Newflow

P572 RMU

Software & Configuration Manual

Contact:

Newflow Ltd
George House
Derwent Road
Malton, North Yorkshire
YO17 6YB, UK

Tel: +44 1653 697 200
Fax: +44 8700 667 325
Email: sales@newflow.co.uk

Document Information

Document Name: P572 RMU - Software & Configuration Manual

Document Identifier NF_P572RMU_SCM

Rev	Date	Changes	Prepared	Checked	Authorized
0	15 Nov 2019	Original release	MOB	DGS	MOB
1	10 Dec 2019	Corrected Modbus Map & added Alarm Relay screenshot	MOB	DGS	MOB
2	17 Jun 2020	Added Brooks mode, improved diagnostics	MOB	MPFJ/GPL	MOB
3	27 Aug 2020	Added ability to prove using the B-Pulse Channel, and Modbus Serial gateway activated	MOB	MPFJ	TDB
4.1	22 Jul 2021	Added BiDi 4-way valve control and typo errors corrected	MOB	DGS	MOB

All trademarks are acknowledged as the property of their respective owners.

TESTit & PROVEit are trademarks of Quorum Business Solutions, Inc. (Flow-Cal, Inc)

This document, submitted in confidence, contains proprietary information which shall not be reproduced or transferred to others without prior written permission of Newflow Ltd.

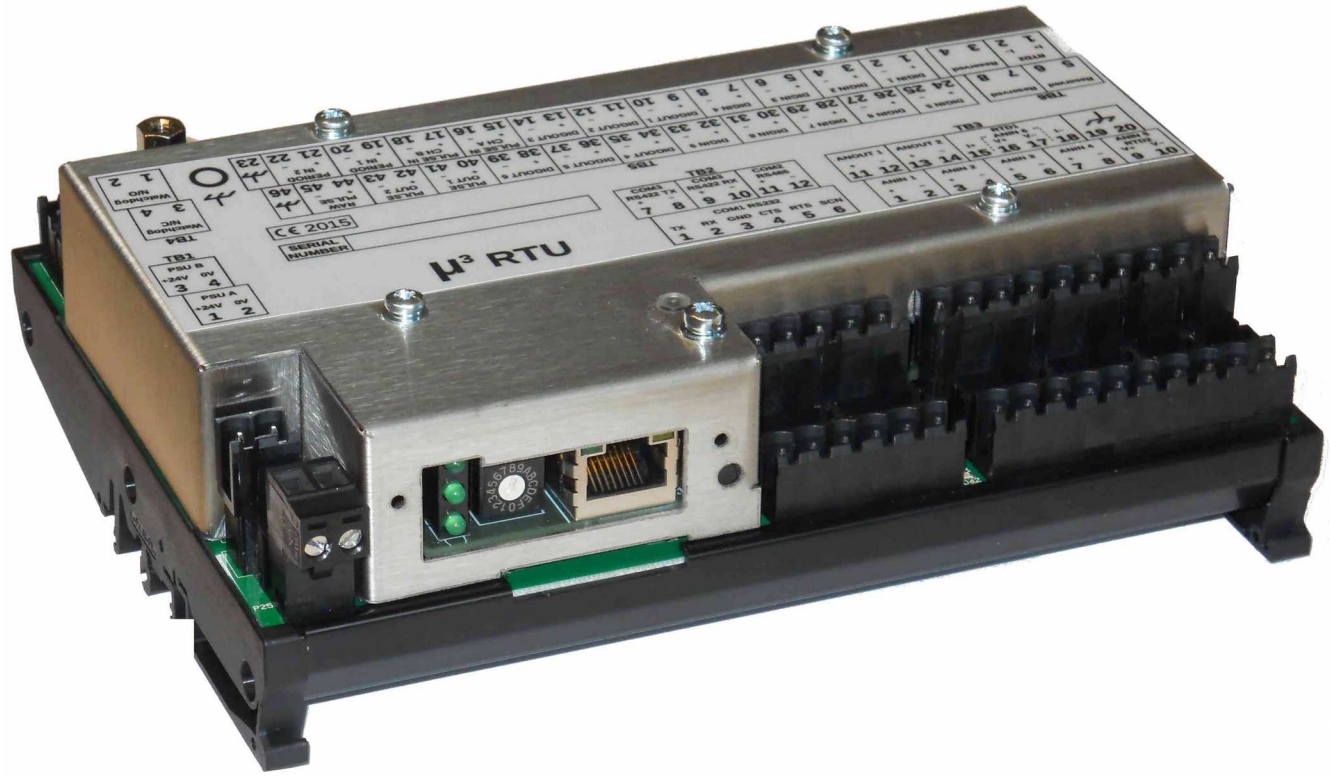
This document shall not form part of any contract. Specifications are subject to change without notice and Newflow Ltd accepts no liability of any kind for errors or omissions.

© Newflow Ltd 2021

Full contractual terms are available on the website at www.newflow.co.uk/pdf/tandc.pdf

MMXXI

Front View of RMU



Web Browser View

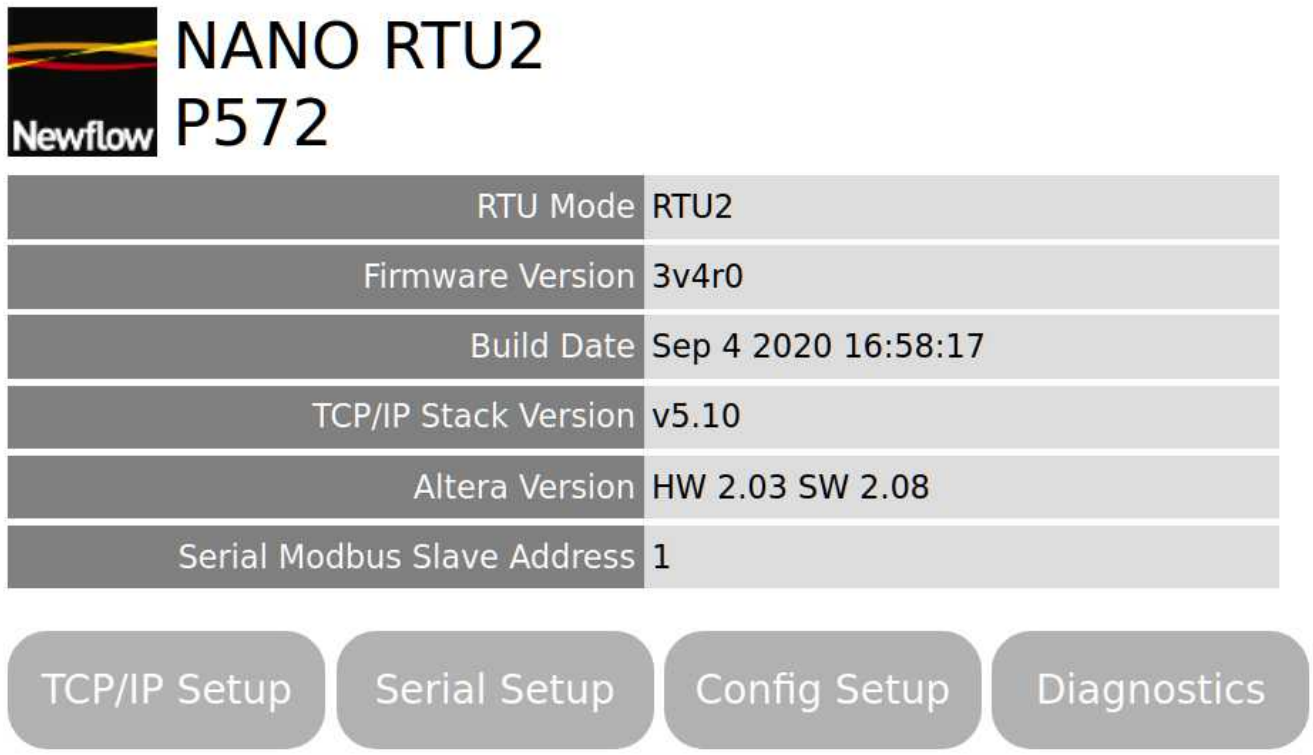


Table of Contents

1 Introduction

1.1 Operating Modes

The RMU has two distinct modes of operation, which are set using the front panel rotary switch. These modes are PIU mode and Standard RTU Mode.

PIU mode is designed to operate as an interface to the Quorum (previously Flowcal) TESTit & PROVEit validation packages and provides a compatible RS232 serial interface from COM1.

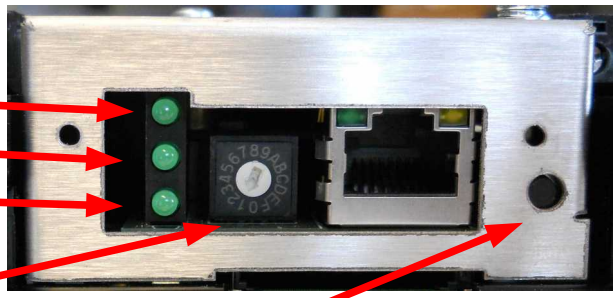
The Standard RTU mode does not support PIU communications mode but provides a high performance, high accuracy RTU to allow PCs and PLCs to operate as a virtual flow computer or other demanding data acquisition tasks. Standard RTU mode supports serial Modbus RTU, on both the RS422 and RS485 ports, as well as Modbus TCP using the Ethernet connection.

To future-proof communications, ideally the XML communications over Ethernet should be utilized, as this is a much more powerful & intuitive communications method, and eliminates all the inconsistencies and numerous incompatible data formats that have been built into Modbus due to the lack of control over the so called "standard". Contact the factory for more information.

In both PIU and Standard RTU mode, the website can be accessed for debug and commissioning purposes, using Ethernet TCP/IP communications, although the facilities and options available are reduced in PIU mode.

1.2 The Front Panel

The Front Aperture



The top LED is LED1

The middle one is LED2

The lowest one is LED3

The Rotary Switch SW1 is used to select the operating mode, explained below.

To the right of the rotary switch is an Ethernet port and the larger hole to the right of the Ethernet port is a reset button, recessed to stop accidental pressing of the reset switch.

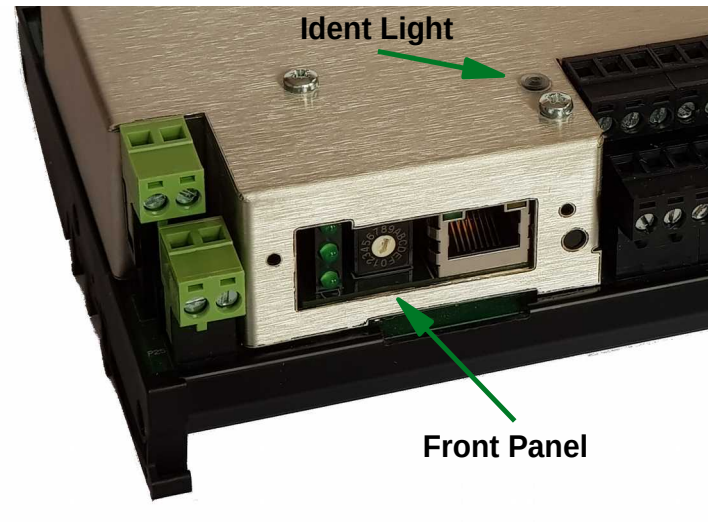
1.3 Additional Indicators on the RMU

There are four other LEDs on the hardware that can be used to inform the operator.

There is a blue power LED adjacent to terminal block TB4, the Alarm Relay terminals.

There are a pair of red and green LEDs adjacent to TB6 which blink to show the I/O Processor communications are established.

On the lid of the enclosure, above the recessed reset switch is a bi-color indicator, called the Ident Light, as shown in the photograph below.



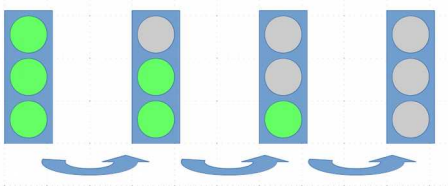
1.3.1 The Ident Light

The Ident Light is used to indicate the running status of the RMU.

A 1Hz flashing green light indicates the machine is healthy, heartbeats are received from the I/O processor and data is exchanged correctly.

A 1Hz flashing red light indicates the I/O processor communications has been lost. After a retry, the RMU will reset the I/O processor.

A 5Hz flashing amber light indicates that the "Strobe Ident Light" signal has been either received from MicroConf, or the operator has forced the RMU to announce itself to MicroConf. See Section 10. MicroConf - Network Discovery & Configuration Tool for more information.



1.4 Start up

When power is applied, the blue power LED adjacent to terminal block TB4 will come on and stay on. The Ident Light will flash amber once then operate as shown above and the Front LED stack will cycle as shown on the right hand side.

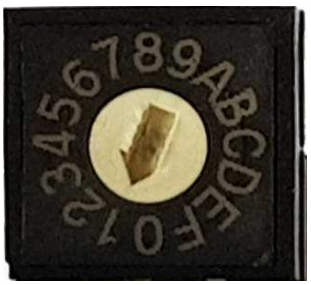
1.5 Setting the Operating Mode

Setting the operating mode may be a two-step process, depending upon the mode and the secondary options needed. There are NO secondary options in PIU mode.

1.6 Configuration Modes

The initial configuration modes are selected by setting the rotary switch SW1 into one of the reserved positions shown in Table 1 below.

Setting the rotary switch SW1 to position 0, and power cycling or resetting the unit, will start the unit in PIU Mode, with 6 Current Inputs and NO Voltage Inputs.



NOTE: Rotary Switch SW1 position 0 is pointing downwards.
Move the switch clockwise to increase the position number.

In the photograph on the right hand side, SW1 is in position 1.

SW1 Position	Operating Mode
0	PIU Mode with 6 Current Inputs & 0 Voltage Inputs
F (15)	PIU Mode with 5 Current Inputs & 1 Voltage Input
E (14)	PIU Mode with 4 Current Inputs & 2 Voltage Inputs
D (13)	RTU Mode, Web Configuration read only, Modbus Slave Address 1
C (12)	RTU Mode, Full Web Configuration, Modbus Slave Address 1
B (11)	Reserved for factory use
A (10)	Reserved for future use
9	RTU Mode, Modbus Slave Address 9
8	RTU Mode, Modbus Slave Address 8
7	RTU Mode, Modbus Slave Address 7
6	RTU Mode, Modbus Slave Address 6
5	RTU Mode, Modbus Slave Address 5
4	RTU Mode, Modbus Slave Address 4
3	RTU Mode, Modbus Slave Address 3
2	RTU Mode, Modbus Slave Address 2
1	RTU Mode, Modbus Slave Address 1

Table 1: Reserved Switch Positions

Rotary switch SW1 positions 1 through 9 are reserved as serial Modbus RTU Slave addresses. In addition, positions C & D are also RTU mode only and are not applicable to PIU Mode.

To set the unit in standard RTU mode for Modbus and XML communications,
see Section 6. Introduction to RTU Mode.

2 Configuration with SW1 set to 0 (PIU Mode 6/0)

PIU mode with six current inputs & no voltage inputs.

Powering up (or resetting) the RMU with the SW1 set to position 0 enables PIU mode.

The RMU has six Analogs inputs that can be jumper selected to be either Current (4-20mA) or Voltage (1-5V) mode but only six of the eight PROVEit analog inputs can be used at the same time.

The first four Analog Input channels (AnIn01, AnIn02, AnIn03 and AnIn04) are always used as Current (4-20mA) inputs in PIU mode but AnIn05 and AnIn06 can be used as Current or Voltage mode.

How the Analog inputs are mapped into PROVEit depends upon the rotary switch selection.

With SW1 in position 0, there are six current inputs and zero voltage inputs.

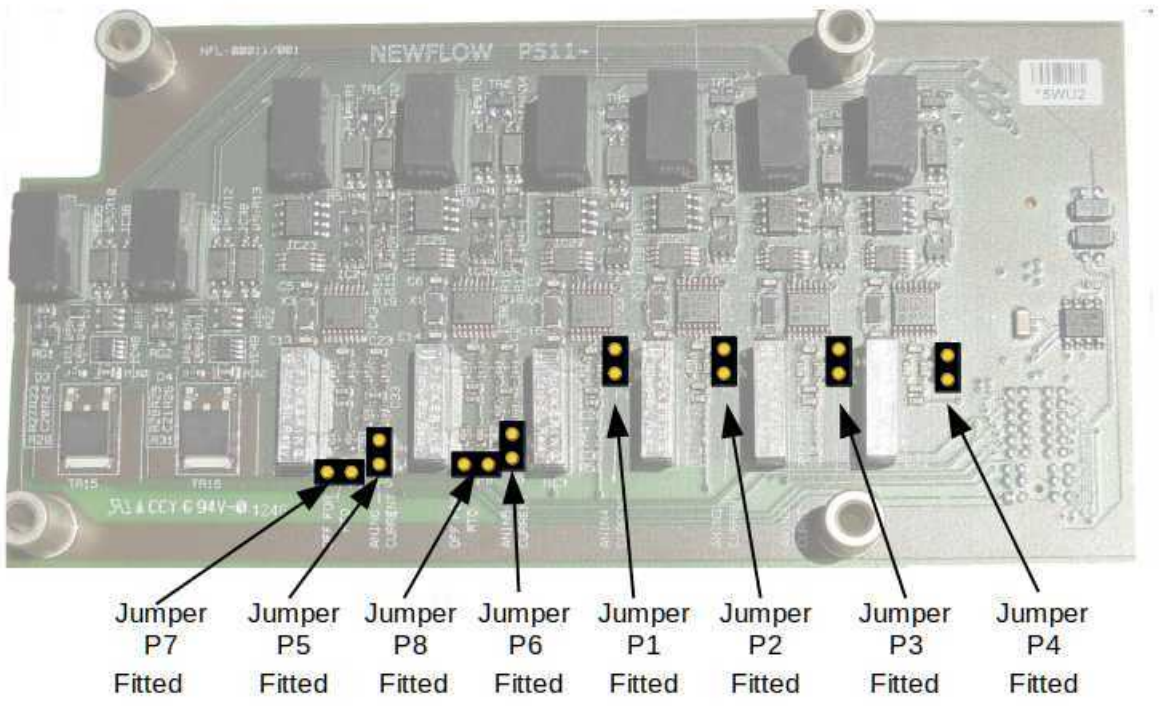
If one voltage input is required, SW1 should be set to position F(15) and the unit power cycled or reset. See Section 3. Configuration with SW1 set to F/15 (PIU Mode 5/1).

If two voltage inputs are required SW1 should be set to position E(14) and the unit power cycled or reset. See Section 4. Configuration with SW1 set to E/14 (PIU Mode 4/2).

Assuming SW1 is left in position 0, then the RMU Analog channels are mapped as shown in the table on the following page.

Analog Input	TB3 pins	PROVEit Function	Comment
AnIn01	1 & 2	Channel 0 (mA)	Jumper P4 must be fitted on the P511 analog board
AnIn02	3 & 4	Channel 1 (mA)	Jumper P3 must be fitted on the P511 analog board
AnIn03	5 & 6	Channel 2 (mA)	Jumper P2 must be fitted on the P511 analog board
AnIn04	7 & 8	Channel 3 (mA)	Jumper P1 must be fitted on the P511 analog board
AnIn05	9 & 10	Channel 4 (mA)	Jumpers P6 & P8 must be fitted on the P511 analog board
AnIn06	16 & 17	Channel 5 (mA)	Jumpers P5 & P7 must be fitted on the P511 analog board
		Channel 6 (V)	This input should not be allocated in PROVEit when in this mode
		Channel 7 (V)	This input should not be allocated in PROVEit when in this mode

In PIU Mode 6/0, ALL jumpers on the P511 Analog board should fitted as shown in the image below.



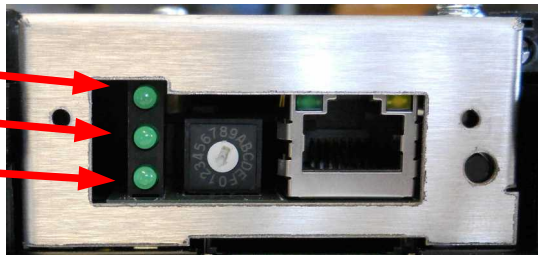
2.0.1 LED usage when operating in PIU Mode

The Front Aperture

LED1 shows a Launch Piston Request

LED2 shows a Return Piston Request

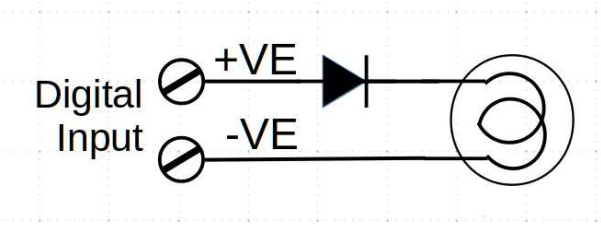
LED3 indicates Volume Timer active



2.1 PIU Mode Digital Inputs

The RMU digital inputs are all individually isolated inputs. Each digital input can be considered as a light bulb with series diode. The voltage must be applied in the right polarity but, because they are all individually isolated, the installer has freedom to connect them in a number of ways.

2.1.1 Digital Input Representation



A digital input is active when a voltage of the correct polarity is connected between the two input connections and the "light bulb" is illuminated.

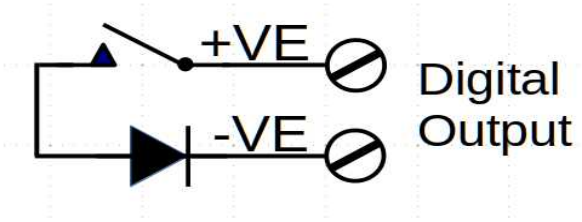
In PIU mode, the use of the Digital Inputs has been allocated as shown in the table below.

Digital Input	TB5 pins +ve & -ve	PROVEit Function
DIGIN01	1 & 2	Reset Forward (resets alternative Forward/Reverse outputs). This information is not transmitted to PROVEit.
DIGIN02	3 & 4	Fwd Endstop. If the BiDi Prover 4-way has a switch to indicate the valve has completed its forward travel, it can be connected here.
DIGIN03	5 & 6	Rev Endstop. If the BiDi Prover 4-way has a switch to indicate the valve has completed its reverse travel, it can be connected here.
DIGIN04	7 & 8	Not currently used in PIU mode
DIGIN05	24 & 25	Fault Detect. The state of this input is transmitted directly to PROVEit.
DIGIN06	26 & 27	Leak Detect. The state of this input is transmitted directly to PROVEit.
DIGIN07	28 & 29	Prover Ready. The state of this input is transmitted directly to PROVEit.
DIGIN08	30 & 31	When DIGIN08 is LO, PULSEIN CH A is used as the Meter pulse source for SVP. When DIGIN08 is HI, PULSEIN CH B is used.
DIGIN09	32 & 33	Detector Switch (Volume_Pulse). The detector switch input is used to trigger the various internal counters and drives the prover sequence along.

2.2 PIU Mode Digital Outputs

The RMU digital outputs are all individually isolated. Each digital output can be considered as the contacts of a relay with series diode. The voltage must be applied in the right polarity. As all the outputs are individually isolated, the installer has freedom to connect them in a number of ways.

2.2.1 Digital Output Representation



When the digital output is OPEN no current will flow from the +ve to the -ve terminals. When the contacts are CLOSED, current will flow, as long as the correct polarity is observed.

In PIU mode, the use of the Digital Outputs has been allocated as shown in the table below.

Digital Output	TB5 pins +ve & -ve	ProveIt Function
DIGOUT01	9 & 10	Launch (500ms duration pulse). This output is triggered directly by PROVEit.
DIGOUT02	11 & 12	Forward (Fwd) Command The Forward Command and Reverse Command outputs are triggered alternatively by the PROVEit Launch request. These are intended for use with bi-directional provers. The Fwd & Rev Command signals stay active until either the associated Endstop input signal is detected or the Prover FWD/REV Timeout is exceeded
DIGOUT03	13 & 14	Reverse (Rev) Command See DIGOUT02 above.
DIGOUT04	34 & 35	Launch (Spare). This is a duplicate of DIGOUT06.
DIGOUT05	36 & 37	Return Piston (500ms duration). This output is triggered directly by PROVEit.
DIGOUT06	38 & 39	Latched Launch This output is triggered by PROVEit Launch request and remains active until the return piston command received from PROVEit. Use this signal with the Brooks prover.

2.3 PIU Mode Pulse Inputs

Pulse Input	TB5 pins +ve & -ve	ProveIt Function
PULSEIN CHA	15 & 16	CH A Frequency Input
PULSEIN CHB	17 & 18	CH B Frequency Input
PERIODIN01	19 & 20	CH C Period Input

2.4 PIU Mode Serial Port

Serial Port Pin Name	TB3 Pin Number
COM1 RS232 TXOUT	1
COM1 RS232 RXIN	2
COM1 RS232 GND	3

Serial Port Configuration	Value
Media	RS232
Baud Rate	9600
Number of Data Bits	8
Parity Bits	None
Number of Stop Bits	1
Handshaking	None

NOTE: The RS232 Port COM1 is NOT accessible in standard RTU Mode.

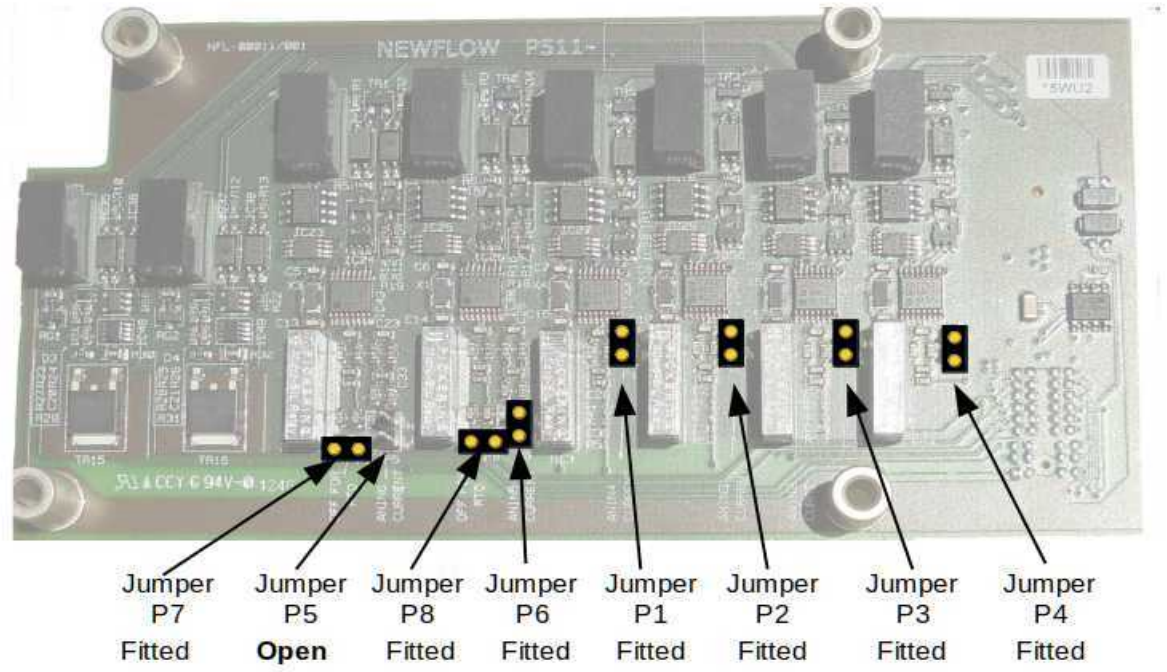
3 Configuration with SW1 set to F/15 (PIU Mode 5/1)

PIU mode with five current inputs & one voltage input.

To set this mode, set the rotary switch SW1 to position F (15) and power cycle or reset the unit.

Analog Input	TB3 pins	PROVEit Function	Comment
AnIn01	1 & 2	Channel 0 (mA)	Jumper P4 must be fitted on the P511 analog board
AnIn02	3 & 4	Channel 1 (mA)	Jumper P3 must be fitted on the P511 analog board
AnIn03	5 & 6	Channel 2 (mA)	Jumper P2 must be fitted on the P511 analog board
AnIn04	7 & 8	Channel 3 (mA)	Jumper P1 must be fitted on the P511 analog board
AnIn05	9 & 10	Channel 4 (mA)	Jumpers P6 & P8 must be fitted on the P511 analog board
		Channel 5 (mA)	This input must not be allocated in PROVEit when in this mode
		Channel 6 (V)	This input must not be allocated in PROVEit when in this mode
AnIn06	16 & 17	Channel 7 (V)	Jumper P5 must be removed and jumper P7 must be fitted on the P511 analog board

NOTE: All other I/O settings (Digital Inputs, Digital Outputs, Pulse Inputs and the Serial Port) are exactly the same as in PIU Mode 6/0.



In PIU Mode 5/1, all jumpers except for P5 should be fitted.

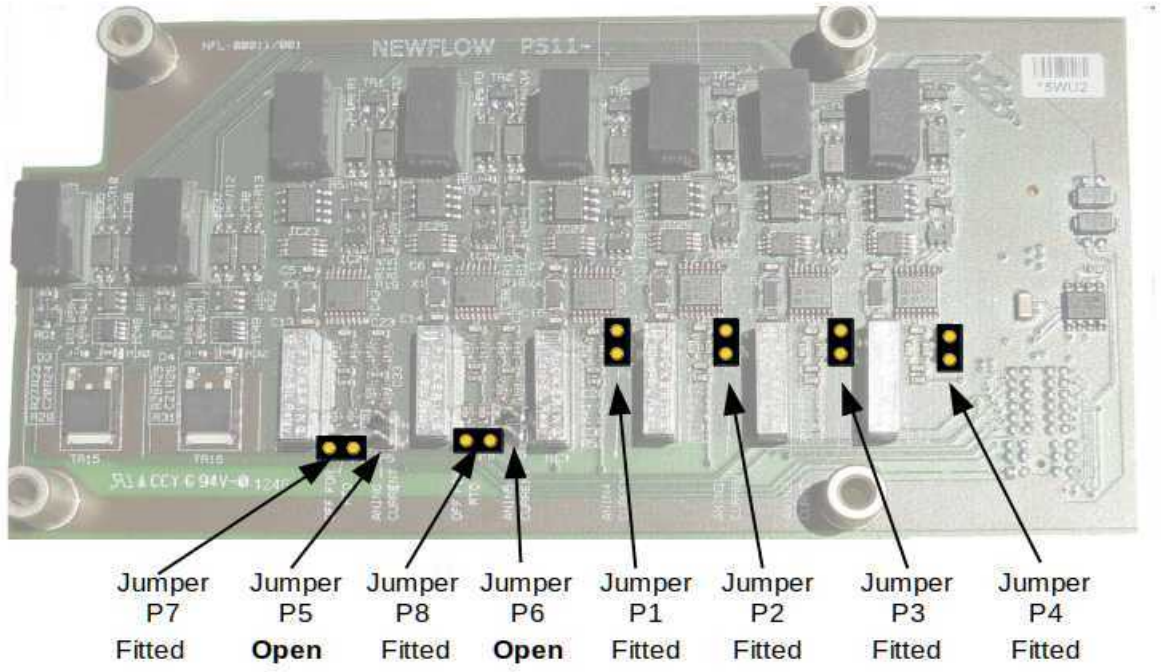
4 Configuration with SW1 set to E/14 (PIU Mode 4/2)

PIU mode with four current inputs & two voltage input.

To set this mode, set the rotary switch SW1 to position E (14) and power cycle or reset the unit.

Analog Input	TB3 pins	PROVEit Function	Comment
AnIn01	1 & 2	Channel 0 (mA)	Jumper P4 must be fitted on the P511 analog board
AnIn02	3 & 4	Channel 1 (mA)	Jumper P3 must be fitted on the P511 analog board
AnIn03	5 & 6	Channel 2 (mA)	Jumper P2 must be fitted on the P511 analog board
AnIn04	7 & 8	Channel 3 (mA)	Jumper P1 must be fitted on the P511 analog board
		Channel 4 (mA)	This input must not be allocated in PROVEit when in this mode
		Channel 5 (mA)	This input must not be allocated in PROVEit when in this mode
AnIn05	9 & 10	Channel 6 (V)	Jumper P6 must be removed and jumper P8 must be fitted on the P511 analog board
AnIn06	16 & 17	Channel 7 (V)	Jumper P5 must be removed and jumper P7 must be fitted on the P511 analog board

NOTE: All other I/O settings (Digital Inputs, Digital Outputs, Pulse Inputs and the serial Port) are exactly the same as in PIU Mode 6/0.



In PIU Mode 4/2, all jumpers except for P5 and P6 must be fitted.

5 PIU Mode Ethernet

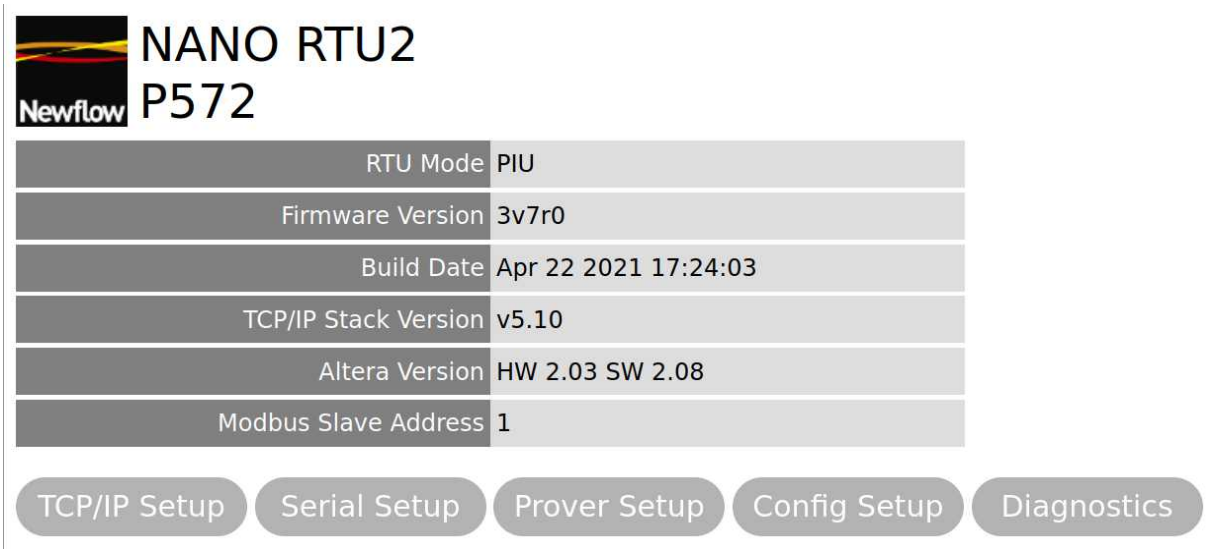
Currently in PIU mode, Ethernet communications cannot be used by PROVEit or TESTit to acquire the prover data, however the built-in web-server can be accessed over Ethernet and this gives access to additional configuration tools and diagnostic aids.

The Ethernet port is set to use DHCP configuration by default. However, if no DHCP server is located, a fall back address of 10.255.255.255, with a netmask of 255.255.255.0 will be set.

NOTE: To speed up the internal DHCP timeout, briefly unplug and reconnect the Ethernet when using a direct laptop to RMU connection. A crossed cable is not required.

Ideally, the RMU Ethernet port should also be configured using the MicroConf zero-configuration tool, a license free discovery tool available from your vendor. To configure your RMU using MicroConf, see Section 10. MicroConf - Network Discovery & Configuration Tool.

If you start a web browser (Firefox, Chrome and Safari are all recommended) and type in the address of the RMU or click the "Start Web Interface" option in MicroConf, the home page will be displayed. This is shown in the screenshot directly below.



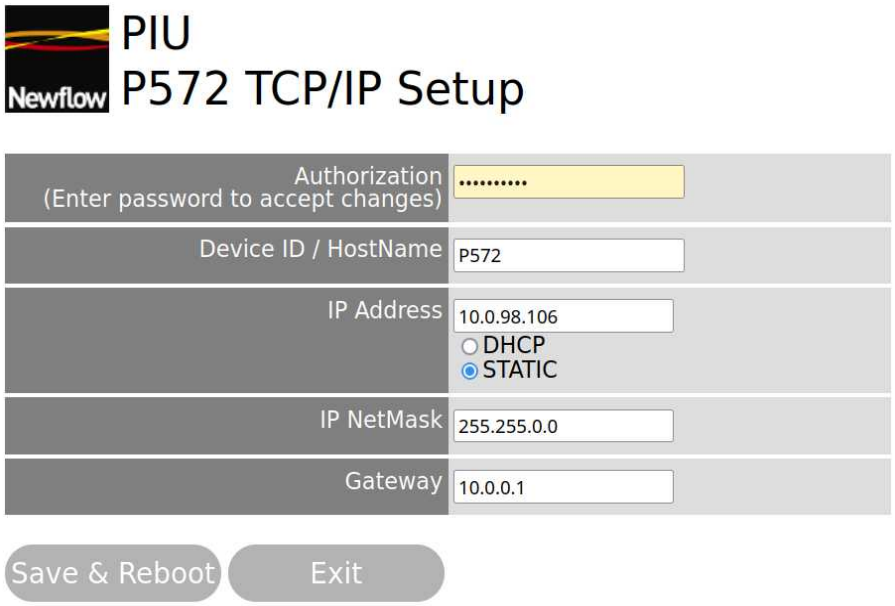
- The top line shows the logo, Product Name and Product Number
- The next five lines are read-only system information, explained in the table below.

RTU Mode	This line indicates if the RMU is in PIU or RTU mode.
Firmware Version	This is the version of firmware in the P572.
Build Date	Compilation date of the P572 firmware.
TCP/IP Stack Version	Version number of the TCP/IP stack used by the P572 firmware.
Altera Version	This field indicates both the Gate Array Hardware design and the NIOS code running in the NÅNO I/O Processor.
Modbus Slave Address	This information is not relevant in PIU mode.

Below the five lines of information there are five buttons:
TCP/IP Setup, Serial Setup, Prover Setup, Config Setup and Diagnostics.

5.1 PIU Mode - TCP/IP Setup

The screenshot directly below shows the web browser view after clicking the TCP/IP Setup button.



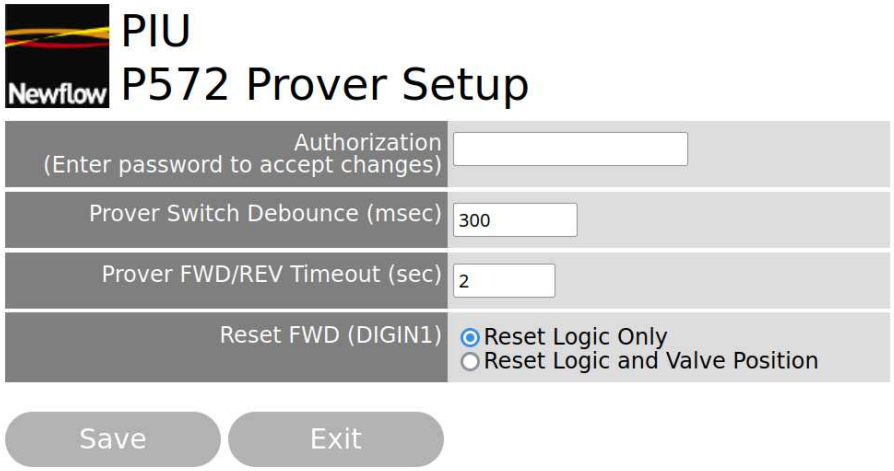
Authorization ***(Enter password to accept changes)***	To be able to change the default Ethernet TCP/IP settings, the password must be entered. Please contact your sales representative for the password.
Device ID / HostName	This field defaults to P572 but can be changed to help identify multiple devices when utilizing MicroConf. Whatever is entered into this field will be shown in the Device ID field of MicroConf.
IP Address	There is a field to enter the IP addresses in IPv4 quad-dotted decimal representation. This address is only used if the radio button has selected STATIC address assignment. If DHCP has been selected, the address will have been allocated by the DHCP server.
IP NetMask	The Netmask must be entered in IPv4 quad-dotted decimal representation, like an IP address.
Gateway	The Gateway address must be entered in IPv4 quad-dotted decimal representation.
Save & Reboot	Clicking the large "Save & Reboot" button will apply the changes made and force a reboot, but ONLY if the password entered is correct. If an incorrect password has been entered, the user will be taken back to the home screen and NO changes will have been made.

5.2 PIU Mode - Serial Setup

In PIU mode, the serial communications are preset to match the default settings for PROVEit and cannot be altered.

5.3 PIU Mode - Prover Setup

The screenshot directly below shows the web browser view after clicking the Prover Setup button.



The text adjacent to the logo shows that the RMU is in PIU mode and you are viewing the Prover Setup

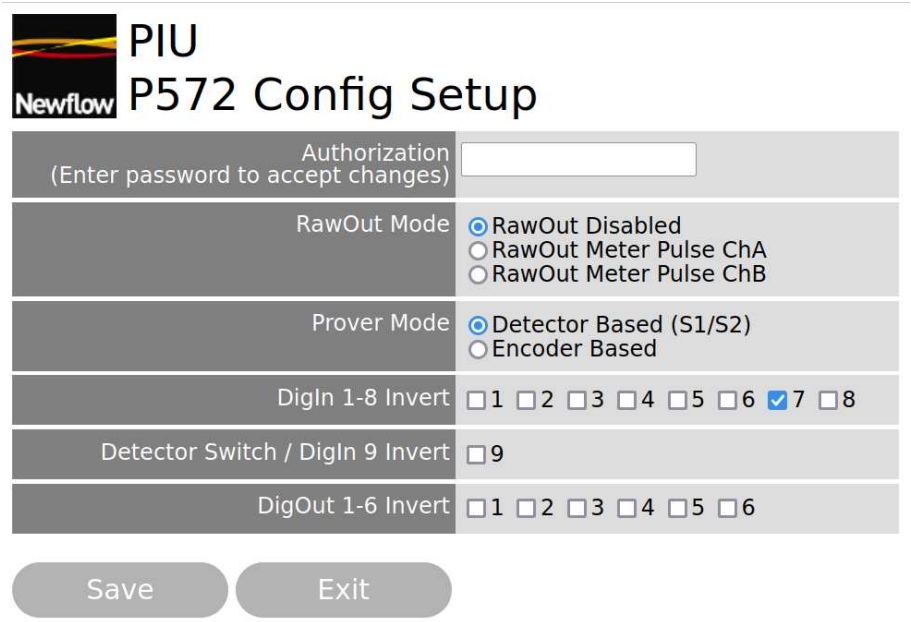
The various fields are described on the page below.

Authorization ***(Enter password to accept changes)***	To be able to change the Prover Setup configuration, the password must be entered. Please contact your sales representative for the password Unless the correct password is entered, any changes made will NOT be saved when the large "Save" button is pressed.
Prover Switch Debounce (msec)	The prover switch debounce time is the dead time following one switch activation, before a second switch will be recognized. For a small volume prover, the default figure of 300 msec (milliseconds) should be adequate, however for a ball prover, this figure can be significantly extended. The time must however be less than the expected minimum time between the sphere switches (detector switches).

Prover FWD/REV Timeout (sec)	In BiDi prover operation, 4-way valve control is provided by the RMU. The Fwd (Forward) Command and Rev (Reverse) Command on Digital Outputs 2 & 3 are intended to control the relays that drive the 4-way valve in the forward and reverse direction. The Fwd or Rev Command Digital Output becomes active when commanded by PROVEit and the output becomes inactive when the timeout expires or associated Endstop Digital Input is activated. If there are no Endstop signals provided from the 4-way valve, then the timeout value sets the pulse width of the Fwd and Rev Command Digital Outputs. If Endstop signals are provided, then the timeout must be set to be longer than the longest expected time to swing the valve, and can be used to protect the motor from continuous operation in the event that an Endstop input signal is not detected due to a fault. In addition, the polarity of the Command Signals and the Endstop signals can be programmed in the Config Setup menu page. The RMU issues a Fwd command on the first prove request following a power on, then alternates between Rev and Fwd.
Reset FWD (DIGIN1)	Should the need arise to reset the alternating Fwd and Rev sequence for what ever reason, setting the Fwd Reset input active for 500 msec minimum will reset the logic and ensure that the next prover cycle will activate the Fwd Command Digital Output. If the Reset Logic and Valve Position radio button has been selected, making the Fwd Reset digital Input active will reset the RMU logic and set the 4-way valve position to its reverse position.
Save	Clicking the large "Save" button will apply the changes made but ONLY if the password entered is correct. If the incorrect password has been entered, the user will be taken back to the home screen and NO changes will have been made.
Exit	Clicking the large "Exit" button will cancel any changes made

5.4 PIU Mode - Config Setup

The screenshot directly below shows the web browser view after clicking the Config Setup button.



The text adjacent to the logo shows that the RMU is in PIU mode and viewing the Config Setup.

The various fields are described on the page below.

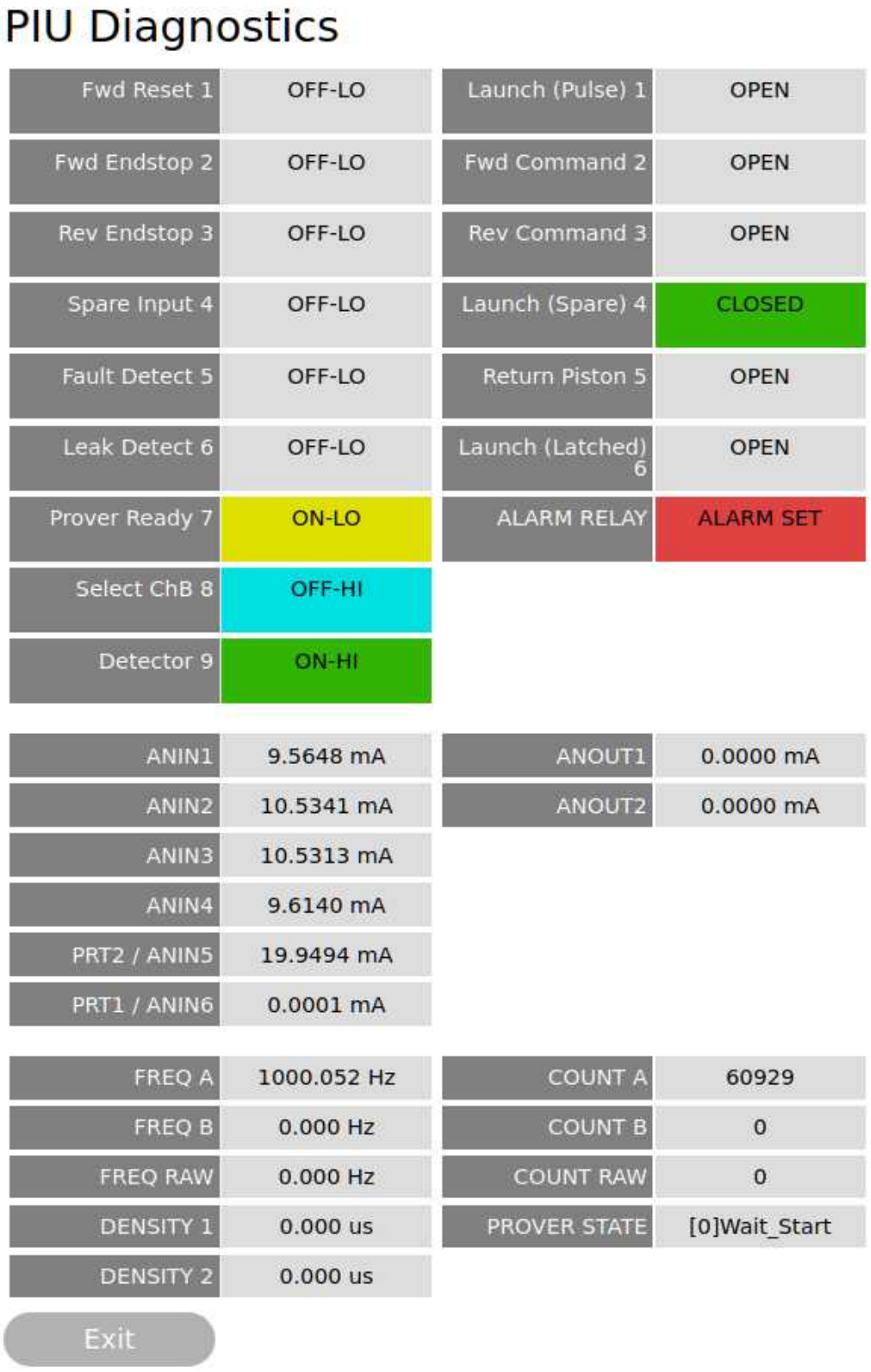
Authorization ***(Enter password to accept changes)***	To be able to change the Input & Output settings, the password must be entered. Please contact your sales representative for the password Unless the correct password is entered, any changes made will NOT be saved when the large "Save" button is pressed.
RawOut Mode	If RawOut Disabled is selected, the incoming Raw Pulse Bus Input frequency and Pulse Count (Modulo 65536) will be displayed on the diagnostic page. If the RawOut Meter Pulse ChA mode is selected, the Raw Pulse Bus will be set in output mode, and an identical copy of the pulse coming in on the Flow Meter Pulse Input Channel A will be driven Out. If the RawOut Meter Pulse ChB mode is selected, Flow Meter Pulse Input Channel B will be driven Out. **NOTE:** The changes are NOT applied dynamically but only when the correct password has been entered and the Save button clicked.
Prover Mode	There are two options selected by radio buttons. The default Detector Based (S1/S2) is used for switch based proving. The Encoder Based proving requires a high resolution linear encoder. If this mode is selected, the Prover Setup menu is also modified. Please contact your Sales Representative for more information on encoder based proving.
DigIn 1-8 Invert	There are eight tick boxes, with the associated Digital Input number to the right of each tick box. Clicking a tick box puts a tick into the box, and this indicates that the digital input for that particular channel will be inverted, assuming the correct

	password is entered, and the "Save" button clicked. Clicking a tick box multiple times, toggles the tick indication.
Detector Switch / DigIn 9 Invert	The Detector Switch / DigIn 9 Invert is similar to the invert function for Digital Inputs 1 to 8 but as well as inverting the read-back value, it also sets the prover to use the falling edge of the Detector Switch (sphere) input rather than the rising edge.
DigOut 1-6 Invert	There are six tick boxes, with the associated Digital Output number to the right of each tick box. Clicking a tick box puts a tick into the box, and this indicates that the digital output for that particular channel will be inverted, assuming the correct password is entered, and the "Save" button clicked. Clicking a tick box multiple times, toggles the tick indication.
Save	Clicking the large "Save" button will apply the changes made but ONLY if the password entered is correct. If the incorrect password has been entered, the user will be taken back to the home screen and NO changes will have been made.
Exit	Clicking the large "Exit" button will cancel any changes made

5.5 PIU Mode - Diagnostic Screen

The screenshot directly below shows the web browser view after clicking the diagnostic screen button. This is entirely read-only, for information, so there is no Save button at the bottom of the screen.

The left hand side of the screen shows the inputs and the top half of the right hand side are the outputs. The lower RHS is additional Input/Prover info.



5.5.1 PIU Mode - Diagnostic Screen, Field Inputs

DIGIN1-8 and Detector/ DIGIN9	The Digital Inputs are “hard coded” in PIU mode, and their function name is added to the description. These nine fields display two pieces of information for each digital input. The first word OFF or ON shows the electrical levels going into the digital input circuit, and indicates if the "light bulb" is turned on or off. The second word LO or HI shows the input logic state following the DigIn invert function described in the Section 5.2. PIU Mode - Config Setup. If LO, then the signal is not active. This could be because the "light bulb" is turned OFF and there is no inversion selected, as DIGIN6 on the screenshot on the previous page, and the background is shown as gray. The alternative is that the "light bulb" is turned ON and inversion has been selected, as shown for DIGIN7, with the yellow background. If HI, then the signal is active. This could be because the "light bulb" is turned ON and there is no inversion selected, as DIGIN9 on the screenshot on the previous page, and the background is shown as green. The alternative is that the "light bulb" is turned OFF and inversion has been selected, as shown for DIGIN8, with the cyan background.
ANIN1-4	In PIU Mode, these four fields show the current being driven into Analog Inputs 1 to 4. The units will always show milliamps (mA). In RTU mode, these channels can be selected to be either 4-20mA or 1-5V Mode, but note the P511 jumpers must ALSO be set to current or voltage mode.
PRT2/ANIN5 PRT1/ANIN6	In PIU Mode, these two fields show the current or voltage being driven into Analog Inputs 5 and 6. If PIU Mode 6/0 (SW1 = 0) is selected, both these fields will show the units as milliamps (mA). PIU Mode 5/1 (SW1 = F/15) is selected, ANIN5 will show the unit as milliamps (mA) and ANIN6 will show the units as volts (V). PIU Mode 4/2 (SW1 = E/14) is selected, both these fields will show the units as volts (V). In RTU mode, these these channels can be selected to be 4-20mA, 1-5V or 4-wire RTD Mode but note the P511 jumpers must ALSO be set to current, voltage or RTD mode. In RTD mode, the reading is the resistance in Ohms (Ω).
FREQA-B	These two fields show the frequency of the Flow Meter Pulse Inputs channel A & B in Hertz (Hz) to 3 decimal places.
FREQ RAW	This field will show the frequency of the Raw Pulse Bus, Rawin in Hertz (Hz) to 3 decimal places.
DENSITY1-2	These two fields show the period of the Density Meter Inputs in microseconds (µs).

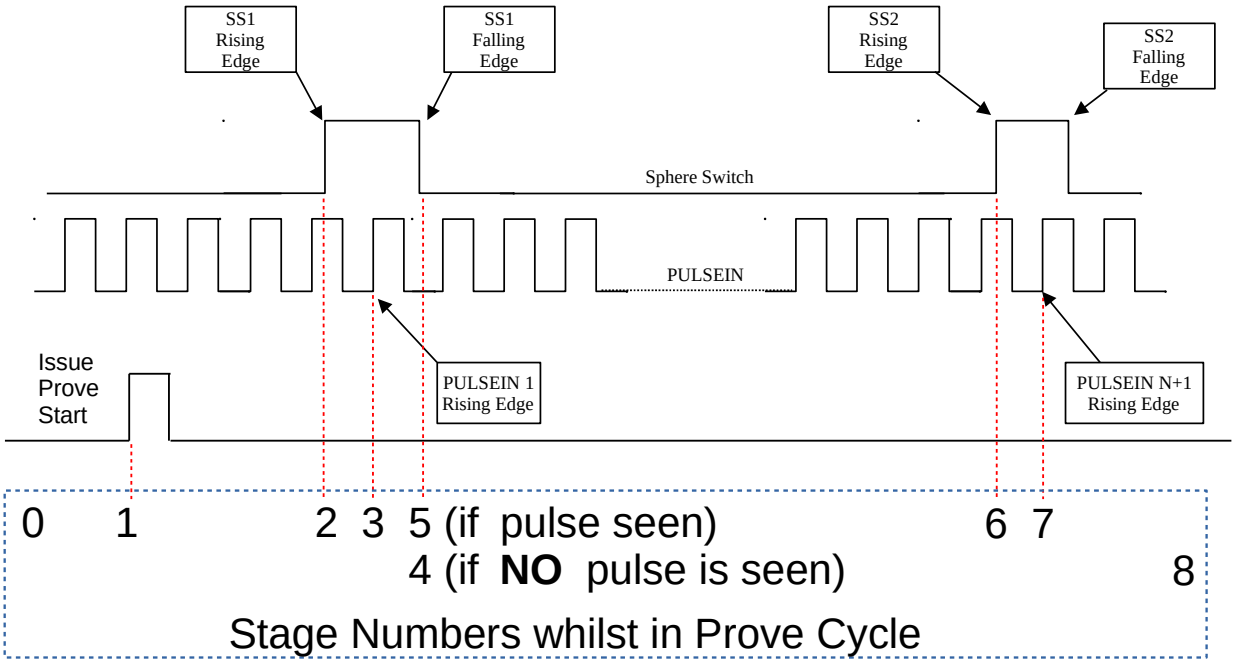
5.5.2 PIU Mode - Diagnostic Screen, Field Outputs & Status

DIGOUT1-6	The Digital Outputs are “hard coded” in PIU mode, and their function name is added to the description, for example Digout 1 is the Launch command. These six fields show the commanded value sent to the Digital Output Circuitry. The actual output may be opposite the software value, if the DigOut invert function described in the Section 5.2. PIU Mode - Config Setup has been used.
ALARM RELAY	In PIU mode the Alarm Relay will show "ALARM SET" on a red background if the communications to PROVEit has been lost for more than 30 seconds. Once the communications are re-established, the background will be cleared and the text will state "NO FAULT". In RTU mode, the Alarm Relay is controlled by the Modbus Communications. It will start in Alarm Set position and must be cleared once the controlling device is operating correctly.
ANOUT1-2	These two fields show the value that the Analog Outputs have been commanded to drive. This figure is in milliamps (mA).
COUNTA-B	These two fields show a 16 bit (modulo 65536) figure for the number of pulses counted on the Flow Meter Pulse inputs for channels A & B.
COUNT RAW	This field show a 16 bit (modulo 65536) figure for the number of pulses counted on the Raw Pulse Bus, Rawin.
PROVER STATE	This field reflects the status of the prover state machine in the RMU Altera Gate Array Dual Chronometry block. The values are: 0 : Waiting for Start 1 : Waiting for SS1 rising edge 2 : Got SS1 rising edge, waiting for subsequent PULSEIN rising edge 3 : Got SS1 rising edge and subsequent PULSEIN rising edge, waiting for SS1 falling edge 4 : Got SS1 falling edge, no PULSEIN rising edge since state 2. 5 : Got SS1 falling edge and PULSEIN rising edge, waiting for SS2 6 : Got SS2 rising edge and waiting for PULSEIN N+1 rising edge 7 : Done, got SS2 rising edge and PULSEIN N+1 rising edge. Waiting for Start 8 : Abort. Waiting for Start The diagram on the next page shows the timing and generation of the states. Note many of these states are either fleeting or not in a normal prove, so not all states will be seen.

5.5.3 Further Explanation of the Digital Input states with and without Inversion

Digital Input – Naming Convention			
Diagnostic	**Inversion selected?**	**Electrical Input Level**	**Reported State**
OFF-LO	No Inversion Selected	Less than 3 Volts	Inactive Signal
OFF-HI	Yes, Input Inverted	Less than 3 Volts	Active Signal
ON-HI	No Inversion Selected	More than 10 Volts	Active Signal
ON-LO	Yes, Input Inverted	More than 10 Volts	Inactive Signal

5.5.4 Prover Sequence Diagram, showing the stage numbers



This ends the PIU Mode configuration.

Next section applies to using the hardware in RTU Mode.

6 Introduction to RTU Mode

When the RMU is operated in RTU Mode, it is a high accuracy data acquisition unit, which can collect all the field data needed for a Liquid or Gas measurement stream as well as a Prover Modbus slave.

In addition, the Ethernet to RS485 Modbus Relay feature also allows intelligent meters, such as Coriolis and Ultrasonic meters with serial Modbus ports to be connected to the RMU, and ALL the data to be transported over the Ethernet link utilizing Modbus TCP, for a highly cost effective and tightly integrated data acquisition solution.

6.1 Field I/O

For full information on the I/O see Nano-RTU Technical Installation Manual.pdf.

6.1.1 The Field Inputs are:

- Nine Digital Inputs, each individually isolated
- Two optically isolated Meter Pulse Inputs than can also be combined for Dual-Pulse
- Two frequency mode isolated Densitometer Inputs
- Six high accuracy Analog Inputs, two can be RTD Inputs, each individually isolated
- One Raw Pulse Bus Input

6.1.2 The Field Outputs are:

- Six Digital Outputs, each individually isolated
- Two Pulse Outputs, each individually isolated
- Alarm relay with both normally open and normally closed contacts
- Two current mode Analog Outputs, individually isolated
- One Raw Pulse Bus Output

6.2 Communications to the RMU

Connections can be made to the RMU using Modbus TCP over the Ethernet link and there are two serial ports which both support Modbus RTU.

The RMU supports two different Modbus maps for greatest flexibility. A concise list is included in the manual but for full information see the P572 Modbus Address Map Manual.pdf

6.3 Ethernet to RS485 Modbus Relay for serial Field devices

If the Ethernet to RS485 Modbus Relay feature has been enabled, any Modbus polls that DO NOT match the Modbus address of the RMU will be relayed to the RS485 Port COM2. The serial port settings can be changed, see Section 5.2. PIU Mode - Serial Setup.

7 Configuring RTU Mode

The rotary switch SW1 is used extensively to configure the RMU in RTU mode.

Selecting rotary switch SW1 into position C(12) and cycling the power, or resetting the unit, forces the unit to RTU Mode with read and write web server access.

This defaults the Modbus Slave address to Address 1 on both the two serial ports (running Modbus RTU serial) and the Ethernet port (running Modbus TCP).

If a Modbus Slave address other than 1 is required, move the rotary switch SW1 to the position that matches the desired Modbus slave address, and power cycle or reset the unit. This will retain the read and write access.

Selecting rotary switch SW1 into position D(13) and cycling the power, or resetting the unit, forces the unit to RTU Mode with read-only web server access.

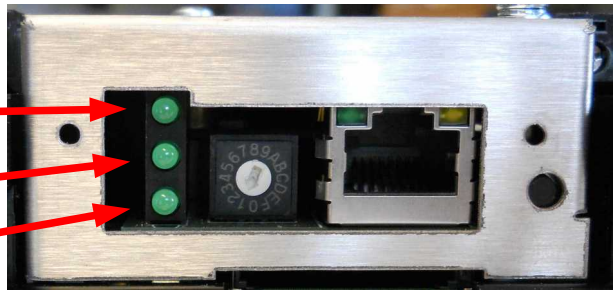
This defaults the Modbus Slave Address to 1 on both the two serial ports (running Modbus RTU serial) and the Ethernet port (running Modbus TCP).

If a Modbus Slave address other than 1 is required, move the rotary switch SW1 to the position that matches the desired Modbus slave address, and power cycle or reset the unit. This will retain the read-only access.

NOTE: Only Modbus Slave address 1 through 9 (switch positions 1 through 9) are supported.

7.0.1 LED usage when operating in RTU Mode

The Front Aperture



LED1 shows validated data received on COM2, the RS485 port. When running as an Ethernet to RS485 Modbus Relay, it will flash to indicate a valid response from the Modbus serial slave device.

LED2 shows validated data received on COM3.

LED3 shows validated data received on Ethernet.

NOTE: The tell-tale LEDs between terminal block TB2 and TB3 show the actual communications activity, whether the data received is valid or not.

The RMU is now running and the configuration setting can now be applied using the built-in web server.

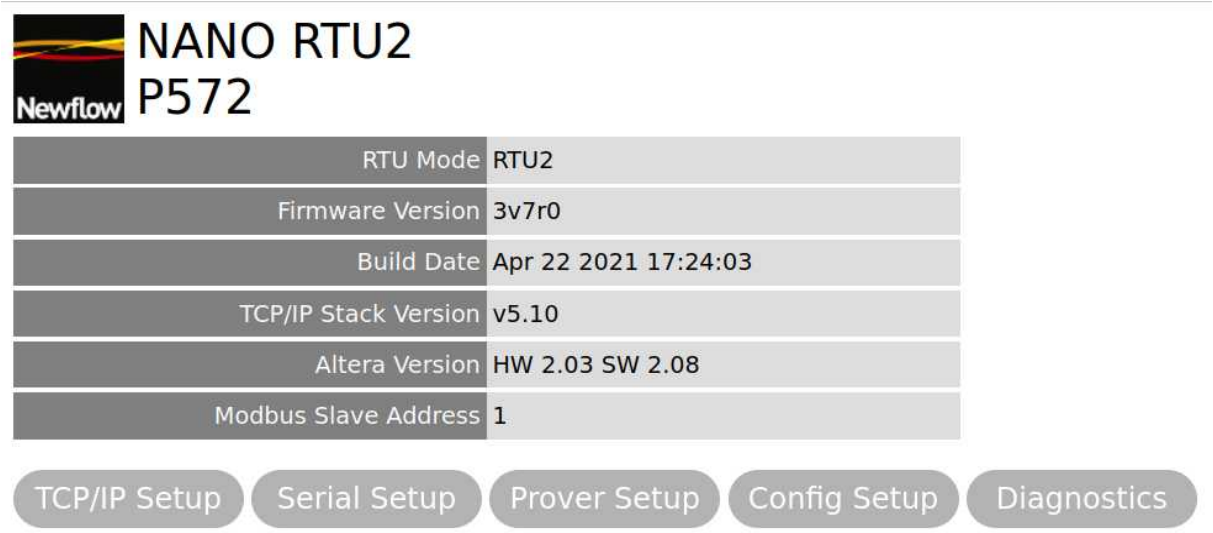
8 RTU Mode Web Browser Interface

The Ethernet port is set to use DHCP configuration by default. However, if no DHCP server is located, a fall back address of 10.255.255.255, with a netmask of 255.255.255.0, will be set.

NOTE: To speed up the internal DHCP timeout, briefly unplug and reconnect the Ethernet when using a direct laptop to RMU connection. A crossed cable is not required.

The RMU Ethernet port can also be configured using the MicroConf zero-configuration tool, a license-free discovery tool available from your vendor. To configure your RMU using MicroConf, see Section 10. MicroConf - Network Discovery & Configuration Tool.

If you start a web browser (Firefox, Chrome and Safari are all recommended) and type in the address of the RMU or click the "Start Web Interface" option in MicroConf, the home page will be displayed. This is shown in the screenshot directly below.



- The top line shows the logo, Product Name (NANO RTU2) and PCB Reference.
- The next six lines are read-only, for information, which are explained in the table below.

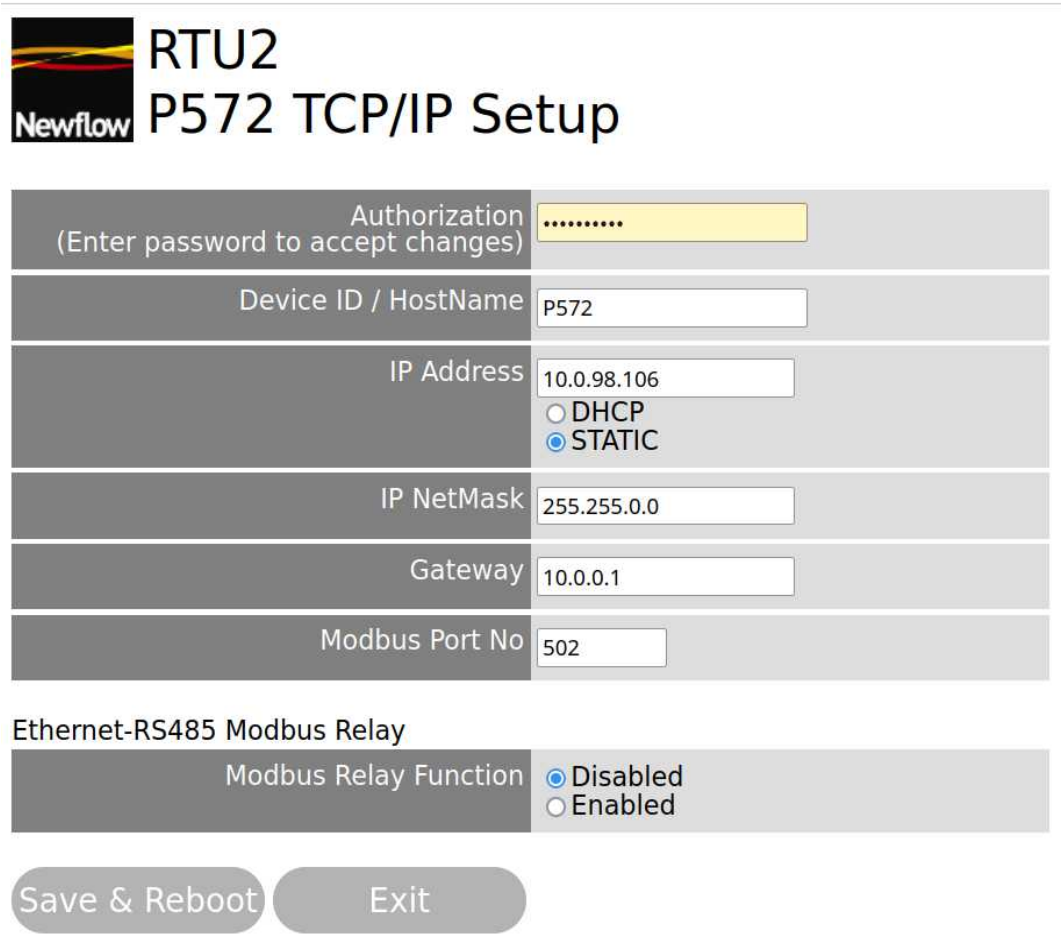
RTU Mode	This line indicates if the RMU is in PIU or RTU mode.
Firmware Version	This is the version of firmware in the P572.
Build Date	Compilation date of the P572 firmware.
TCP/IP Stack Version	Version number of the TCP/IP stack used by the P572 firmware.
Altera Version	This field indicates both the Gate Array Hardware design and the NIOS code running the NÅNO I/O Processor.
Serial Modbus Slave Address	This shows the currently selected Modbus slave address, from the front panel rotary switch SW1.

- Below the five lines of information, there are five buttons: TCP/IP Setup, Serial Setup, Prover Setup, Config Setup and Diagnostics. These are detailed in the following pages.

8.1 RTU Mode - TCP/IP Setup

Clicking the TCP/IP Setup button 

will take you to the setup menu shown below.



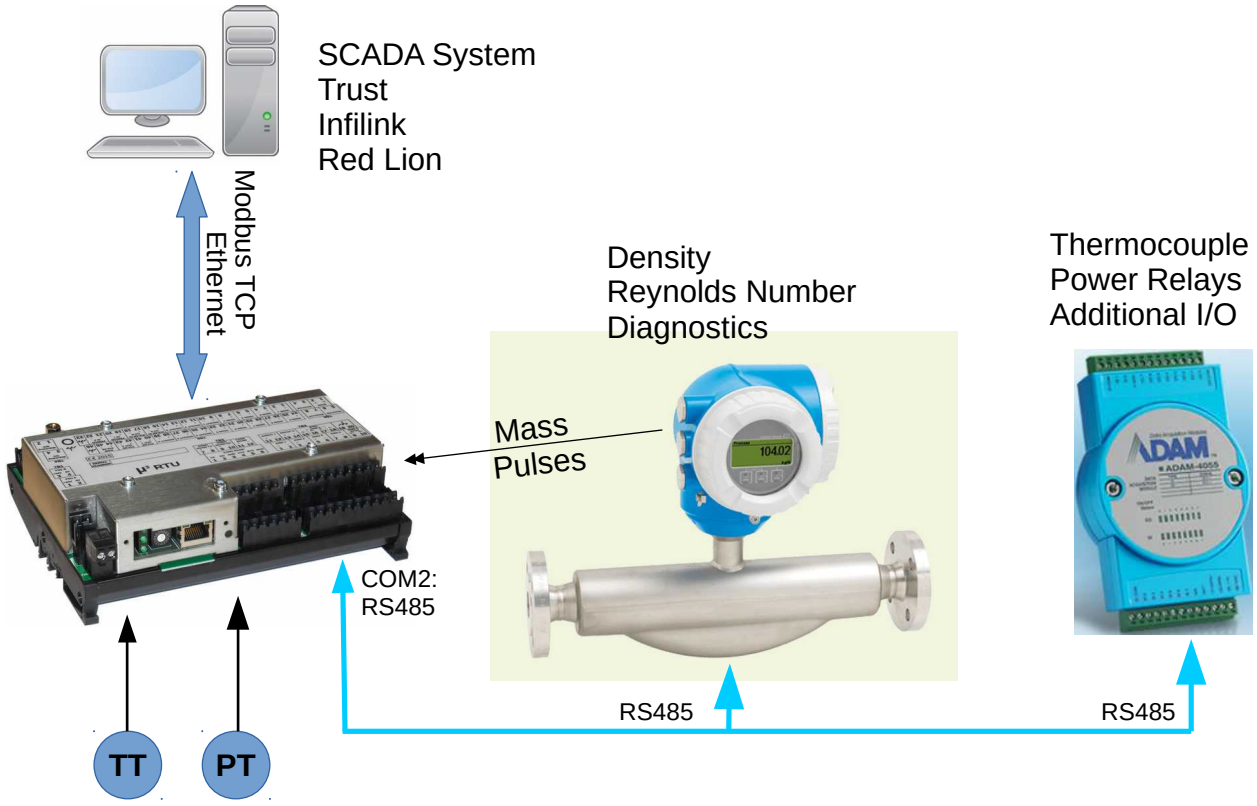
Authorization (Enter password to accept changes)	To be able to change the default Ethernet TCP/IP settings, the password must be entered. Please contact your sales representative for the password.
Device ID / HostName	This field defaults to P572 but can be changed to help identify multiple devices when utilizing MicroConf. It is shown as the Device ID field of MicroConf.
IP Address	The IP addresses can be entered in IPv4 quad-dotted decimal representation if the radio button has selected STATIC address assignment. If DHCP has been selected, the address will have been allocated by the DHCP server.
IP NetMask	The Netmask must be entered in IPv4 quad-dotted decimal representation, like an IP address.
Gateway	The Gateway address must be entered in IPv4 quad-dotted decimal representation.
Modbus Port No	This is the Modbus TCP Port number. The value is defaulted to 502, as this is the commonly used port address.
Modbus Relay Function	See Section 8.1.1 - Ethernet to RS485 Modbus Relay below.

Save & Reboot	Clicking the large "Save & Reboot" button will apply the changes made and force a reboot, but ONLY if the password entered is correct. If an incorrect password has been entered, the user will be taken back to the home screen and NO changes will have been made.
Exit	Clicking the large "Exit" button will cancel any changes made

8.1.1 Ethernet to RS485 Modbus Relay

In addition to the high fidelity data acquisition performed by the RMU itself, the RMU can also act as a Modbus serial communications gateway to multiple third-party devices. These could be for example a Coriolis meter to collect the observed density, Reynolds number and the range of diagnostic information that is available. Additional Modbus Serial devices can also be connected to further expand the functionality.

This feature allows the RMU to be the single data acquisition device, with a simple Modbus TCP interface using an Ethernet connection to a PC or SCADA system.



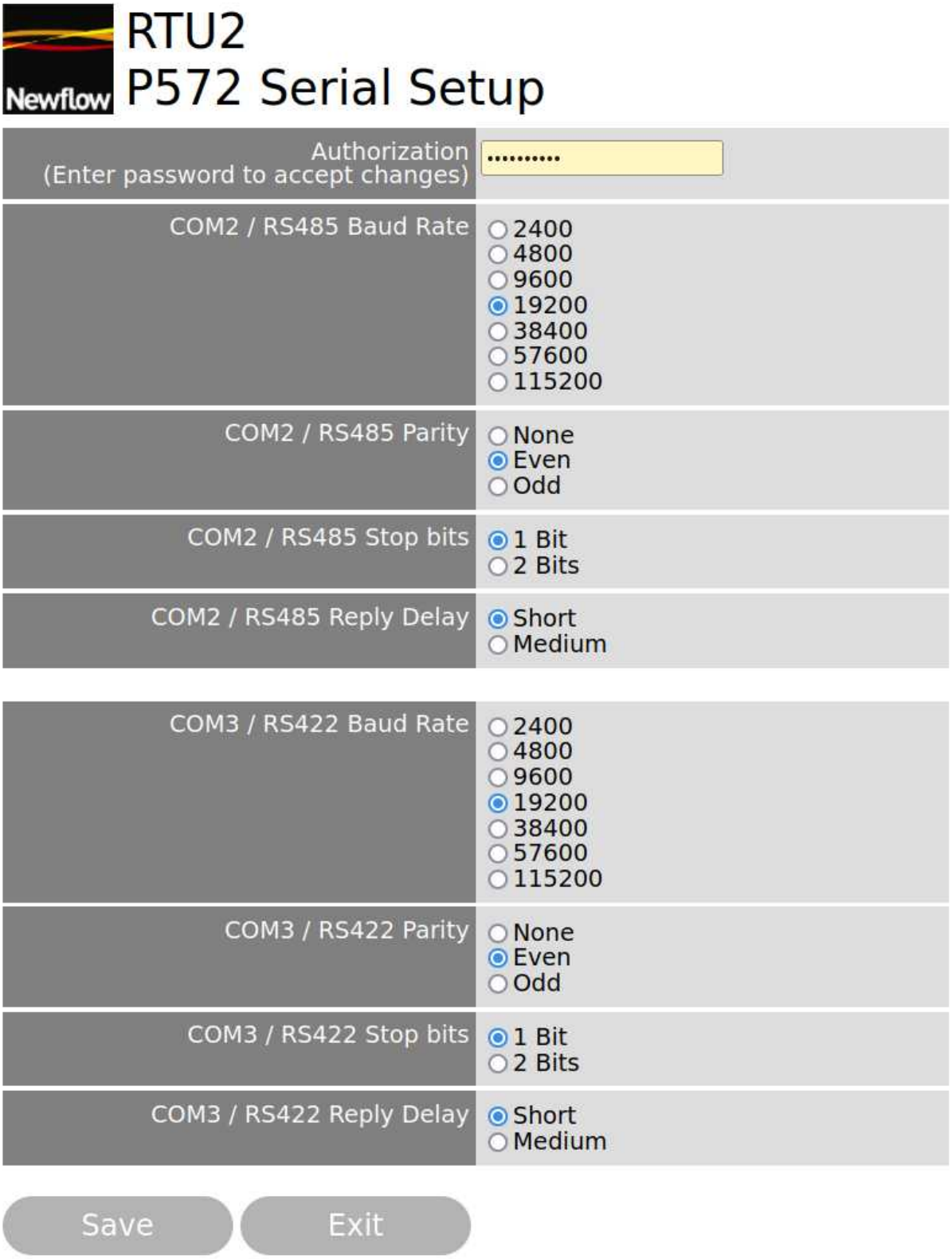
If the Ethernet to RS485 Modbus Relay function is enabled, any Modbus TCP packets received which **DO NOT** match the Modbus Slave Address selected for the RMU, will be passed to the COM2 RS485 serial port as Modbus RTU.

If the Ethernet to RS485 Modbus Relay function is disabled, any Modbus TCP packets which do not match the selected Modbus Slave Address of the RMU will be ignored.

8.2 RTU Mode - Serial Setup

Clicking on the Serial Setup button 

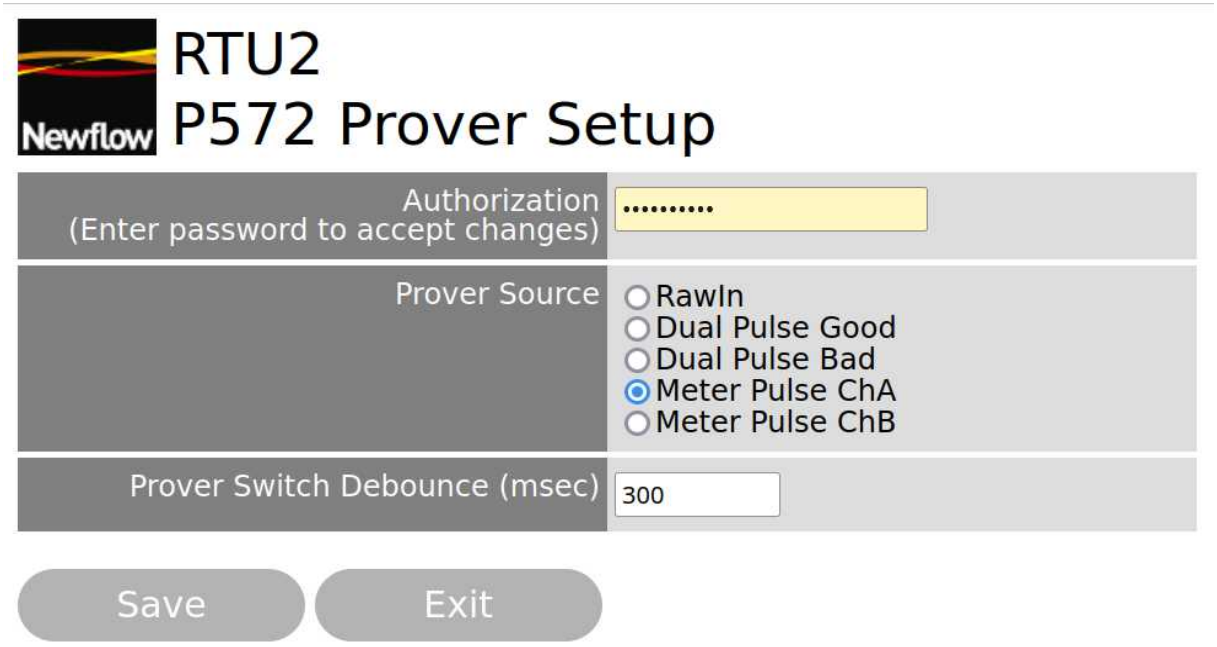
opens the menu shown below.



8.3 RTU Mode – Prover Setup

Clicking on the Prover Setup button 

opens the menu shown below.



When using the RMU for meter proving, the source of the pulses for the prover electronics can be selected.

Note, when using Dual Chronometry, avoid the Dual Pulse signal options.

To be able to change the Prover Setup configuration menu, the password must be entered. Please contact your sales representative for the password.

8.4 RTU Mode - Config Setup

Clicking on the Config Setup button 

opens the menu shown below.

RTU2
P572 Config Setup

Authorization (Enter password to accept changes)	•••••••••
Config Word	0000017C
Pulse Out 1 Mode	○ Always 0 ○ Always 1 ◉ Pulse Output
Pulse Out 2 Mode	○ Always 0 ○ Always 1 ◉ Pulse Output
Meter Pulse Mode	◉ Twin Single Streams ○ Dual Pulse (Level B) ○ Dual Pulse (Level A)
RawOut Mode	◉ RawOut Disabled ○ RawOut Meter Pulse ChA ○ RawOut Meter Pulse ChB
ANIN1	◉ mA ○ V
ANIN2	◉ mA ○ V
ANIN3	◉ mA ○ V
ANIN4	◉ mA ○ V
ANIN5	◉ mA ○ V ○ PRT
ANIN6	◉ mA ○ V ○ PRT
DigIn 1-8 Invert	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☑ 7 ☑ 8
Detector Switch / DigIn 9 Invert	☐ 9
DigOut 1-6 Invert	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☑ 6

Save Exit

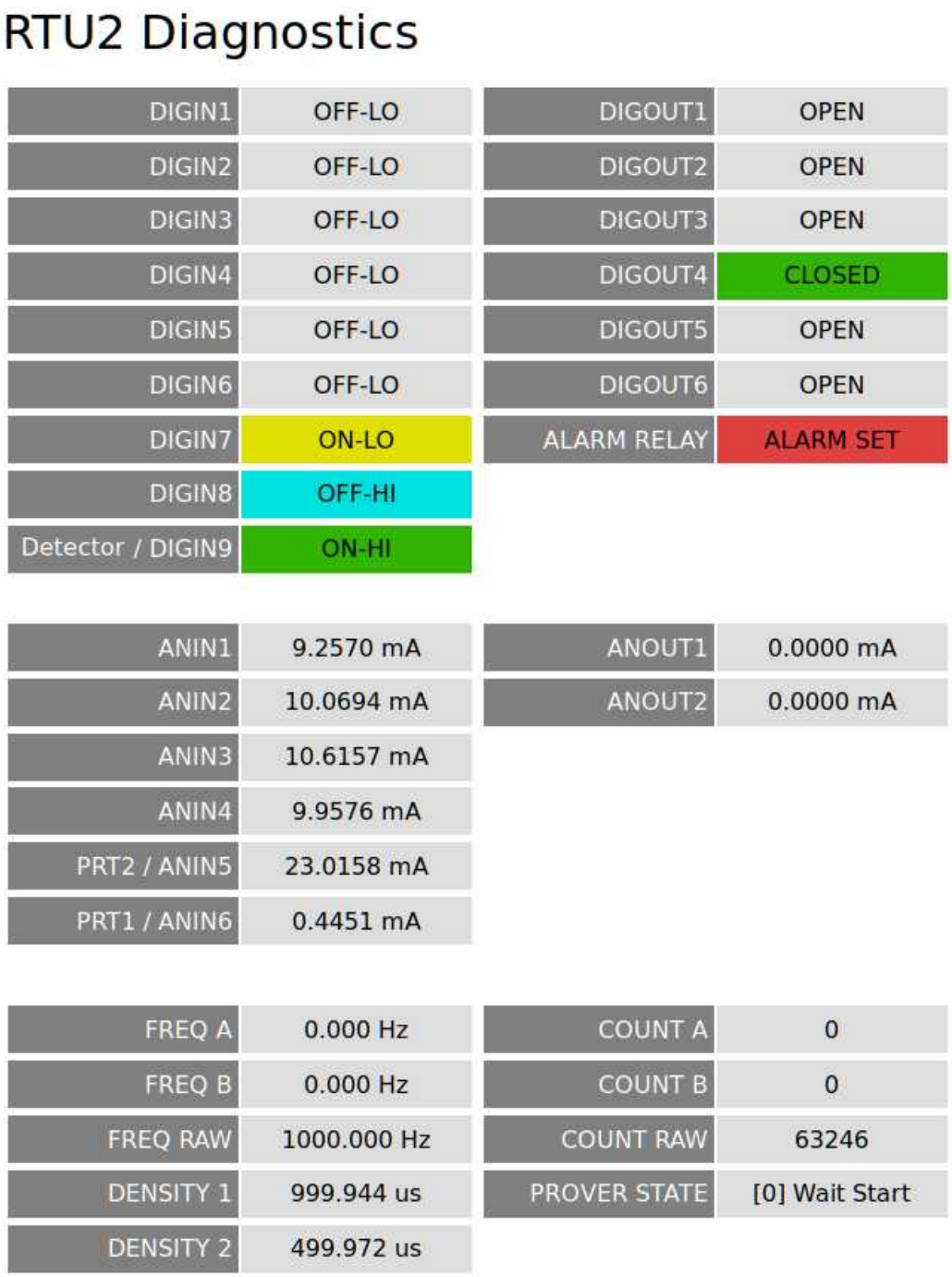
Authorization (Enter password to accept changes)	To be able to change the Input & Output and Operational settings, the password must be entered. Please contact your sales representative for the password. Unless the correct password is entered, any changes made will NOT be saved when the large "Save" button is pressed.
Config Word	This field is unique for every combination of configuration setting, so if the Config word from one machine matches that of another unit, they are configured identically in software.
Pulse Out 1 Mode	Normally this would be set as Pulse Output mode but for testing purposes, the outputs can be set as Open (Always 0) or Closed (Always 1).
Pulse Out 2 Mode	Normally this would be set as Pulse Output mode but for testing purposes, the outputs can be set as Open (Always 0) or Closed (Always 1).
Meter Pulse Mode	There are 3 modes that the Meter Pulse Inputs can be set to. In Twin Single Stream mode, Pulse Input Ch A and Ch B are totally independent. In Dual Pulse (Level B) both channels are used together, giving Good & Bad pulse counts. Missing pulses are **not** re-inserted in Level B mode. In Dual Pulse (Level A) both channels are used together, giving Good & Bad pulse counts. Missing pulses are re-inserted in Level A mode.
Rawout Mode	If RawOut Disabled is selected, the incoming Raw Pulse Bus Input frequency and Pulse Count (Modulo 65536) will be displayed on the diagnostic page. If the RawOut Meter Pulse ChA mode is selected, the Raw Pulse Bus will be set in output mode, and an identical copy of the pulse coming in on the Flow Meter Pulse Input, Channel A will be driven out. If the RawOut Meter Pulse ChB mode is selected, Flow Meter Pulse Input, Channel B will be driven out.
ANIN1	The P511 Analog Board has jumper settings to determine if each input is a 4-20 mA or a 1-5 V input. The software configuration must be set to match the physical hardware. See the Nano-RTU Technical Installation Manual for more information.
ANIN2	See ANIN1 above.
ANIN3	See ANIN1 above.
ANIN4	See ANIN1 above.
ANIN5	See ANIN1 above.
ANIN6	See ANIN1 above.
DigIn 1-8 Invert	There are eight tick boxes, with the associated Digital Input number to the right of each tick box. Clicking a tick box puts a tick into the box, and this indicates that the digital input for that particular channel will be inverted, assuming the correct password is entered, and the "Save" button clicked. Clicking a tick box multiple times, toggles the tick indication.
Detector Switch / DigIn 9 Invert	The Detector Switch / DigIn 9 Invert is similar to the invert function for Digital Inputs 1 to 8 but as well as inverting the read-back value, it also sets the prover to use the falling edge of the Detector Switch (sphere) input rather than the rising edge.

DigOut 1-6 Invert	There are six tick boxes with the associated Digital Output number to the right of each tick box. Clicking a tick box puts a tick into the box, and this indicates that the digital output for that particular channel will be inverted, assuming the correct password is entered, and the "Save" button clicked. Clicking a tick box multiple times, toggles the tick indication.
Save	Clicking the large "Save" button will apply the changes made but ONLY if the password entered is correct. If the incorrect password has been entered, the user will be taken back to the home screen and NO changes will have been made.
Exit	Clicking the large "Exit" button will cancel any changes made

NOTE: The changes are NOT applied dynamically, but only when the correct password has been entered and the Save button clicked.

8.5 RTU Mode - Diagnostics

Clicking on the Diagnostic button takes you to the Diagnostics diagnostic page shown below.



For a description of the fields on the in RTU mode, please refer to Section 5.4.1. Diagnostic Page Description.

8.6 RTU Mode - Read Only Web Access

In many installations, once the RMU has been configured using the website, it is imperative the settings are not accidentally, or maliciously, changed remotely. This is the purpose of the Read Only mode. The website can still be accessed, and the configured settings can be viewed, but without physical access to the RMU, these settings cannot be altered.

8.6.1 Rotary Switch SW1 Operation

If the rotary switch SW1 is set to position C when power is applied, or when reset, the write-access flag, stored in non volatile memory is set to ENABLED, and the Modbus slave address is set to 1. The operator will now have full read and write access to the RMU configuration.

If the rotary switch SW1 is set to position D when power is applied, or when reset, the write-access flag, stored in non volatile memory is set to DISABLED, and the Modbus slave address is set to 1. The operator will now only have read access to the RMU configuration.

No other positions of the rotary switch SW1 can alter the value of the write-access flag. Other rotary switch positions can however alter the Modbus slave address. The Modbus slave address can be changed by setting the rotary switch SW1 to positions 1 through 9.

NOTE: The "new" Modbus Slave Address will not be used until the power is cycled or the unit reset. However, if the rotary switch SW1 is moved whilst the unit is operating, it will then announce itself on the network, using the Zero-Configuration networking method, and will be highlighted in MicroConf (returning SW1 to its original position will clear the announcement).
See Section 10. MicroConf - Network Discovery & Configuration Tool

8.6.2 Example Configuration Sequence

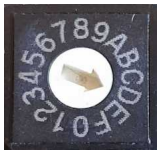
In this example, the operator needs a second RTD for the particular application, the Modbus Slave address need to be set to 3 and the configuration locked in by selecting Read Only web access.

To achieve, the sequence of steps required is as follows:

a) Turn the rotary switch SW1 to position C, and apply power (or reset if already running). The write-access flag, stored in non volatile memory is now set to ENABLED.

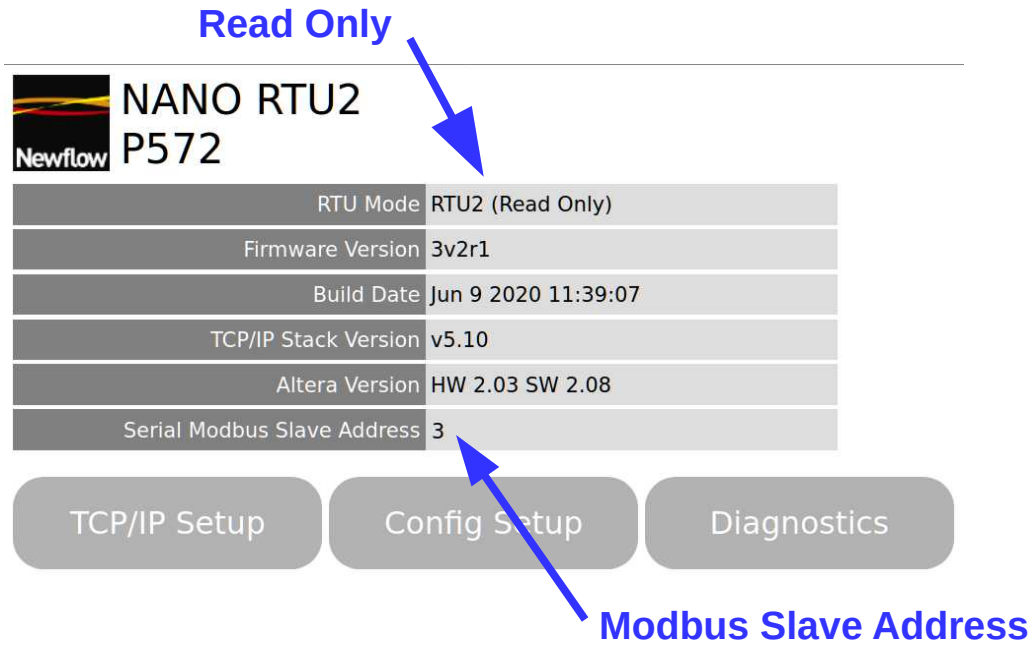
The operator now logs into the website, navigates to the Config Setup page and makes the changes needed for the application. The Configuration settings are stored in non volatile memory, assuming the correct Authorization password has been supplied.

b) The operator now turns the rotary switch SW1 to position D, and cycles the power (or resets the RMU). The write-access flag, stored in non volatile memory is now set to DISABLED.



c) The operator now turns the rotary switch SW1 to position 3, and cycles the power (or resets the RMU). The write-access flag remains set as DISABLED, and the Modbus slave address will now be set to 3.

Navigating back to the home page, the screenshot below will show Read Only Mode and the changed Modbus slave address



In read-only mode, no changes can be made to the configuration but the diagnostic page can be accessed to help with system debugging.

9 RTU Modbus Interfaces

There are three communications ports available on the RMU in Modbus standard RTU Mode.

There are two serial ports and one Ethernet port.

9.1 Serial Modbus RTU

There are two serial ports, COM2 as RS485 (2-wire) and COM3 as RS422 (4-wire), that can be connected as a 2-wire RS485 port.

Serial Port Configuration	Default Value
Media	RS422 or RS485
Baud Rate	19200
Number of Data Bits	8
Parity Bits	None
Number of Stop Bits	1
Handshaking	None

9.1.1 COM2 RS485 (2-wire) Pinout

Serial Port Pin Name	TB3 Pin Number
COM2 RS485 TxRx+	11
COM2 RS485 TxRx-	12
Screen	6

9.1.2 COM3 RS422 (4-wire) Pinout

Serial Port Pin Name	TB3 Pin Number
COM3 RS422 TXOUT+	7
COM3 RS422 TXOUT-	8
COM3 RS422 RXOUT+	9
COM3 RS422 RXOUT-	10
Screen	6

9.2 Ethernet Modbus/TCP

The Ethernet link is intended to be used as a point to point link but if the Modbus Master drops the link between polls, other devices may be interleaved with the original.

9.3 Scaled 32bit Integer Modbus Slave Map

The RMU supports a fully contiguous map, allowing all the data to be collected in a single poll. The data is in scaled 32bit Integer (3210) format which allow the data to be "human" readable.

In the table below, the heading labeled ATT. means attribute and defines is the data is Read Only (RO) or has both Read and Write (R/W) attributes.

NV indicates if the R/W value is stored in Non-Volatile memory, so will be remembered following a power cycle. A "YES" indicates that the value is stored.

Int32 denotes a 32bit extended Modbus integer in 3210 byte order.

Modbus Address	Type	Description	ATT.	NV?	Range	Pre-Scaler Value
2000	Int32	P513 Hardware Version	RO	n/a	0 to 65,535	Not Scaled
2002	Int32	P513 Software Version	RO	n/a	0 to 65,535	Not Scaled
2004	Int32	P572 Firmware Version	RO	n/a	0 to 65,535	Not Scaled
2006	Int32	Reserved	RO	n/a		-
2008	Int32	System Status (Bits: 0-7)	RO	n/a	0 to 255	Binary
2010	Int32	Digital Inputs (Bits: 0-8)	RO	n/a	0 to 511	Binary
2012	Int32	Prover Status	RO	n/a	0 to 8	Binary
2014	Int32	Message Id (2Hz)	RO	n/a	0 to 4,294,967,295	Not Scaled
2016	Int32	Reserved	RO	n/a		-
2018	Int32	Good / A pulse count	RO	n/a	0 to 4,294,967,295	Not Scaled
2020	Int32	Reserved	RO	n/a		-
2022	Int32	Bad / B pulse count	RO	n/a	0 to 4,294,967,295	Not Scaled
2024	Int32	Reserved	RO	n/a		-
2026	Int32	RAWIN pulse count	RO	n/a	0 to 4,294,967,295	Not Scaled
2028	Int32	Prover PULSEIN pulse count	RO	n/a	0 to 4,294,967,295	Not Scaled
2030	Int32	Prover PULSEIN SW1-2 (gated)	RO	n/a	0 to 4,294,967,295	Not Scaled
2032	Int32	Prover Time SW1-2 (gated) (x100ns)	RO	n/a	0 to 4,294,967,295	Not Scaled
2034	Int32	Prover Time P1-N1 (gated) (x100ns)	RO	n/a	0 to 4,294,967,295	Not Scaled
2036	Int32	Reserved	RO	n/a		-
2038	Int32	Good / A frequency (0 to 10kHz)	RO	n/a	0 to 1,000,000,000	Hz x 100,000
2040	Int32	Bad / B frequency (0 to 10kHz)	RO	n/a	0 to 1,000,000,000	Hz x 100,000
2042	Int32	RAWIN frequency (0 to 10kHz)	RO	n/a	0 to 1,000,000,000	Hz x 100,000
2044	Int32	Reserved	RO	n/a		-
2046	Int32	Density 1 period (50Hz to 5kHz)	RO	n/a	0 to 2,000,000,000	µs x 100,000
2048	Int32	Density 2 period (50Hz to 5kHz)	RO	n/a	0 to 2,000,000,000	µs x 100,000

Modbus Address	Type	Description	ATT.	NV?	Range	Pre-Scaler Value
2050	Int32	Reserved	RO	n/a		-
2052	Int32	Analog Input 1 (0 to 22mA)	RO	n/a	0 to 2,500,000,000	mA x 1,000,000
2054	Int32	Analog Input 2 (0 to 22mA)	RO	n/a	0 to 2,500,000,000	mA x 1,000,000
2056	Int32	Analog Input 3 (0 to 22mA)	RO	n/a	0 to 2,500,000,000	mA x 1,000,000
2058	Int32	Analog Input 4 (0 to 22mA)	RO	n/a	0 to 2,500,000,000	mA x 1,000,000
2060	Int32	Analog Input 5 (0 to 22mA) or PRT2 (50 to 250Ohms)	RO	n/a	0 to 2,500,000,000 or 50,000,000 to 250,000,000	mA x 1,000,000 or Ohm x 1,000,000
2062	Int32	Analog Input 6 (0 to 22mA) or PRT1 (50 to 250Ohms)	RO	n/a	0 to 2,500,000,000 or 50,000,000 to 250,000,000	mA x 1,000,000 or Ohm x 1,000,000
2064	Int32	Analog Channel Status	RO	n/a	0 to 4,095	Binary
2066	Int32	Reserved	RO	n/a		-
2068	Int32	DAC 1 (0 to 21mA)	R/W	No	0-24,000	mA x1,000
2070	Int32	DAC 2 (0 to 21mA)	R/W	No	0-24,000	mA x1,000
2072	Int32	Digital Outputs (Bits 0-6)	R/W	No	0 to 127	Binary
2074	Int32	Pulse Output 1 bucket	R/W	No	0 to 65,535	Not Scaled
2076	Int32	Pulse Output 2 bucket	R/W	No	0 to 65,535	Not Scaled
2078	Int32	Prover Configuration (1=Run)	R/W	No	0 or 1	Binary
2080	Int32	Reserved (Writes are ignored)	R/W	No		-
2082	Int32	Purge Pulse Output #1 (1=Reset)	R/W	No	0 or 1	Binary
2084	Int32	Purge Pulse Output #2 (1=Reset)	R/W	No	0 or 1	Binary
2086	Int32	System Configuration [Bits: 0-7 Pulses]	R/W	**YES**	0 to 256	Binary
2088	Int32	System Configuration [Bits 0-15 Analogs]	R/W	**YES**	0 to 65,535	Binary
2090	Int32	Pulse Output 1 width (1 to 2047ms)	R/W	**YES**	1 to 2,047	Not Scaled
2092	Int32	Pulse Output 2 width (1 to 2047ms)	R/W	**YES**	1 to 2,047	Not Scaled
2094	Int32	Prover OneShot Count (1ms debounce counts)	R/W	**YES**	0 to 65,535	Not Scaled
2096	Int32	RAWOUT Mode (Bits 0-1)	R/W	No	0 to 3	Binary
2098	Int32	Prover Source Selection (Bits 0-2)	R/W	No	0 to 7	Binary

For a full bit by bit description of this Modbus map, refer to the P572 Modbus Address Map Manual.

9.4 Example Modbus Messages

Poll for Good Pulse Count (Channel A) – INT32, 3210 byte order at base address 2018

Request:

TX: 01 03 07 E2 00 02 65 49

where;

Slave Address = 01

Function Code = 03

Starting Address = 07 E2 (Decimal 2018)

Quantity of Registers = 00 02

Checksum = 65 49

Response:

RX: 01 03 04 00 08 9B 53 50 FC

where;

Slave Address = 01

Function Code = 03

Byte Count = 04

Data Register 2018 Value = 00 08 (MS Register)

Data Register 2019 Value = 9B 53 (LS Register)

Checksum = 50 FC

Register 2018 represents the higher 16 bits of the INT32, Register 2019 represents the lower 16 bits of the INT32

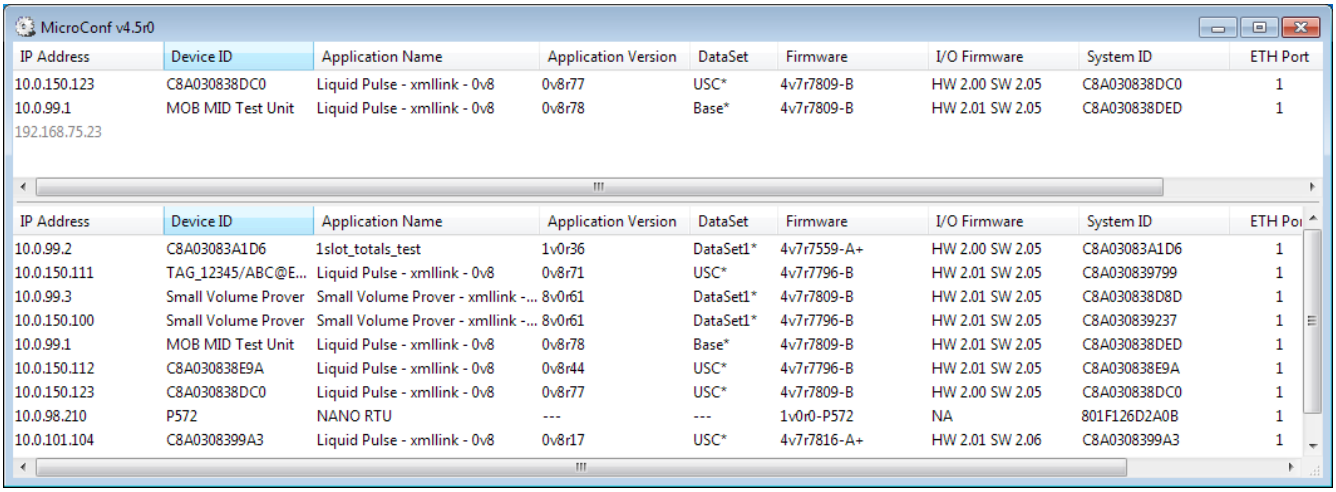
The combined hexadecimal register data 00089B53 equates to a decimal value of 564051

10 MicroConf - Network Discovery & Configuration Tool

When used with a MicroCube Flow Computer, MicroConf allows the operator to load applications and a host of additional tasks. When used with the RMU, only the following functions are available.

- Strobe Ident Lights
- Start Web Interface
- Configure

A screenshot of a Windows PC running MicroConf is shown below.



The MicroConf program shows two panes when started. The upper pane is used to display machines that are being actively managed, with known and fixed IP address, and the lower pane shows all the machines that have been discovered using the NÅNO Zero-Configuration networking.

Each machine is shown on a separate row and there are 10 columns of information shown for each machine, which are explained in the table below.

NOTE: MicroConf has the concept of Local and Remote machines. A local machine is one that is available over an office LAN, which supports the full range of TCP/IP commands and allows broadcast messages to be sent. A remote machine is one with more limited connectivity, internet connected but outside the corporate firewall and hence having restricted TCP/IP connectivity and with broadcast messages filtered out.

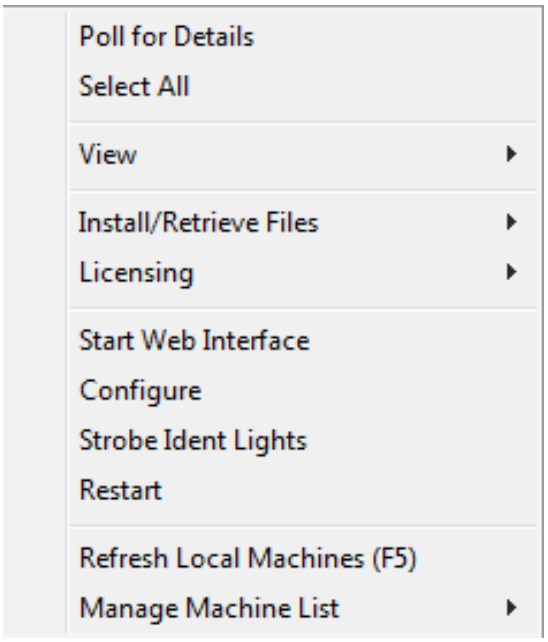
The NÅNO Zero-Configuration networking eliminates the highly frustrating and convoluted methods needed to set up some Ethernet enabled equipment. There is no requirement to change either your PC/Laptop's IP address or subnet in order to discover a NÅNO and change its network settings, even if it has been set to address outside the range used on the LAN network.

IP Address	This column shows the IP addresses in IPv4 quad-dotted decimal representation.
Device ID (Hostname)	The Device ID is a user selectable field that can be used to differentiate between machines.
Application Name	This field is fixed and will show NANO PIU or NANO RTU2, depending upon the configuration mode selected by rotary switch SW1.
Application Version	This field is not populated for the RMU.
DataSet	This field is not populated for the RMU.
Firmware	This column shows the version number of the RMU firmware resident.
I/O Firmware	This column shows the version number of the I/O processor firmware resident.
System ID	This field shows the MAC address of the RMU.
ETH Port	This field will always be a 1 for the RMU (as there is only 1 Ethernet port).
Comment	This shows the comment is changed in the Configure right-click option.

MicroConf is a deceptively powerful program. Although it only appears to have two similar panes, without tabs or menu items, access to the additional functions is obtained by the use of the right-click mouse button.

If you left-click on the line which shows the RMU machine you wish to interact with, the line will be highlighted.

If you now right-click whilst pointing at the highlighted line, the menu shown here on the right will be displayed. All of the menu items are shown as available. If you do not highlight a line and right click over white space on the screen, then the menu displayed will have most of the items shown "grayed-out" indicating these options are not available for use.



For example you cannot install an application if you have not selected a target device.

It is possible to select more than one unit using the shift and control keys, in line with the usual Windows conventions. When you right-click after selecting more than one unit, you will get a different selection of options in the right-click menu.

Poll for Details	This is not relevant when using the RMU.
Select All	This is not relevant when using the RMU.
View	This is not relevant when using the RMU.
Install/Retrieve Files.	This is not relevant when using the RMU.
Licensing	This is not relevant when using the RMU.

Start Web Interface	This item is only available when one machine has been selected. Selecting this option will start the PC/Laptop's default browser and load the selected IP address into the browser.
Configure	This item is only available when one machine has been selected. Selecting this option opens the Configure Machine window. This shows the Network settings for each of the Ethernet Interfaces. Ethernet Interface one has a check box for DHCP. If selected, this network interface will be given its setting by the DHCP server. If the box is not checked, the user can enter in standard quad-dot notation the IP address, the Netmask and the Gateway address. The second port does not exist in the RTU.
Strobe Ident Lights	This item is only available when one machine has been selected, and causes the unit's hardware Ident Lights to flash. **NOTE:** Pressing the Ident Switch on the RMU controller hardware for 10 seconds will also cause the Ident Lights to flash and the selected unit will also be highlighted in the MicroConf window.
Restart	This is not supported when using the RMU.
Refresh Local Machines (F5)	This option is available with none, one or several machines selected. This action forces the auto-discovery mechanism to do an immediate check for machines that may be on the Local Area Network (LAN).
Manage Machine List	This option is used to select which machines appear in the managed (upper) pane. There are 4 sub-menus available, these are:. **Add** - This option is always available, and allows the user to type in an IP address or a range of addresses. **NOTE:** The user can highlight one or more machines in the discovered (lower) pane and drag them to the upper pane to add them to the managed list. **Remove** - This option is only available with one or more of the managed machines selected in the upper pane. **Import** - With the cursor in the managed (upper) pane, this option opens an explorer style dialog and a nanolist file (.nnl suffix) can be selected. The selected file will be parsed and the upper window will be populated accordingly. **Export** - This allows the user to export the list of managed machines in .nnl format. One or more managed machines must be selected and this option then exports the details of the selected machines to the .nnl list.

11 Firmware Version History

The RMU has two devices that require firmware: the I/O Processor (in the Altera gate array on the P513 Main I/O board) and the Microchip processor (on the P572 RTU2 CPU board).

P513 Main I/O board

Minimum version HW 2.03 SW 2.08 (released 5 December 2019) is needed to support Dual Chronometry whilst master metering.

P572 RTU2 CPU board

3v0r4	Added DigOut01 as a redundant copy of DigOut06.
3v1r0	Added Brooks Prover mode - Run signal stays active on DigOut06 until return piston command issued from proving computer.
3v1r1	Added DigOut04 as a redundant copy DigOut06.
3v2r0	In PIU mode, a potential glitch on inverted digital inputs eliminated and website improved. to show input inversion on diagnostic page.
3v2r1	Minor wording change on website.
3v3r0	Added DigIn8 to select A or B channel for proving.
3v4r0	Released the Ethernet to RS485 Modbus Relay feature & serial port configuration menu.
3v5r0	DHCP fallback modified to increase boot speed
3v6r0	Added support for encoder based proving
3v7r0	Added enhanced support for BiDi prover 4-way valve control in PIU mode. Ability to update the RMU firmware and the I/O Processor gate-array utilizing MicroConf was added.

12 RMU Field I/O Connection Information