd

Table 4 Input Connector 2

All –ve Inputs and Gnd connections are common

3.1.5 Digital inputs

The digital inputs are activated by connection of a voltage free contact across the input pair. Status of input can be configured from the configuration menu as either normal open or normal closed.

A typical digital connection would consist of a contact pair across the +ve and –ve input pins. Line lengths of up to 50m can be supported in this way. However, it is recommended that external protection is provided where wiring is run close to low voltage (LV) cabling or where high electromagnetic interference is present.

All digital inputs have Electrostatic Discharge (ESD) and Electromagnetic Compatibility (EMC) protection circuits.

3.1.6 Analog inputs

Analog inputs are 0-20mA sinks and must be connected as the final sink of the loop. These are 120ohms inputs and as such drop 2.4V (@20mA) across the input. Additional EMC protective circuitry increases the drop to 4.4V (equivalent load of 220ohms). This required voltage drop must be allowed for in the loop voltage budget.

The current source can either be driven by the same supply as the Multitrode Translator or it can have a separate supply. When an external supply is used, the ground of both supplies must be common.

External power supplies can have a range of 12V to 48V DC where the external power supply has ground connected to the Multitrode Translator's negative input (either "R1-" or "R2-"). All analog inputs have ESD and EMC protection circuitry.

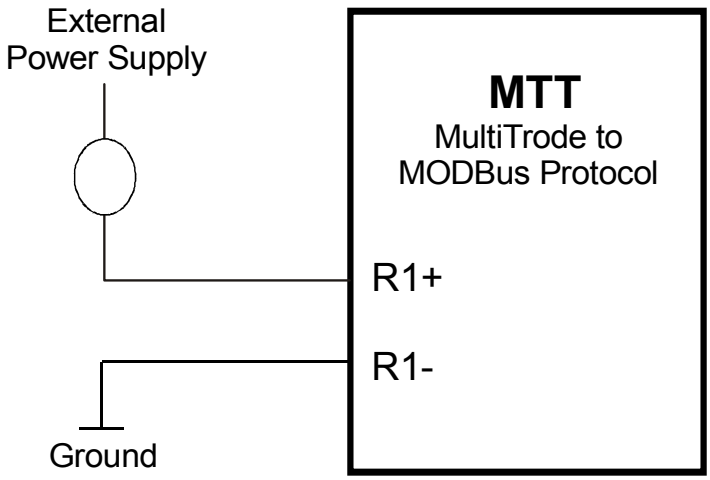

Figure 3 Typical Analog Sensor Connection.

3.2 Status LED's

The status LEDS on the front panel indicate operation of the Multitrode Translator. The function of each of the LEDs is as follows:

POWER	This LED indicates that the power supply inside the Multitrode Translator is functioning.
485TX	The RS485 Com. port is a reserved port. The 485**TX** LED is lit whenever the Multitrode Translator is transmitting via the RS485 line.
Run	This LED will flash continuously to indicate that processor code is running correctly.
MTRX	This LED is lit whenever data is being received via Com. 1 from the MonitorPRO.
MTTX	This LED is lit whenever data is being sent via Com. 1 to the MonitorPRO.
MBRX	This LED is lit whenever data is being received via Com. 2 from MODBus or DNP. The LED will still come on even if the baud rates are set incorrectly. This is useful in determining if there is a cable connection problem.
MBTX	This LED is lit whenever data is being sent via Com. 2 to MODBus or DNP.
FSKRX	This LED indicates that the Multitrode Translator has detected a squelch signal from the radio port (the radio is receiving).
FSKTX	This LED indicates that the Multitrode Translator is transmitting via the radio port.

4 MultiTrode Translator Configuration

4.1 Configuration

Configuration of the Multitrode Translator can be done through any communications port using a terminal emulation program such as HyperTerminal®. Entering the string "`login`" will cause the protocol driver on the associated port to suspend and display a list of configuration options. The login string functions much like the "`+++`" offline sequence for Hayes compatible modems and requires one second of silence before and after with no more than one second in between the characters. This will prevent false triggering if the string should appear within a protocol packet. Note also that it is case sensitive and does not end with a carriage return or line feed.

If the configuration menu is enabled, and no key presses have been seen for 60 seconds, the menu will force a log off with the message "`Auto logoff due to inactivity !!!`". This is a safeguard in case the Multitrode Translator is left with the menu active and hence rendering the protocol driver on that port unusable. Also, if the menu detects a key press that corresponds to a non-printable character, it assumes there is no longer an operator at a terminal but a Master trying to communicate using the configured protocol. In this case the menu will immediately disconnect (without feedback) and reinstate the protocol driver to handle the incoming data.

This last feature is active on all but the FSK port. It is not uncommon for squelch to activate before a clean carrier is available resulting in the odd spurious character being received on radio key-up. This often causes the operator to be kicked off without warning. Originally, the configuration menu was not intended to be used over the radio and the "forced logoff on non-printable character" feature was disabled for the FSK port as a concession to make it work. Similarly, non-printable characters are also ignored when matching the "`login`" string for initial connection.

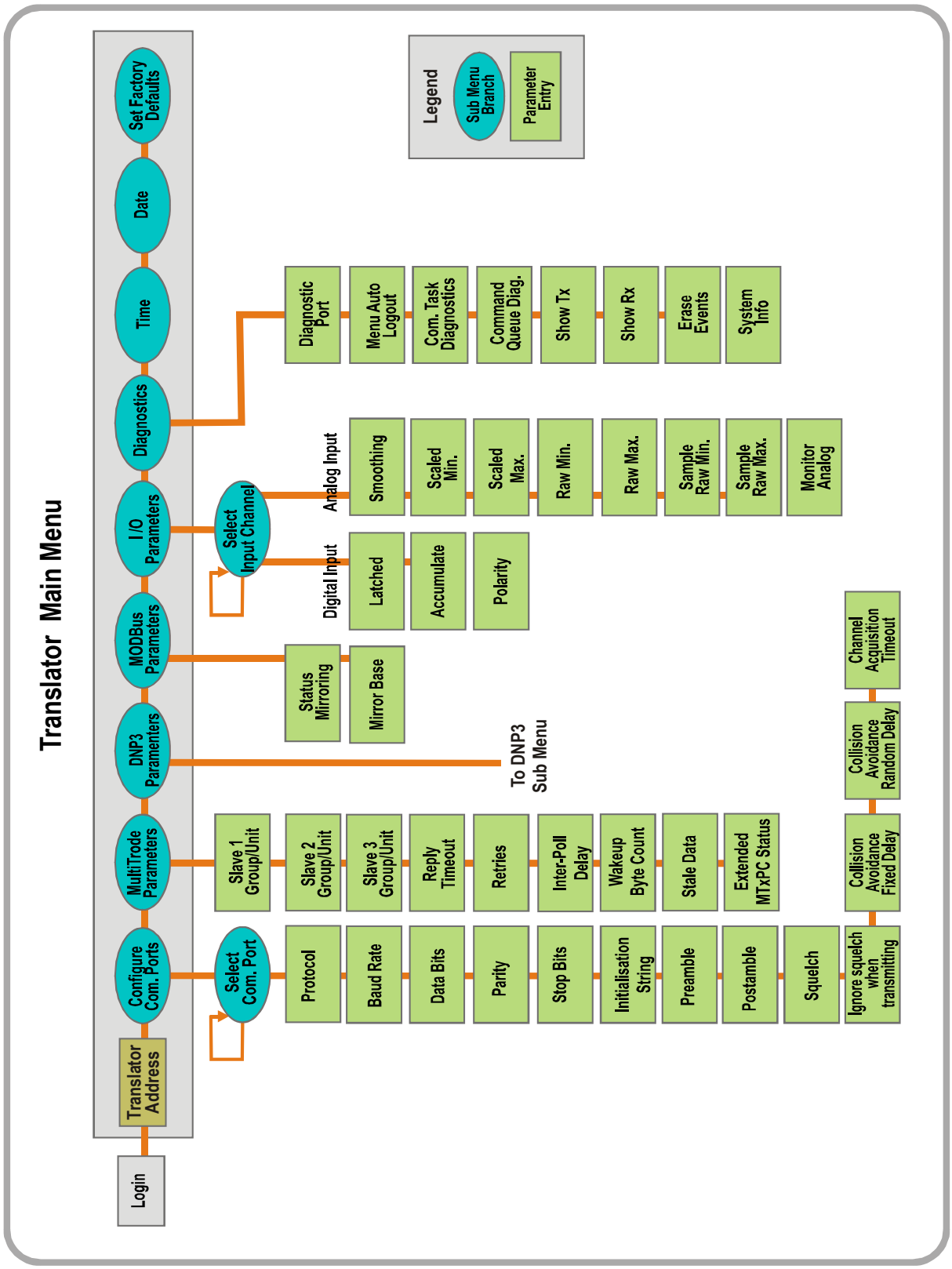

Figure 4 - Translator Main Menu

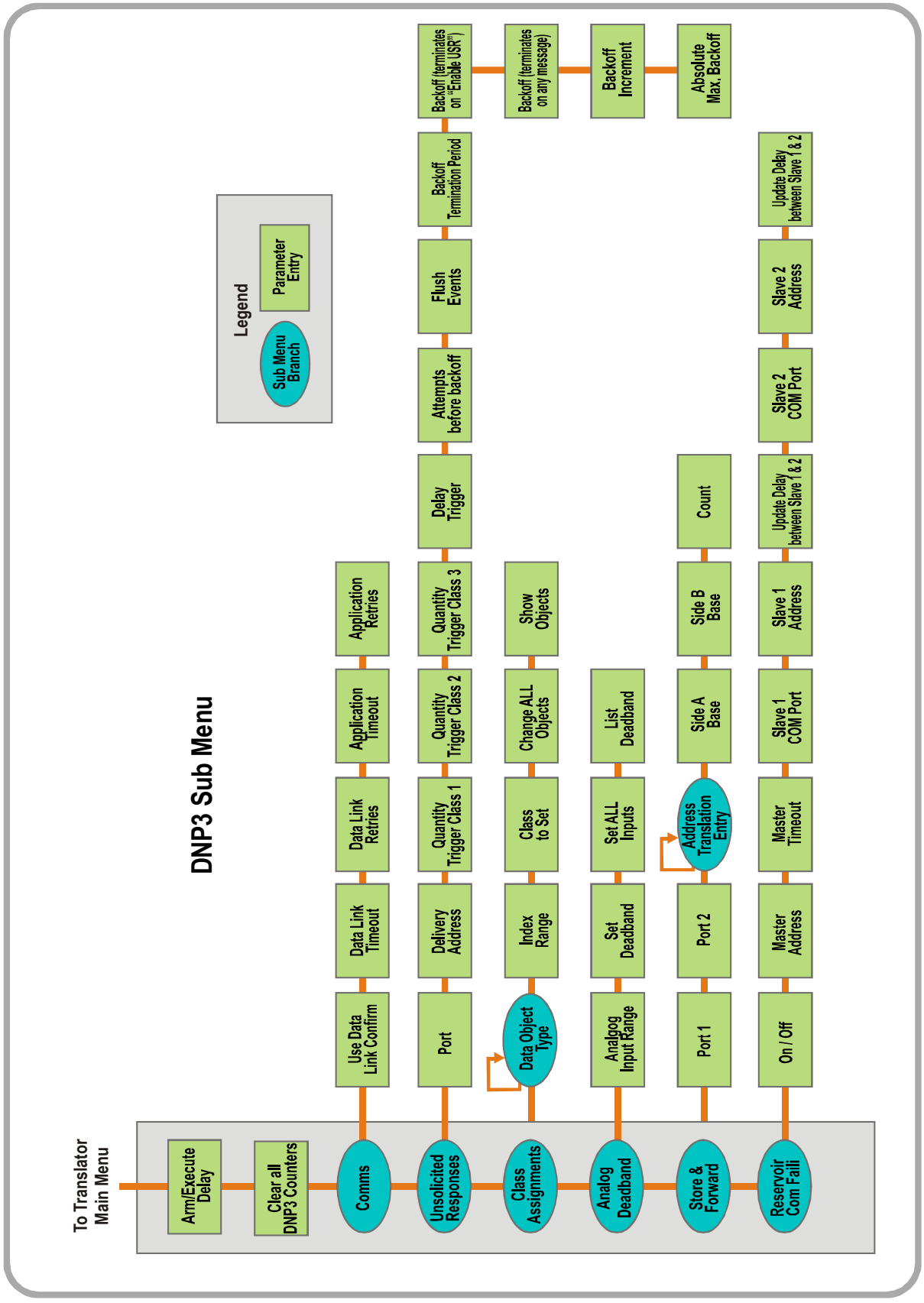

Figure 5 - DNP3 Sub Menu

4.1.1 Main Menu

Once logged in, the main menu is displayed. It reports the device name and version. Most of the options under this menu are links to other sub-menus but it also contains an option to set the Multitrode Translator address, Time, Date and one reset factory defaults.

```
Multitrode Translator (Multitrode - DNP / Modbus
converter) v1.00.
Main Menu.

1) Translator Address                [1]
2) Configure COM ports.
3) Multitrode Communications.
4) DNP Parameters.
5) Modbus Parameters.
6) I/O.
7) Diagnostics.
8) Time                         [10:40:12]
9) Date                         [22/10/2001]
A) Set factory defaults.

ESC) Exit.
```

Configuration Menu 1 Main Menu

Translator Address	This menu item is a 16-bit address to which the Multitrode Translator answers when communicating with a Master. MODBus has an 8-bit address structure and therefore the maximum address is decimal 256. If a larger number was entered only the lower 8-bits are used and the upper 8-bits are ignored. For example if 300 (0x012C) were entered, only the 44 (0x2C) would be used as the MODBus address.
Configure Com. ports	This menu item allows the configuration of options relating to individual communication ports.
Multitrode Communications	This menu item contains options, which control the behaviour of the Multitrode Translator when talking to a Multitrode device.
DNP Parameters	This menu item allows configuration of options, which relate to the DNP protocol.
MODBus Parameters	This menu item allows configuration of options, which relate to MODBus protocol.
I/O	This menu item allows the operator to configure the analog and digital inputs, calibrate the analog scaling and view analog input, in real time, for diagnostic purposes.
Diagnostics	This menu item allows the configuration of diagnostic information and can help with trouble shooting, particularly communications related issues.
Time	Allows the operator to change the Multitrode Translator time.
Date	Allows the operator to change the Multitrode Translator date.
Set factory defaults	This menu item causes the unit to display a confirmation message to verify that it should proceed with restoring factory defaults. If the operator enters “Y” or “y” it will reset the unit to its factory defaults.

4.1.2 Configure Com. ports

The Com. port menu allows the configuration of each of the Com. ports. It displays the current port in the title and all of the options associated with that type of port. The first option allows the operator to cycle through each of the ports. Other options vary depending on the type of port.

4.1.2.1 RS-232 Ports (Com. 1 & Com. 2)

Displayed below is the Com. 2 port menu for RS-232 type ports. The Multitrode Translator has 2 RS-232 ports (Com. 1 and Com. 2). Com. 1 is similar to Com. 2 except that the protocol and baud rate cannot be changed on Com. 1.

```
COM2 (RS-232) Port Configuration.

1) Next port
2) Protocol                          [DNP3 Slave]
3) Baud rate                  [9600]
4) Data bits                  [8]
5) Parity                            [None]
6) Stop bits                  [1]
7) Initialisation string      [ ]

ESC) Back.
```

Configuration Menu 2 RS232 Port Configuration

Next port	This option allows the operator to cycle through each of the ports.
Protocol	Selects which protocol is used on the selected port. Options are “DNP3” or “MODBus”. Com. 1 is fixed at “Multitrode”.
Baud Rate	Selects the baud rate of the RS232 port. The baud rate can be set to any of the following values; 300, 600, 1200, 2400, 4800, 9600, 19200 or 38400.
Data Bits	Selects either 7 or 8 data bits.
Parity	Selects parity. Can be one of; None, Odd or Even.
Stop Bits	Selects either 1 or 2 stop bits.
Initialisation String	Specifies an initialisation string. This string is transmitted out of the Com. port at power up. Control codes can be sent by a “^” followed by a capital letter where “A” results in binary 01, “B” in binary 02 etc… To transmit a carriage return “^M” is normally used. A literal “^” can be sent by specifying “^^”

4.1.2.2 FSK Ports (Com. 3)

Displayed below is the Com. port menu for the FSK port. The Multitrode Translator has a single FSK port (Com. 3).

```
COM3 (FSK) Port Configuration.

1) Next port
2) Protocol                          [DNP3 Slave]
3) Baud rate                  [1200]
4) Data bits                  [8]
5) Parity                            [None]
6) Stop bits                  [1]
7) Initialisation string      [ ]
8) Preamble                          [220] (msec)
9) Postamble                  [20] (msec)
A) Squelch                           [Active Low]
B) Ignore SQL when transmitting[No]
C) CA fixed delay (msec)      [0]
D) CA random delay limit (msec)[0]
E) Channel aquisition timeout (sec)  [0]

ESC) Back.
```

Configuration Menu 3 FSK Port Configuration

Next Port	This option allows the operator to cycle through each of the ports.
Protocol	Determines what protocol is used on the selected port. Options are “DNP3” or “MODBus”
Baud Rate	Displays the baud rate of the FSK port. The baud rate is fixed at 1200 and cannot be changed.
Data Bits	Selects either 7 or 8 data bits.
Parity	Selects parity. Can be one of: None, Odd or Even.
Stop Bits	Selects either 1 or 2 stop bits.
Initialisation String	Specifies an initialisation string. This string is transmitted out of the Com. port at power up. Control codes can be sent by a “^” followed by a capital letter where “A” results in hex 0x01, while a “B” results in hex 0x02 etc… To transmit a carriage return, “^M” is normally used. A literal “^” can be sent by specifying “^^”.
Preamble	Specifies the preamble in milliseconds. The preamble is the period that the Multitrode Translator waits after keying up the radio (asserting PTT) before it begins to transmit.
Postamble	Specifies the postamble in milliseconds. The postamble is the period that the Multitrode Translator waits after transmitting the last character of a packet before keying down the radio (de-asserting PTT).
Squelch	Selects the polarity of the Squelch pin. This facilitates a wide range of radios. Options are “Active High”, “Active Low” and “Unavailable”. Normally characters received when squelch is not active are considered noise and are discarded. When squelch is unavailable, any character will be accepted.
Ignore SQL when transmitting	Normally the Multitrode Translator will not transmit when the communications channel is in use by another device (indicated by squelch being active). This option can be used to force the Multitrode Translator to ignore the squelch signal and transmit when it wants without regard to others.

CA fixed delay	This menu item defines the *fixed_delay* component of the *backoff_time* as shown below in collision avoidance procedure.
CA random delay limit	This menu item defines the *random(max_random_dely)* component of the *backoff_time* as shown below in collision avoidance procedure.
Channel acquisition timeout	This menu item defines the maximum time allowed before the retries are stopped as shown below in collision avoidance procedure.
Collision Avoidance Procedure	The DNP3 Data Link Layer specification, discusses many different issues and configurations of physical connections in a general manner. Unfortunately, it does not clearly describe how to avoid collisions between messages, especially unsolicited messages, sent by several devices sharing a half-duplex, multi-drop link. The following configuration items allow the Multitrode Translator to be configured to overcome possible channel access related limitations. The physical layer must provide an indication to the data link layer of when the link is in use, e.g. using the DCD (Data Carrier Detect) signal. If a device prepares to transmit and finds the link busy, it waits until it is no longer busy, then waits a backoff_time as follows: **backoff_time = fixed_delay + random(max_random_delay)** After the backoff_time, the device tries again, either indefinitely, or up to a configurable maximum time allowed for retries. If a maximum is used, the protocol behaves as if a link failure occurred, i.e. data is returned to buffers at the application layer and application layer retries take place if desired. The fixed_delay can be adjusted per device to provide priority of access. For instance, it could be zero (0) for Masters and non-zero for all the Slave devices. This provides a minimum "window" of access time for the Master(s).

4.1.3 MultiTrode Parameters Menu

Options on this menu control parameters that relate to communications with the MonitorPro. It contains the group and unit numbers to be used when addressing RTUs Slaved to the MonitorPro, as well as parameters that control the Multitrode protocol transaction.

```
Multitrode Communications.
  1) Slave 1 Group                    [0x01].
  2) Slave 1 Unit                     [0x02].
  3) Slave 2 Group                    [0x01].
  4) Slave 2 Unit                     [0x03].
  5) Slave 3 Group                    [0x01].
  6) Slave 3 Unit                     [0x04].
  7) Reply Timeout                    [7000] (msec).
  8) Retries                          [1].
  9) Inter-Poll Delay                 [0] (msec).
  A) Wakeup Byte Count                [60].
  B) Data Considered Stale After      [60] (sec).
  C) Extended MTxPC Status            [Yes]

  ESC) Back.
```

Configuration Menu 4 Multitrode Configuration

Slave 1 Group	This is the group number of the first Slave connected to the MonitorPro. Used for control operations.
Slave 1 Unit	This is the unit number of the first Slave connected to the MonitorPro. Used for control operations.
Slave 2 Group	This is the group number of the second Slave connected to the MonitorPro. Used for control operations.
Slave 2 Unit	This is the unit number of the second Slave connected to the MonitorPro. Used for control operations.
Slave 3 Group	This is the group number of the third Slave connected to the MonitorPro. Used for control operations.
Slave 3 Unit	This is the unit number of the third Slave connected to the MonitorPro. Used for control operations.
Reply Timeout	The Multitrode Translator will wait this long for a reply to any request. If a reply is not seen before the timeout expires, the transaction will be failed (after retries have been exhausted).
Retries	If a response is not seen within the configured timeout period, the Multitrode Translator will issue the request again. Retries determine how many additional attempts should be made before the transaction is considered a failure.
Inter-poll Delay	This option allows a delay between subsequent transactions with the MonitorPro to be configured.
Wakeup Byte Count	This controls the length of the wake up sequence (0xFF) that must be sent to the MonitorPro to get its attention. Its default value is that specified in the Multitrode protocol documentation.
Data Considered Stale After	This menu item sets the maximum time after which time, if no new data is retrieved from the Multitrode device, existing data will be considered stale.
Extended MTxPC Status	When set to “Yes”, this polls the Telemetry Inputs from the MTxPC. Inputs must be configured as telemetry inputs using on the MTxPC for this to operate. When set to “No” the MTT does not poll this extra data from the MonitorPro. (This is provided only for compatibility reasons. There is normally no need to change this setting.)

4.1.4 DNP Parameters Menus

This menu allows the operator to change options that relate to the operation of the DNP protocol. It contains the Arm/Execute Delay as well as some more specific sub menus.

```
DNP Configuration.

1) Arm / Execute Delay                [5000] (msec)
2) Clear All DNP Counters
3) Communications
4) Unsolicited Responses
5) Class Assignments
6) Analog Dead Bands
7) Store & Forward
8) Reservoir Comfail Master

ESC) Back.
```

Configuration Menu 5 DNP3 Configuration

Arm/Execute Delay	Under DNP, a control operation (digital or analog output) can be issued using a "Direct Operate" command or a pair of "Select"/"Operate" commands. A "Direct Operate" acts like a write and operates the control point as soon as the request is received. A "Select" command selects a control point for operation and will only execute that operation if a matching "Operate" is received within a specified time. This provides a more secure method of activating critical controls. Some devices do not allow direct operations on certain control points but the Multitrode Translator allows them on all of its outputs. The Arm/Execute Delay specifies the longest allowable interval between the select and operate commands. The term Arm/Execute is commonly used for this type of operation.
Clear All DNP Counters	This menu item prompts for confirmation by displaying "`OK to clear counters (Y/N) ?`". If the operator responds with "`y`", all DNP counters will be zeroed.
Communications	Selects the DNP communications sub-menu (see section 0 below for more details).
Unsolicited responses	Selects a sub-menu that configures the behaviour of unsolicited responses (see section 4.1.4.2 below for more details).
Analog Deadbands	Selects a submenu that controls the analog deadbands (see section 4.1.4.3 below for more details).

4.1.4.1 Communications

This menu allows configuration of DNP link and application layer transmission parameters and service types. It is recommended that the reader browse the DNP protocol specification to become familiar with the function of and relationship between the link and application layers (and to a lesser extent, the transport layer).

```
     DNP Communications Configuration.


     1) Use Data Link Confirm        [Never]
     2) Data Link Timeout                  [1000]
       (msec)
     3) Data Link Retries                  [2]
     4) Application Timeout                [2000]
       (msec)
     5) Application Retries                [0]


ESC) Back.
```

Configuration Menu 6 DNP3 Communication Configuration

Use Data Link Confirm	This option tells the link layer of the DNP protocol driver when to use confirmed delivery services as opposed to unconfirmed delivery services. Options are "`Never`", "`Multi-Fragment Only`" or "`Always`". The Multi Fragment only option forces confirmed delivery services to be used only if the application layer transmission requires multiple fragments. Normally application layer responses will act as a confirmation of delivery anyway.
Data Link Timeout	Determines the time that the DNP link layer will wait for a confirmation when using confirmed delivery services before the transaction is deemed unsuccessful.
Data Link Retries	This is the number of additional attempts made by the DNP link layer to transmit an unsuccessful request before giving up and notifying the application layer that it's fragment could not be delivered.
Application Timeout	This is the time (after being told by the link layer that it's request has been delivered) that the DNP application layer will wait for a response or application layer confirmation before the transaction is deemed unsuccessful.
Application Retries	This is the number of additional attempts made by the DNP application layer to send an unsuccessful request before giving up.

4.1.4.2 Unsolicited Responses

```
     DNP Unsolicited Responses [USR] Configuration.


     1) Issued via                          [No port]
     2) Delivery Address for USR's               [1]
     3) Quantity Class 1 Before Transmission     [10]
     4) Quantity Class 2 Before Transmission     [10]
     5) Quantity Class 3 Before Transmission     [10]
     6) USR Notification Delay (x10msec)         [1500]
     7) Delivery Attempts Before Backoff         [6]
     8) Flush Events After Attempts Exhausted    [No]
     9) Backoff Terminates After Time Period     [60]
       (sec)
     A) Backoff Terminates On 'Enable USR' [No]
     B) Backoff Terminates On Any Message  [No]
     C) Backoff Increment On Timeout       [0]          (sec)
     D) Absolute Max Backoff Time                [3600]
       (sec)


ESC) Back.
```

Configuration Menu 7 DNP3 Unsolicited Responses Configuration

Issued Via	Selects the communications port through which unsolicited responses are reported. If set to "No Port", then unsolicited responses will be unsupported and any related protocol requests (e.g. class enable and disable) will result in a "function unsupported" in the response.
Delivery Address for USR's	This is the address to which unsolicited responses are sent. Normally the Master address.
Quantity Class 1 Before Transmission	A USR will be triggered if there are at least this many unreported events of a given class. This is useful to save bandwidth, when many events are generated over a short period. Only the events in the Class that triggers the USR will be sent.
Quantity Class 2 Before Transmission	
Quantity Class 3 Before Transmission	
USR Notification Delay	This option defines one of several conditions that can trigger the transmission of an unsolicited response. A USR will be triggered if the specified time has elapsed without an event being generated. This is useful in conjunction with "Minimum Quantity per Class" when few events are being generated. It forces a USR if it is taking too long to accumulate the minimum number of events.
Delivery Attempts Before Backoff	This option controls how many times the Multitrode Translator should try delivering an unsolicited response to a Master that does not accept it. If the configured number of delivery attempts is made without success, the Multitrode Translator will enter a Back-Off mode during which it will not send any USRs. This allows a Master to recover when it is being swamped by USRs. Several conditions, which are covered by the following options, will cause the unit to exit Back-Off mode and allow it to continue issuing USRs. A value of 0 for "delivery attempts" indicates that Back-Off is disabled and USRs will continue to be sent until successful.

	**NOTE:** *A single delivery attempt includes any retries configured for the link and application layers of the DNP protocol. Attempting to deliver a single USR results in the Multitrode Translator asking the application layer of its DNP driver to build and send an unsolicited response. The application layer may do this several times (as determined by "application layer retires") before telling the Multitrode Translator that its request succeeded or failed* *Similarly, each transmission by the application layer is passed to the link layer, which may also make several attempts before the application layer is told that its request has failed. For example if the number of application retries is 2 (3 attempts total) and link retries is 1 (2 attempts total), then a single attempt by the Multitrode Translator to deliver a USR can result in up to six transmission being issued.*
Flush Events After Attempts Exhausted	With this option the operator can tell the Multitrode Translator to flush the event recorder if the configured number of delivery attempts is made without success. This option is only recommended for systems where the Master may have a hard time clearing a backlog of events after it has been down and/or the events themselves are not crucial.
Backoff Terminates After Time Period	This option tells the Multitrode Translator to exit Back-Off mode after a certain time period. A value of 0 means "for ever". Other conditions can terminate Back-Off before this time has expired.
Backoff Terminates On 'Enable USR'	This option tells the Multitrode Translator to exit Back-Off mode when it receives an "Enable Class x for USR" protocol request from the Master.
Backoff Terminates On Any Message	This option tells the Multitrode Translator to exit Back-Off mode when it receives any Master message effectively instructing the Multitrode Translator to lay off sending USRs until the Master is known to be back up.
Backoff Increment On Timeout	If Back-Off is repeatedly entered without a successful USR delivery, the Back-Off period can be extended by this value each time thereby reducing the load on the communications network when the Master is not responding for extended periods. A successful delivery will restore the next Back-Off time to its original configured value.
Absolute Max Backoff Time	This limits the Back-Off time period by not allowing it to exceed this configured value.

4.1.4.3 Class Assignments

All DNP3 objects can be assigned into classes. The assignment of classes to DNP3 objects is made through this menu. The factory default class allocation is shown in the DNP3 Users Manual.

```
DNP Class Assignments.

1) Select data object type      [BINARY INPUT EVENTS
(02)]
2) Select index range           [0-956]
3) Set class for these points   [*]
4) Set class for ALL points
5) Show list of selected points

ESC) Back.
```

Configuration Menu 8 DNP3 Class Assignments

Select data object type	Prompts for a DNP3 data object type to be selected. This selection is what is operated on when option 4 or 5 is chosen. The three DNP3 data objects that are class configurable are: [BINARY INPUT EVENTS (02)] [COUNTER EVENTS (22)] [ANALOG INPUT EVENTS (32)]
Select index range	Prompts for a range of DNP3 data object to be updated.
Set class for these points	Prompts for the class to which the DNP3 data objects selected in option 2 need to be updated.
Set class for ALL points	All DNP3 data object types selected in option 1 above will be updated with the class prompted for.
Show list of selected points	This menu item lists the range of classes, as defined in option 1 and 2, with their respective class settings.

4.1.4.4 Analog Dead Bands

The analog deadband is the maximum allowable excursion from the last evented value before a new event is generated. This means a deadband of 10 allows a point to vary from -10 to +10 (inclusive) of its last evented value, without generating a new event.

The following pseudo-code illustrates the action of a deadband:

```
IF absolute_value(current_value - value_at_last_event) > deadband
      Generate_new_event
```

```
DNP Analog Deadband Configuration.

1) Select analog input range          [0-251]
2) Set Deadband for these points      [*]
3) Set Deadband for ALL points
4) Show list of selected points

ESC) Back.
```

Configuration Menu 9 DNP3 Analog Deadband Configuration

Select analog input range	Prompts for a range of analog inputs to be updated with the deadbands selected in option 2. This range is updated when option 4 is used.
Set Deadband for these points	Prompts for a new deadband and assigns it to the selected analog inputs set in option 1.
Set Deadband For All Analogs	Sets the deadband on all the analog inputs to the prompted value.
Show list of selected points	This menu item lists the range of analog outputs, as defined in option 1, with their respective deadband settings.

4.1.4.5 DNP3 Store and Forward

The Multitrode Translator supports store and forwarding of DNP3 packets which is a feature over and above the DNP3 specification. This feature allows a Multitrode Translator to re-transmit any DNP3 packet that is not addressed to it and act as a repeater for devices that are out of range of the Master. This retransmission is subject to several configurable conditions and actions that are best illustrated by example:

Consider the case of a Master and two Slaves. The Master has address 1 and the Slaves have addresses 2 and 3, (called M1, S2 and S3 respectively). A problem exists if S3 is outside the range of M1. A solution would be to have S2 pass on messages from M1 to S3 by simply retransmitting any messages not addressed to it. Unfortunately, if S2 is intermittently within range of M1 (which is often the case) there is a danger of S3 receiving and answering two requests. Address translation is used to eliminate this problem. S3 is configured with an address of 103 rather than 3 but the Master is still addresses it's requests to 3. This way if S3 receives a request directly from the Master it will be ignored. S2 is configured to know that requests from the Master destined for address 3 are actually meant for address 103 and it will alter the addresses in the DNP3 packet before re-transmitting it. To prevent the same thing from happening on the return path, S2 also changes the source address of the request from 1 to 101. S3 is configured with address 103 and hence will accept the retransmission and respond to the Master (thinking it's address is 101). S2 will translate the addresses back, which then satisfies the requirements of the Master. This is illustrated in the diagram below:

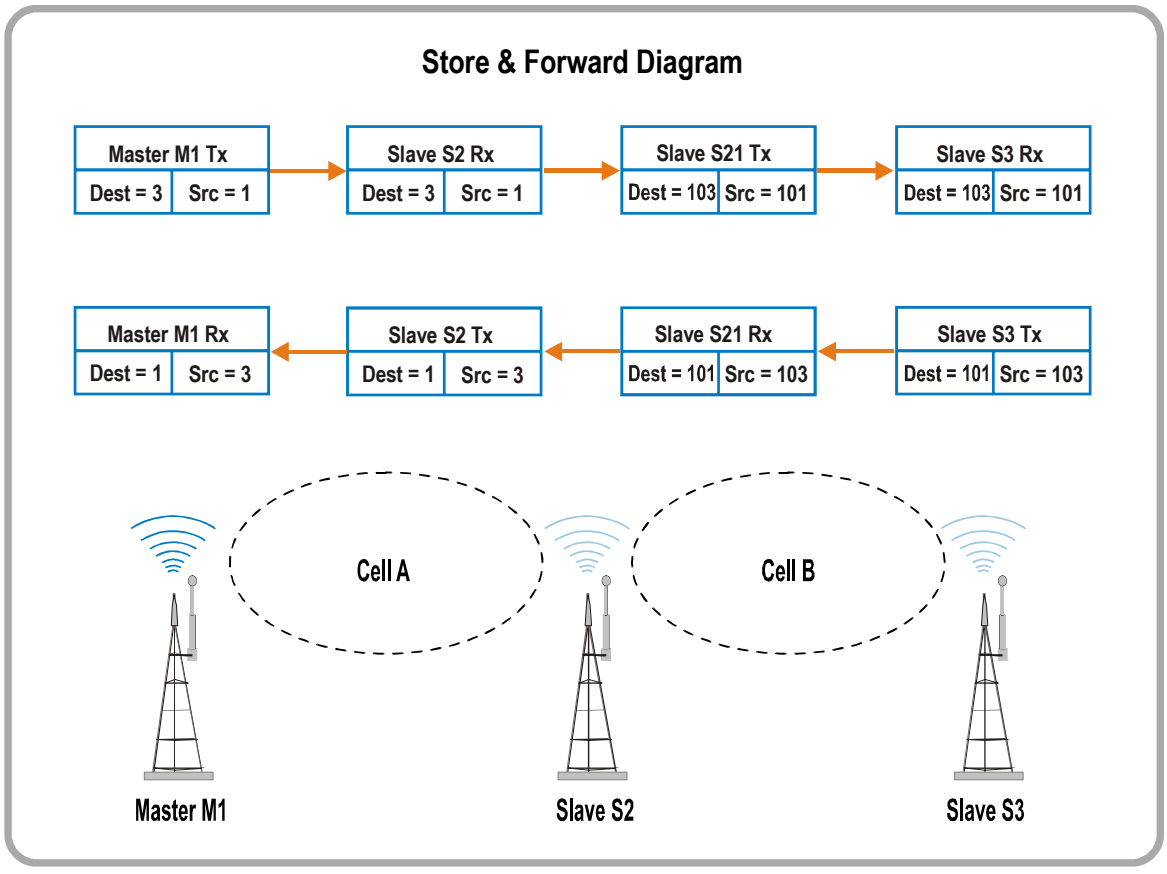

Figure 6 Store and Forward Diagram

Effectively, the network has been divided into two "cells" with one on each side of the repeater (Slave S2). The repeater acts as a gateway between the two cells. In the example above, cell A has addresses 1 and 3, while cell B has addresses 101 and 103. Devices that can not normally talk to each other physically exist in separate cells but have a "virtual equivalent" in the other cell. In the example, address 3 does not really exist but M1 talks to it as if it does. Similarly, S3 responds to a Master that appears to have address 101. Normally, devices only address units within their own cell and the repeater takes care of translating it into the other cell by changing the source and destination addresses.

Using this scheme, there is nothing to prevent M1 explicitly addressing S3 with 103. If S3 is in range, it will happily respond to address 1. In this case S2 recognizes that the packet is intended to cross a cell boundary and will not re-transmit. This gives the Master a choice of path by using different addresses. Addressing the request to a device's configured address (103) will use the direct path, while sending a request to the equivalent address within its own cell (3) will direct it through the repeater.

To configure the Multitrode Translator to act as a store and forward repeater, one or more "address translation entries" need to be defined. An address translation entry specifies a range of addresses on one "side" of the repeater and the associated equivalents on the other. An address translation entry consists of three values; Side A base address, Side B base address and a count. There is no special significance attached to side A or B other than to distinguish one "cell" from another. The address translation entries control store and forward operation as follows:

When a packet is received by the repeater, its destination address is tested against the Multitrode Translator's address. If it matches, the packet is accepted by the repeater as a message for it. If not the packet is intended for another unit and is considered for forwarding.

If a packet is intended for another unit, the Multitrode Translator will scan all of its address translation entries to see if the destination address lies within either the side A address range or side B address range.

```
dest > BaseSideA) AND (dest <= (BaseSideA + Count)) OR
dest > BaseSideB) AND (dest <= (BaseSideB + Count))
```

If the destination address was not within any such range, the packet is ignored and no action is taken. Otherwise, the first matching entry is used to translate the destination address to the associated address in the other side. The packet's destination address is replaced with this new value:

```
new_dest = old_dest - BaseSideThis + BaseSideOther
```

where `BaseSideThis` is the base address of the side that matched the destination address and `BaseSideThis` is the base address of the other side.

Steps 2 and 3 are repeated using the source address of the packet.

If the original source and destination were found to be on different sides of the repeater, the packet is ignored and no action is taken. Otherwise the packet is re-transmitted.

Finally, up to two communications ports can be specified for store and forwarding. If only one is specified, only packets received on that port will be considered for forwarding and will be forwarded out of that same port. If two ports are specified, packets received on either will be considered for forwarding but they will be transmitted out of the other port (i.e. in one and out of the other in either direction). If no ports are selected, store and forwarding is disabled. The configuration menu below shows the default settings:

```
DNP Store And Forward Configuration.

1) Store and forward port 1                    [None]
2) Store and forward port 2                    [None]
3) Next address translation entry
4) Address translation entry 1, side A base    [0]
5) Address translation entry 1, side B base    [0]
6) Address translation entry 1, count          [0]

ESC) Back.
```

Configuration Menu 10 DNP3 Store and Forward Configuration

Example:

An example showing the configuration settings. A Master with address 1 is in a radio network with five Slaves (addressed 2 to 6). Slaves 5 and 6 are outside the range of the Master. Slave 4 is to act as a repeater since it is within range of the Master and Slave 5 and Slave 6.

- Login to the configuration menu of Slave 5 and 6 and change the addresses of units 5 and 6 to 105 and 106 respectively.
- Login to the configuration menu of Slave 4 (the repeater) and navigate to the store and forward configuration sub-menu.

```
    DNP Store And Forward Configuration.

    1) Store and forward port 1                  [COM3]
    2) Store and forward port 2                  [None]
    3) Next address translation entry
    4) Address translation entry 1, side A base  [1]
    5) Address translation entry 1, side B base  [101]
    6) Address translation entry 1, count        [1]

ESC) Back.
```

- Select "Next address translation entry"

```
    DNP Store And Forward Configuration.

    1) Store and forward port 1                  [COM3]
    2) Store and forward port 2                  [None]
    3) Next address translation entry
    4) Address translation entry 2, side A base  [5]
    5) Address translation entry 2, side B base  [105]
    6) Address translation entry 2, count        [2]

ESC) Back.
```

- Entry 1 will take care of mapping the Master's address 1 on side A to 101 on side B.
- Entry 2 will take care of mapping the Slave addresses 5 and 6 on side A to 105 and 106 on side B.

Note: ***Addresses 2 and 3 should not be translated since we don't want the Store and Forward unit to retransmit for these addresses.***

If it were units 2 and 3 that were out of range rather than 5 and 6, the configuration would only require one translation entry:

```
     DNP Store And Forward Configuration.

     1) Store and forward port 1                  [COM3]
     2) Store and forward port 2                  [None]
     3) Next address translation entry
     4) Address translation entry 1, side A base  [1]
     5) Address translation entry 1, side B base  [101]
     6) Address translation entry 1, count        [3]

ESC) Back.
```

4.1.4.6 Reservoir Comfail Master [RCM]

In most applications the Multitrode Translator would be connected to a Multitrode MonitorPRO to gather the information for its database which can be as large as 1400 points. In other applications the Multitrode Translator may be connected to a Multitrode Remote Reservoir Monitor [MTRRM]. The MTRRM has different functionality and provides only its local level and 6 digital input information to the Multitrode Translator. Under special conditions described below the Slave Multitrode Translator can act as an Interim Master to two other Slave Multitrode Translator's.

When these special conditions occur the Multitrode Translator will send a DNP3 Object to the receiving Slaves. The receiving Slaves will use this DNP3 Object to populate its database (Analog Output 9) and take the action of passing this information to the MonitorPRO, thus transferring level and digital input information from one Slave device to another, i.e. peer to peer communication.

A Multitrode Translator can be designated as a "Reservoir Comfail Master" [RCM]. In this mode of operation the RCM will detect that the Master communication has broken and will automatically assume a limited role as an Interim Master. While the RCM is in the Interim Master mode it can send only one DNP3 Object to two possible remote Slaves.

Under normal conditions the RCM will act as a normal Slave but will monitor communications for messages originating from the system Master. If no such message is seen within a configurable period, it will begin to send commands to a remote Slave device until it again sees a message originating from the system Master. This works on the assumption that no communication from a Master means that it is down.

NOTE:
This may not be the case in a system using unsolicited reporting. If Slaves are periodically issuing unsolicited reports, the Master's acknowledgments will be sufficient to keep the RCM from becoming an Interim Master but this may not always be the case. In such a system it may be necessary for the Master to issue periodic requests to announce its presence (a simple link layer "link test" would be adequate). It is not uncommon for Masters in unsolicited reporting systems to issue periodic "integrity polls" to Slaves.

```
DNP Reservoir Comfail Master Configuration.


1) Act as Reservoir Comfail Master              [No]
2) System Master address                        [0]
3) Timeout before System Master is deemed down  [60]
(sec)
4) Slave 1 communications port
[Disabled]
5) Slave 1 address                              [0]
6) Update period between Slave 1 and 2          [15]
(sec)
7) Slave 2 communications port
[Disabled]
8) Slave 2 address                              [0]
9) Update period between Slave 2 and 1          [15]
(sec)


ESC) Back.
```

Configuration Menu 11 DNP3 Reservoir Comfail configuration

Act as Reservoir Comfail Master	Selects the Reservoir Comfail Master feature
System Master address	Selects the DNP3's Master's address. This is the address for which the Multitrode Translator checks, to determine if the DNP3 Master is working or not.
Timeout before System Master is deemed down	Sets the timeout in seconds before the Multitrode Translator considers the Master to be down.
Slave 1 communications port	If the Multitrode Translator detects a DNP3 Master failure then it assumes a Master role and transmits the Remote Reservoir Level to the Multitrode Translator designated via this port.
Slave 1 address	If the Multitrode Translator detects a DNP3 Master failure then it assumes a Master role and transmits the Remote Reservoir Level to the Multitrode Translator designated by this address.
Update period between Slave 1 and 2	The time set by this option is the time in seconds between updating the designated Slave Multitrode Translator 1 and the Slave 2 Multitrode Translator.
Slave 2 communications port	If the Multitrode Translator detects a DNP3 Master failure, then it assumes a Master role and transmits the Remote Reservoir Level to the Multitrode Translator via this port.
Slave 2 address	If the Multitrode Translator detects a DNP3 Master failure then it assumes a Master role and transmits the Remote Reservoir Level to the Multitrode Translator designated by this address.
Update period between Slave 2 and 1	The time set by this option is the time in seconds between updating the designated Slave Multitrode Translator 2 and the Slave 1 Multitrode Translator.

The following diagram shows how the different timeouts and update periods relate.

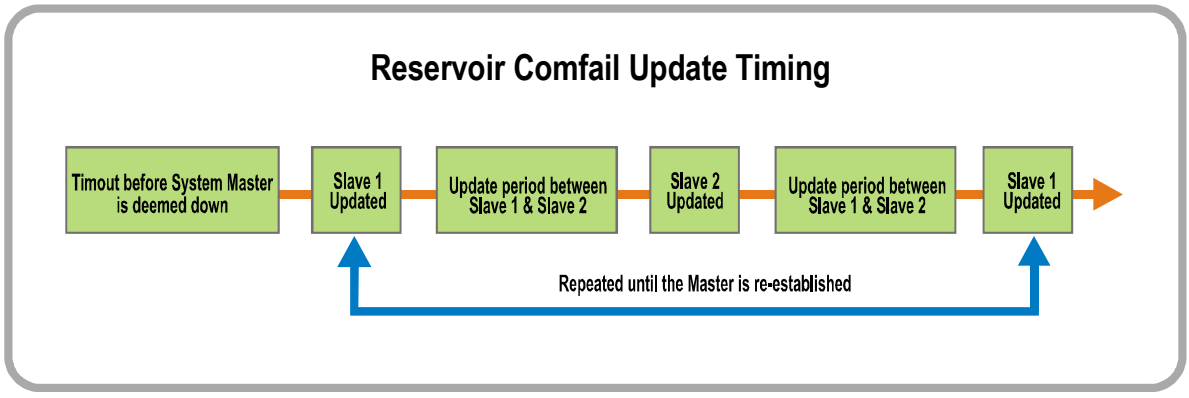

Figure 7 Reservoir Comfail Update Timing

4.1.5 MODBus Parameters Menu

This menu can be used to alter the behaviour of the MODBus database by specifying if Inputs Status should be mirrored to Input Registers to minimise point count.

```
    Modbus Database Configuration.

    1) Mirror 'Input Status' into 'Input Registers'   [No].
    2) Base Register For Mirrored Block               [312].

ESC) Back
```

Configuration Menu 12 MODBus Database Configuration

Mirror "Input Status" to "Input Registers"	This tells the Multitrode Translator that MODBus reads from a group of input registers (called the mirrored input status block) returns the input status packed into 16-bit fields.
Base Register For Mirrored Block	This specifies what the first register of the mirrored input status block should be. This allows the block to be positioned anywhere in the register space. For example, the first 16 digital inputs are packed together in a single 16-bit word. This word is then readable using normal MODBus register read commands from register 312. When this mirror functionality is selected, ALL digital inputs are mirrored to 59 registers, starting at register index selected in this option. As there are already 311 16-bit registers in use these mirrored registers should only start at a number higher than 311.

4.1.6 I/O Configuration Menu

The I/O configuration menu allows the operator to tailor the behaviour of individual input channels by cycling through them one by one and changing options that are relevant to a particular type of input. The input type and number for the current input are displayed in the menu title. Digital inputs will have options to control latching behaviour and polarity. Analog inputs have options for smoothing and scaling as well as a special option to display the current analog value in real time

4.1.6.1 Digital inputs

```
I/O Configuration. Channel 1 (Digital Input)

1) Next I/O port
2) Latched                      [No]
3) Accumulate while latched     [No]
4) Polarity                     [Normally Open]

ESC) Back.
```

Configuration Menu 13 Digital Input Configuration

Next I/O port	Selects the next input channel for configuration.
Latched	When Latched is set to “No”, the database reflects the current instantaneous value of the input. When latched is “Yes”, the database point will change to **1** when the input does and remain so even if the input goes back to **0**. To clear the database point, it must be explicitly cleared by a write or control operation (as appropriate for the configured protocol). If this is done while the input is still **1**, the database point will remain **1**. It will only go to **0** if cleared when the input is **0**. A **1** is considered a high or closed contact on the input, while a **0** is the converse.
Accumulate while latched	This setting allows the digital input to accumulate input transitions while also indicating the latched status of the input in the database. The accumulator is shown in the Holding Registers for MODBus and in the Binary Counters for DNP3.
Polarity	This allows the polarity of the input to be specified as normally open (contact closure is represented as 1 in the database) or normally closed (contact closure is represented as 0 in the database).

4.1.6.2 Analog inputs

```
I/O Configuration. Channel 7 (Analog Input)

1) Next I/O port
2) Smoothing factor                    [10]
3) Set scaled minimum                  [0x0000]
4) Set scaled maximum                  [0x7FFF]
5) Set raw minimum                     [0x00CC]
6) Set raw maximum                     [0x03FF]
7) Sample raw minimum
8) Sample raw maximum
9) Monitor this analog

ESC) Back.
```

Configuration Menu 14 Analog Input Configuration

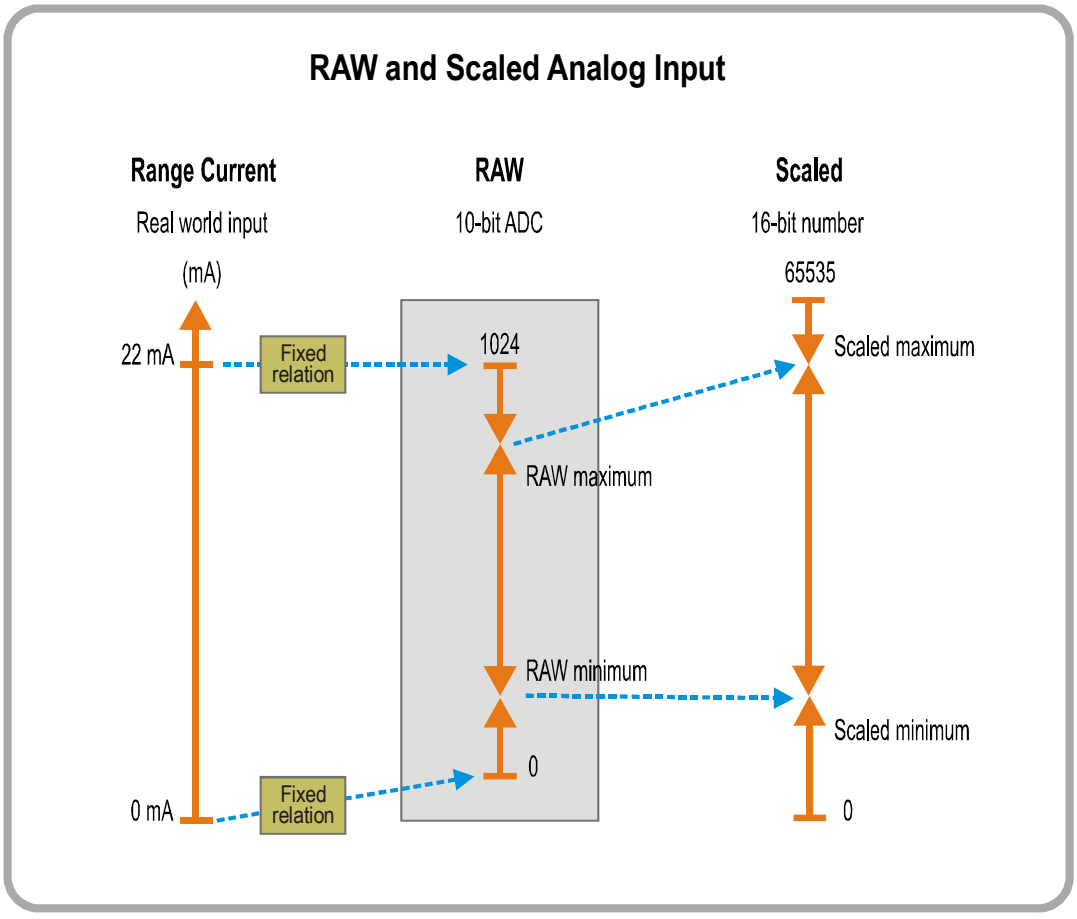

Figure 8 Representation of RAW and Scaled Analog Input

Next Input Channel	Selects the next input channel for configuration.
Smoothing Factor	This is the number of samples over which each analog channel is averaged to provide filtering.
Set Scaled Minimum	This is the minimum value that the analog should have after scaling (in a database).
Set Scaled Maximum	This is the maximum value that the analog should have after scaling (in a database).
Set Raw Minimum	This is the expected raw value of the analog when minimum range current is applied to the physical input.
Set Raw Maximum	This is the expected raw value of the analog when maximum range current is applied to the physical input.
Sample Raw Minimum	This option allows the operator to apply the minimum range current to the physical input and sample that as the raw minimum. When selected, the user will be prompted to apply the appropriate signal to the physical input and asked either to proceed or cancel the operation.
Sample Raw Maximum	This option allows the operator to apply the minimum range current to the physical input and sample that as the raw minimum. When selected, the user will be prompted to apply the appropriate signal to the physical input and asked either to proceed or cancel the operation.
Monitor This Analog	This option provides a dynamic display of the current analog as both raw and scaled values updated every 300 milliseconds. Press “ESC” to return to the I/O configuration menu.

4.1.7 Diagnostics Menu

The diagnostics menu contains a variety of tools that help in trouble shooting the system, particularly communications problems. It allows any one of the communications ports to be commandeered as a diagnostic port and enables or disables messages from various software sub-systems to be directed through this port. See the “Diagnostics” section of this document for more information.

```
Diagnostic.

1) Console port                    [Inactive]
2) Menu Auto Logout Time           [60] (sec)
3) COM task diagnostic level       [0].
4) Command queue diagnostic level  [0].
5) Show TX                         [No].
6) Show RX                         [No].
7) Erase DNP Event Logger.
8) System info.

ESC) Back
```

Configuration Menu 15 Multitrode Translator diagnostic configuration

Console port	This will cycle through each of the available communications ports to allow the operator to select which one is to be used for diagnostics. When the diagnostic port is assigned to a physical Com. port, the normal protocol functions will be disabled on that port (all other ports behave normally). An “Inactive” setting, deactivates the diagnostic port and allows all physical Com. ports to operate normally. Note that the configuration menu has precedence over the diagnostic port. This means diagnostics will not be displayed if the configuration menu is currently logged into the diagnostic port.
Menu Auto Logout Time	Normally, if there has been no activity for a while, the configuration menu will automatically log off. This prevents the unit from inadvertently being left with the configuration menu on and thus not able to respond to protocol requests in that port. As this can sometimes be annoying for an operator doing lengthy diagnostics, this option will allow the auto log off time to be extended. The operator will be logged off for the configured number of seconds after the last keystroke was received by the Multitrode Translator.
Com. Task Diagnostic Level	This allows the user to select the level (verbosity) of diagnostics generated by the communication tasks. See the “Diagnostics” section of this document for more information.
Command Queue Diagnostic Level	This allows the user to select the level (verbosity) of diagnostics generated by the command queue tasks. This is useful for observing the commands being issued to the MonitorPRO and whether they were successful or not. See the “Diagnostics” section of this document for more information.
Show TX	Enables or disables the display of all transmitted bytes (by all Com. ports) in ASCII format.
Show RX	Enables or disables the display of all received bytes (by all Com. ports) in ASCII format.
Erase DNP Event Logger	Erases the DNP event logger.
System Info	Displays stack usage information about each Com. task.

The Multitrode Translator supports several features that aid in field and/or bench diagnostics. Normally all communications ports will be running the configured protocol driver. Any port can be set up to act as a diagnostic console port, using the configuration menu. This will cause the associated protocol driver to be suspended so that diagnostic information can be printed as ASCII text from this port. Several of the sub systems have a diagnostic level that can be set to a value of 0, 1, 2 or 3 using the configuration menu.

0	Will disable all messages for that sub system
1	Will show only errors or unexpected events
2 and 3	Will show increasingly more message types

For example: to find out if communications to the MonitorPro is functioning, assign a port as the diagnostic port and set up a level 1 diagnostic on the command queue. This will show information on commands that fail in real time. To view all commands, simply increase to level 2. This will show successful commands as well as the failures.

The console port can also be configured to show the characters being received and transmitted out of all other ports as text in real time. This is very useful in identifying communication problems. There are obvious bandwidth limitations on this feature, as the diagnostic port is potentially transmitting everything being received and transmitted on all other ports in a format that is three times less efficient (1 binary character requires 2 ASCII characters and a space to show as text). The ports have reasonably large buffers allowing bursts of high activity to be handled but when this is sustained, the buffers may overflow. This is not fatal but may cause the diagnostics to become temporarily unreadable until the buffer can empty.

The “Diagnostics Menu” heading under section 4.1.7 of this document will give details on how diagnostics can be set up. It also has several options that report system status information.

Note that the configuration menu has precedence over the diagnostic functions. This means that if a port has been configured as the diagnostic port and a user is logged in to the configuration menu on that same port then no diagnostics are displayed until the menu is exited.

4.1.8 Time

When the Time option is selected the Multitrode Translator’s time can be set in Hours**:**Minutes**:**Seconds format. The Multitrode Translator is equipped with a long life battery to ensure retention of these settings after a power failure

```
Enter Time (HH:MM:SS): 12:45:00
```

4.1.9 Date

When the Date option is selected, the Multitrode Translator’s date can be set in Day**:**Month**:**Long year format. The Multitrode Translator is equipped with a long life battery to ensure retention of these settings after a power failure.

```
Enter Date (DD:MM:YYYY): 24:10:2001
```

4.1.10 Set factory defaults

When this option is selected the Multitrode Translator’s will reset all settings to the factory defaults. Confirmation of this action is required. The factory default settings are shown in the respective configuration items above.

```
Are you sure (Y/N)?
```

4.2 Transparent Mode Operation

The Multitrode Translator supports a transparent communications mode whereby any of the non-Multitrode ports can be internally connected directly to the Multitrode port allowing the character stream to pass though the unit directly to the Multitrode device. This is done by sending the string “offline” to the appropriate non-Multitrode port. It instructs the Multitrode Translator to disengage the protocol driver and pass the data stream directly to the Multitrode port. The “online” string will terminate transparent mode and restore usual protocol functionality. The “online”/“offline” strings require at least one second of silence before and after with not more than one second of delay between characters. This will prevent false triggering in the event that these bytes appear within a valid protocol packet.

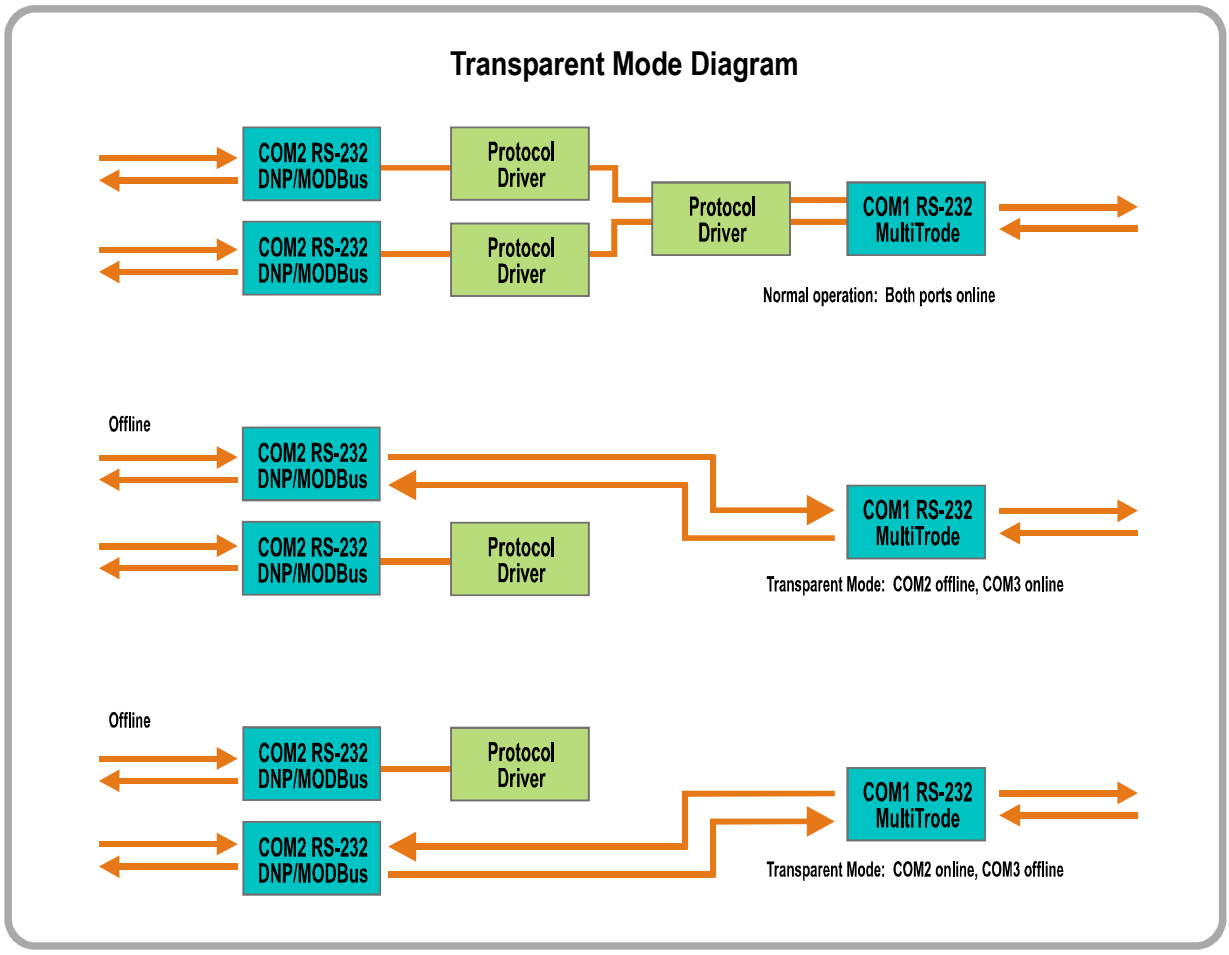

Figure 9 Transparent Mode Diagram

By default the ports will remain at their configured baud rates when transparent mode is entered. This can be overridden by specifying one or more arguments to the “offline” command. The first argument is the desired baud rate of the Multitrode port. The second is the baud rate of the port to which the off-line command has been sent. When transparent mode is terminated, baud rates are restored to the configured values. Formally, the syntax of the online/offline commands are given below:

offline [*multitrode-port-baud-rate* [,*connected-port-baud-rate*]]

online

Whenever transparent mode is activated or deactivated, the command is echoed back as a confirmation. The baud rate parameters are always sent in the confirmation even if not specified in the command and indicate the actual settings that have been applied. The confirmation of the online command also echoes the baud rates even though they cannot be set in the command. Below are some example transactions. They assume that Com. 1 (Multitrode port) is at its default value of 1200 and communications is into Com. 2 which is at its default of 9600.

Example 1	To Translator:	offline
	From Translator:	offline 1200,9600
Example 2	To Translator:	offline 19200
	From Translator:	offline 19200,9600
Example 3	To Translator:	offline 19200,19200
	From Translator:	offline 19200,19200
Example 4	To Translator:	online
	From Translator:	online 1200,9600

Transparent mode will always be inactive after a power reset.

5 Specifications

Dimensions:	118H x 45W x 135D - DIN Rail mounted
Supply:	Typically: 100mA at 12VDC. Minimum supply voltage 8V DC. Maximum supply voltage 38V DC. Supply is fused at 250mA (self-resetting fuse).
Inputs:	6 x digital: Voltage free input contacts. Cable length should not exceed 50m. ESD and EMC protected. -ve line is common ground. Maximum input frequency of 100Hz (10 milliseconds) 2 x analog: 0 to 22mA input. Input resistance 220 Ohms. 10bit ADC accuracy, linearity ±1lsb (0.025%). ADC value scaleable via configuration menu. External supply range 12 to 48VDC. ESD and EMC protected. -ve line is common ground.
Communications Ports:	2 x RS232 Asynchronous:- 9 pin male D type connector with TD, RD, RTS, CTS, DTR and DSR.
Modem:	1 x Radio port to Bell 202, FSK - 1200 baud(fixed) Audio output: adjustable via trimpot to 400mVp-p Audio input sensitivity: 10-500mVp-p Squelch input: 5-30VDC common ground Press To Talk (PTT): Open drain 200mA at 40VDC
Indicators:	9 status LEDS
EMC: C-Tick and CE compliant	AS/NZS3548 (C-Tick) CISPR 24:1997; EN55024:1998 EN61000-4-2:1995, Including Amendment A1 EN61000-4-3:1995, Including Amendment 1:1998 EN61000-4-4:1995. IEC61000-4-5:1995. IEC61000-4-6:1995, Including Amendment A1 IEC61000-4-8:1993 IEC61000-4-11:1994.
Environmental:	Temperature -10°C to 60°C Humidity 0 to 95% non- condensing

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