Newflow

NÅNO-RTU2

Hardware Installation & Specification Manual

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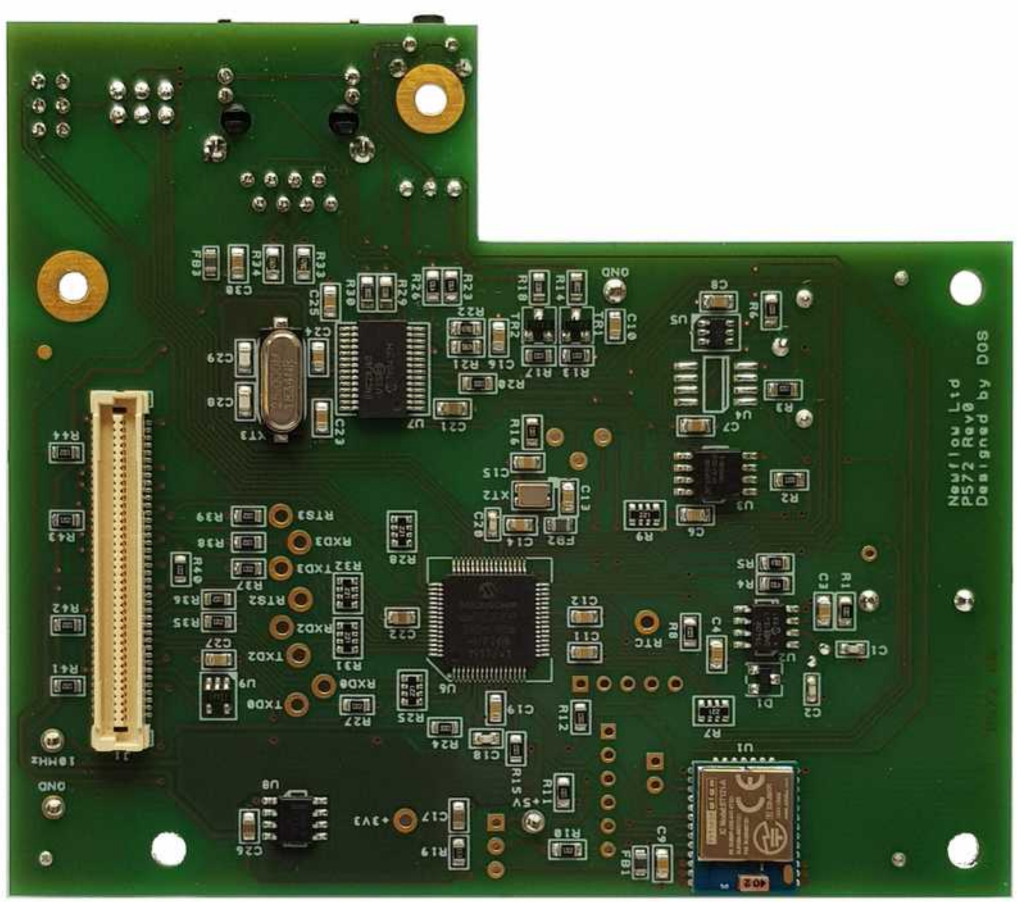

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1 Introduction

The NÅNO-RTU2 is a derivative of the NÅNO Flow Computer hardware.

The Field I/O is exactly the same as the Flow Computer, but the very high performance processor board, together with the suite of non-volatile Memory and the C||Cure run-time environment have been replaced by a communications board. This allows all the field I/O to be measured and controlled as before, but the intelligence is now provided by a 3rd party device. This make the NÅNO-RTU2 ideal for use as a Virtual Flow Computer, a Prover Controller or any other product that needs fiscal grade measurement

There are two version of the NÅNO-RTU2. It can be supplied as a digital only device or it can be supplied with the optional Analog I/O board.

1.1 Warranty

The NÅNO-RTU2 is warranted for 3 years as standard (see our terms and conditions at www.newflow.co.uk/tandc.pdf for further details). Extended warranties can be purchased.

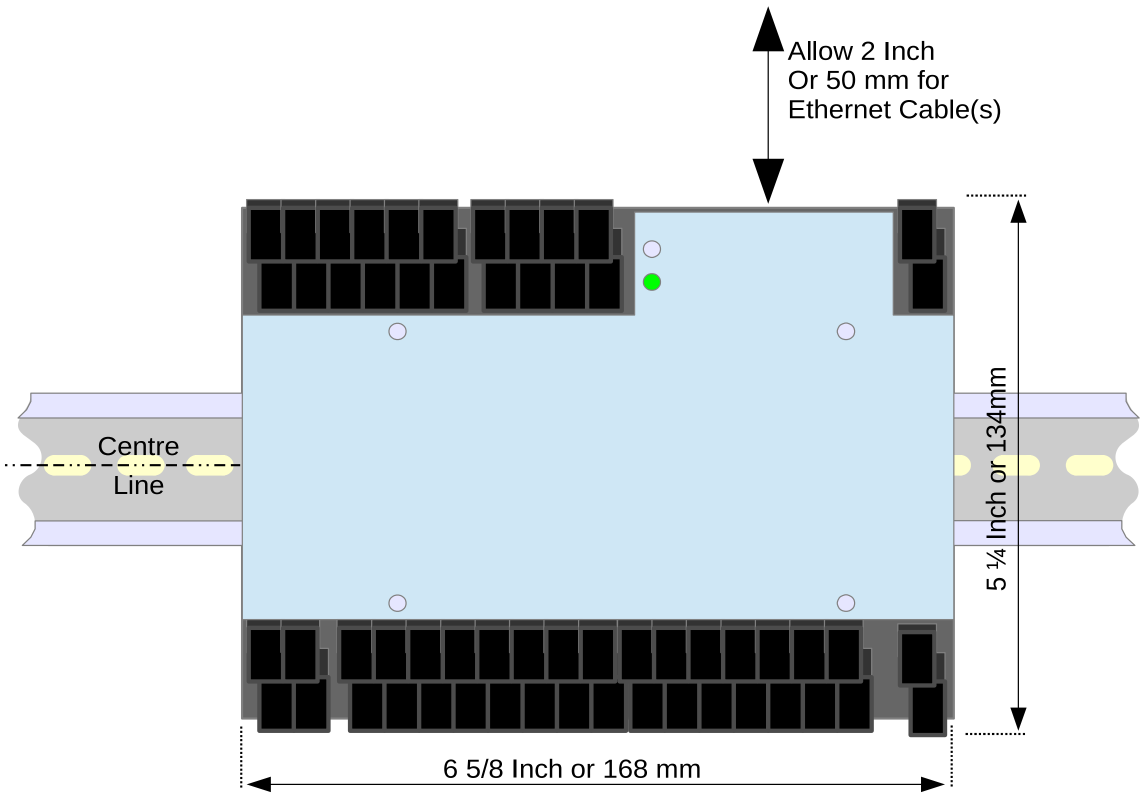
By prior arrangement, long term product availability guarantees are available. For information, please contact sales on sales@newflow.co.uk.

1.2 Prior to mounting the NÅNO-RTU2

The NÅNO-RTU2 is a highly configurable unit, and almost all parameters can be configured in software. There is however one exception. If the Analog expansion board has been specified, it is simpler to configure the Analog Board before it is mounted and wired. Refer to section 3.6.3 for link setting details. Please note, units can be pre-configured directly from the factory for your convenience.

2 Physically Mounting the NÅNO-RTU2

The NÅNO-RTU2 is designed to be attached to 35mm symmetrical Top Hat rail to TS35/7.5 DIN, EN50022 or asymmetric G-type rail to EN50035.

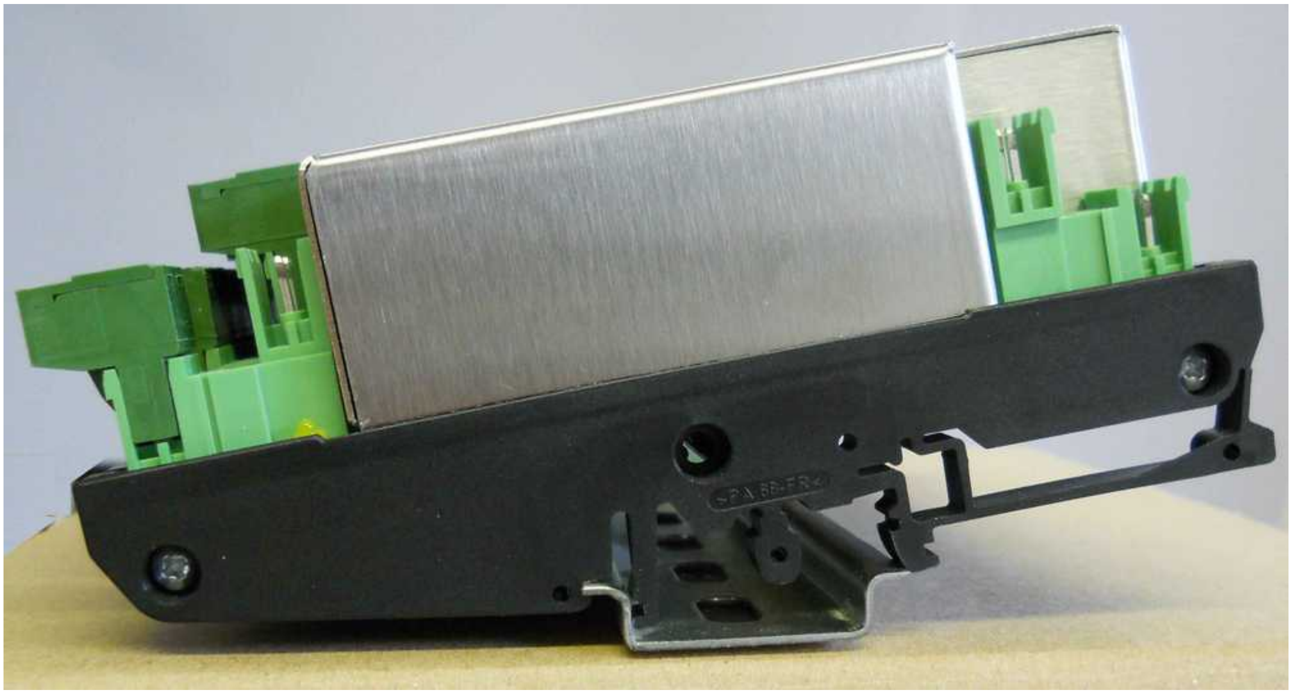


The highest point of a NÅNO-RTU2 mounted on a din rail will be 2 ¼" or 56mm above the mounting surface, but note, the Field wiring emerges vertically, and we recommend at least 2 inches (50 mm) of clearance above the unit for the cables. If cable tags are used, then allow additional height, as the bend radius is increased.

Each NÅNO-RTU2 requires 6 5/8"(168mm) of rail length and takes up 5 ¼"(134mm) of width. Allow extra space for the Ethernet connection; at least 2 inches of additional clearance is recommended for Ethernet Cat 5E cable.

2.1 Attaching and removing from Rail

To attach the NÅNO-RTU2 to the rail, hold the unit with the Ethernet connectors toward you, and lower the back of the unit onto the rail first, then rotate the unit until it clicks onto the rail, as shown in the illustration below.



To remove the unit, apply a small flat-bladed screwdriver into the release slots as illustrated and lift the front.

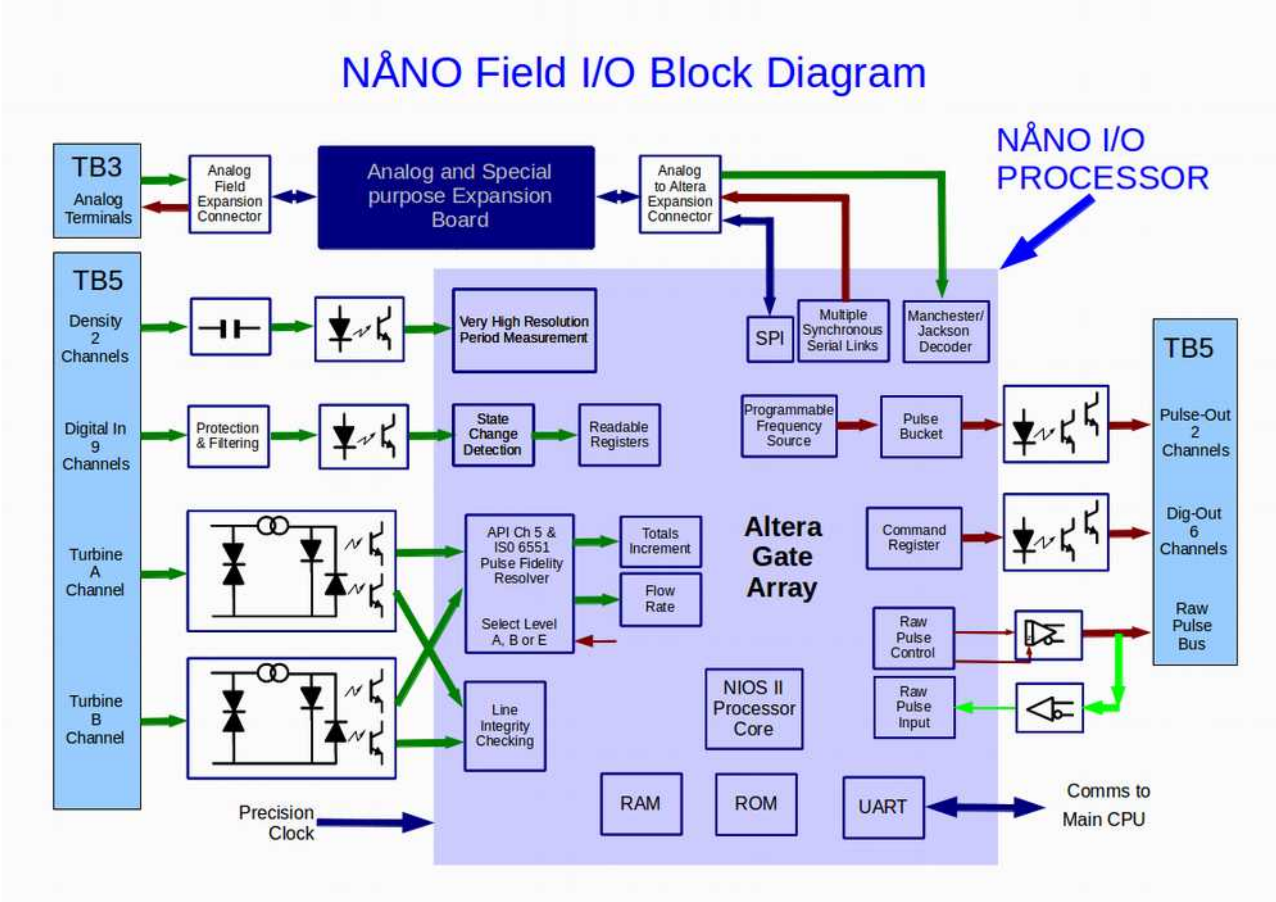
2.2 The I/O Complement

The digital only version of the NÅNO-RTU2 has the following I/O available

- 1 RS485 Serial Port (4 wire)
- 1 RS485 Serial Port (2 wire, Optically Isolated)
- 1 Ethernet Port
- 9 Digital Inputs
- 6 Digital Outputs
- 2 Pulse Outputs
- 1 Dual Pulse Input
- 2 Period/Density Measurement Inputs
- 1 Alarm relay with both Form A and Form B contacts
- 1 Raw Pulse bus bidirectional I/O

With the optional P511 analog board fitted, the following additional I/O is provided:

- 6 Analog Inputs
- 2 RTD Inputs (each uses one Analog Input)
- 2 Analog Outputs



All field inputs and outputs are individually isolated and after isolation are fed to the I/O processor.

The I/O processor provides the following specific hardware:

- High resolution period measurement
- Level A, B or E dual pulse resolver
- Fleeting Input detection
- Multiple synchronous serial links
- Multiple Manchester/Jackson decoders
- Programmable frequency source & Pulse buckets
- Prover gating and dual chronometry timers & counters
- SPI and asynchronous serial links

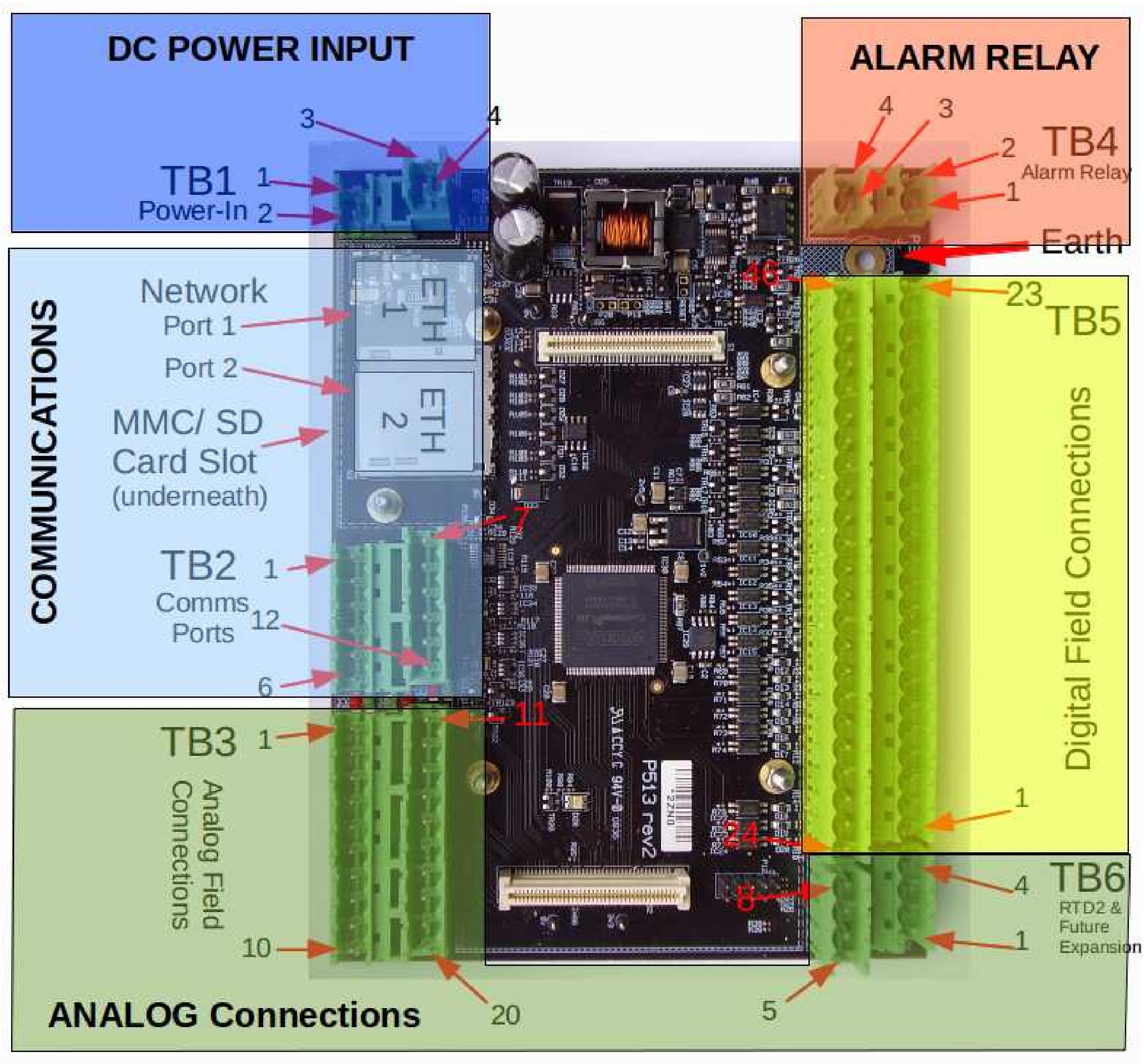
All the real-time I/O is handled by a high performance 80MIPS NIOS II processor, which is capable of handling the interrupt load form the multiple asynchronous sources. The processor performs integrity checks and calibration of the analog I/O, and during each heart-beat, it snapshots the accumulated and averaged data and generates engineering values for transmission to the Main CPU, as well as receiving outputs in engineering values, which it then converts to drive the outputs.

All of the specific hardware listed above, together with the asynchronous serial ports, the program storage, working RAM and the NIOS II 32 bit processor have all been designed and compiled to fit within a single Altera field programmable gate array, and this device is known as the I/O Processor.

3 Wiring the NÅNO-RTU2

The connectors on the NÅNO-RTU2 are arranged in functional groups as shown in the illustration below. The main groups are:

- DC Power Input
- Alarm Relay
- Communications, Serial & Ethernet ports
- Analog Field Connections
- Digital Field connections



NOTE: A NÅNO-RTU2 has only one Ethernet port and the MMC/SD card slot is not usable.

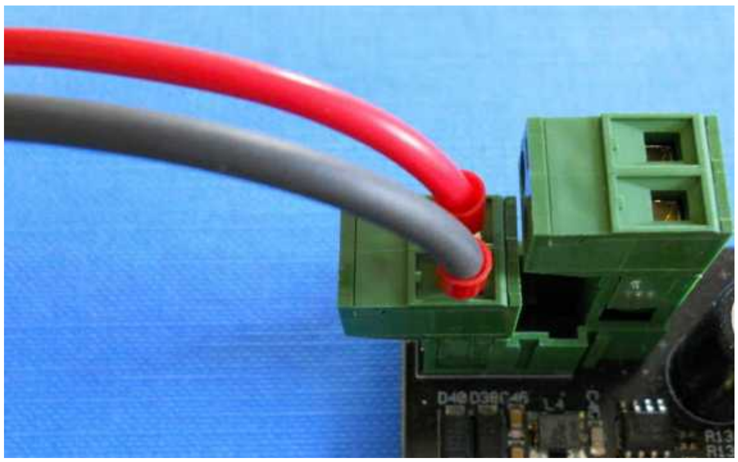
3.1 Power Input Connections

The NÅNO-RTU2 is designed to be powered by 12V or 24V DC supply. For additional reliability, a second redundant DC Power supply can be used so that in the event of one supply failing, the NÅNO-RTU2 will remain powered.

The inputs are protected against reversed polarity and can operate with a voltage of between 11.5 to 28 Volts (hence suitable for float charged 12V lead-acid rechargeable batteries). The unit consumes approximately 4?? watts.

The power supply provides galvanic isolation between the incoming DC Power In and the internal computer ground.

When only one supply is available, either pair of connectors on Terminal Block TB1 can be used, Pin 1 is positive and Pin 2 is the return. If the plug is put into the upper socket, it will work exactly the same, using terminals 3 & 4.



3.2 Alarm Relay

The NÅNO-RTU2 is equipped with an alarm relay with two sets of complementary contacts, such that when one set is open, the other set will be closed. The two sets of contacts are isolated from each other and all other connections on the NÅNO-RTU2.

Alarm Relay Contacts	
Contacts Open when Alarm Active	**Contacts Closed when Alarm Active**
TB4-1	TB4-3
TB4-2	TB4-4

When the NÅNO-RTU2 is powered off or in an alarmed condition, the pair of contacts called **Contacts Open when Alarm Active** will be OPEN, and the **Contacts Closed when Alarm Active** set will be CLOSED.

When the NÅNO-RTU2 is powered off, the relay will be de-energised, and the contacts will be in the alarm active position (contact TB4-3 & TB4-4 will be closed and contact TB4-1 & TB4-2 open)

The alarm relay will stay de-energised until the application has determined that it is running correctly, and there are no alarms. It will then energise the relay. Contact TB4-3 & TB4-4 will NOW be open and contact TB4-1 & TB4-2 will NOW be closed.

The relay will be de-energised, and the contacts will revert to the Alarm states in the event of:-

a) A complete power fail

b) The NÅNO-RTU2 detecting a problem during its routine checks (for example a memory corruption)

c) A problem that triggers the watchdog

d) The remote application commanding the Alarm relay to be set to alert an operator

3.3 Serial Communications

Each NÅNO-RTU2 is provided with 2 high speed rugged serial ports, one Galvanically isolated 2-wire RS485 port and one 4-wire RS422 (which can be linked to be RS485).

For information on configuration of the ports see section 5.2.1 Serial Port Configuration

3.3.1 COM2: - RS485 (2-wire) Port

The RS485 port is ultra-hardened and Galvanically isolated to provide the best possible communication channel even in very noisy electrical environments. The isolation allows signal integrity even when the common-mode voltage between connected devices exceeds the standard RS485 −7V to +12V limit.

Pin No	*Signal Name*	*Signal Description*
TB2-11	COM2 RS485 A	Bi-directional Differential Signal A
TB2-12	COM2 RS485 B	Bi-directional Differential Signal B
TB2-6	COM2/3 SCREEN	Signal Ground (Interconnects ground to limit common mode voltages)

3.3.2 COM3: - RS422 Port (runs as 4-wire RS485 in RTU mode)

The RS422 port can be used as a 4 wire RS485 or by linking terminals externally it can operated as a 2 wire RS485 connection.

TB2 Pin No	*Signal Name*	*Signal Description*
TB2-7	COM3 RS422/485 TXOUT+	Differential Data Output +ve
TB2-8	COM3 RS422/485 TXOUT-	Differential Data Output -ve
TB2-9	COM3 RS422/485 RXIN+	Differential Data Input +ve
TB2-10	COM3 RS422/485 RXIN-	Differential Data Input -ve
TB2-6	COM2/3 SCREEN	Signal Ground (Interconnects ground to limit common mode voltages)

To use the port in 2 wire RS485 mode, connect the TXOUT+ to the RXOUT+ (this becomes RS485 Signal B) and connect the TXOUT- to the RXOUT- (this becomes RS485 Signal A).

3.4 Digital Field Connections

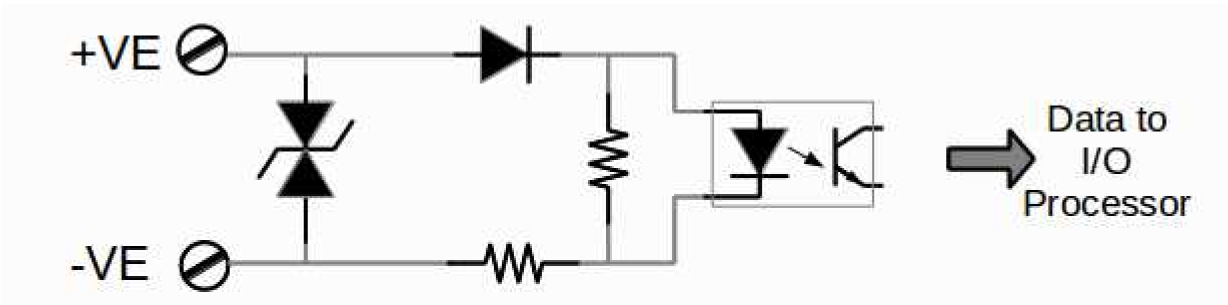
The digital I/O described below is common to all NÅNO-RTU2 variants.

The NÅNO-RTU2 has the following digital field I/O connectivity

- 9 Individually Galvanically isolated Digital Inputs
- 6 Individually Galvanically isolated Digital Outputs
- 2 Individually Galvanically isolated High Speed Pulse Outputs. These can also be used as Digital Outputs.
- 2 Individually Galvanically isolated Period (frequency) Inputs
- 2 Galvanically isolated Meter Pulse Inputs, which can be used a dual-pulse pair
- A single bi-directional Raw Pulse Bus. This is not isolated and only intended for connection to another NÅNO-RTU2 or NÅNO, hence maintaining full system isolation. Newflow offer a range of ancillary products for connecting 3rd party flow computers and prover computers

3.4.1 Digital Inputs

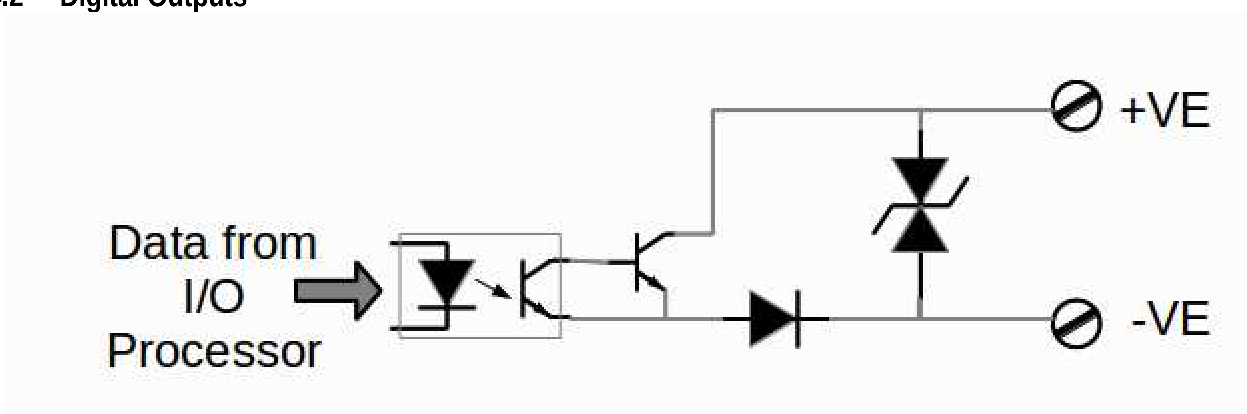
There are 9 identical high impedance Digital Input channels. Each channel has both surge and reverse voltage protection, the input circuit is shown below. Following recovery of the signal from the opto-isolator, the signal is fed into the I/O Processor.



Pin	*Digital Input Channel Number*								
	DigIn 1	**DigIn 2**	**DigIn 3**	**DigIn 4**	**DigIn 5**	**DigIn 6**	**DigIn 7**	**DigIn 8**	**DigIn 9**
+ve Pin	TB5-1	TB5-3	TB5-5	TB5-7	TB5-24	TB5-26	TB5-28	TB5-30	TB5-32
-ve Pin	TB5-2	TB5-4	TB5-6	TB5-8	TB5-25	TB5-27	TB5-29	TB5-31	TB5-33

In Prover applications, DigIn 9 is used as the detector input. See section 4.1 for example wiring.

3.4.2 Digital Outputs



There are 6 Digital Outputs provided. Each Digital output has a high current Darlington output which is surge and reverse connection protected. Each output is Galvanically isolated from all other I/O points. This allows it to be connected to either the positive rail to act as a current source or connected to the negative rail to mimic a grounded open collector output.

Pin	*Digital Output Channel Number*					
	DigOut 1	**DigOut 2**	**DigOut 3**	**DigOut 4**	**DigOut 5**	**DigOut 6**
+ve Pin	TB5-9	TB5-11	TB5-13	TB5-34	TB5-36	TB5-38
-ve Pin	TB5-10	TB5-12	TB5-14	TB5-35	TB5-37	TB5-39

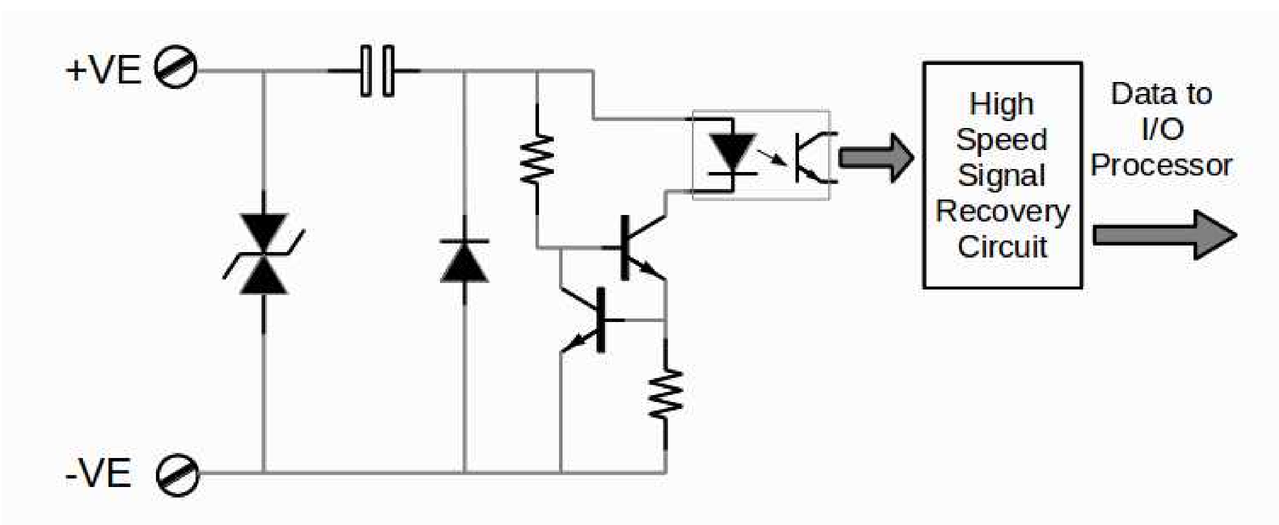
3.4.3 High Speed Pulse Outputs

There are two dedicated Pulse Outputs. The output circuitry is exactly the same as for the Digital Outputs. This is controlled from the application and can also be independently driven as additional Digital Outputs.

Pin	*Pulse Output Channel Number*	
	PulseOut 1	**PulseOut 2**
+ve Pin	TB5-40	TB5-42
-ve Pin	TB5-41	TB5-43

3.4.4 Period (frequency) Inputs

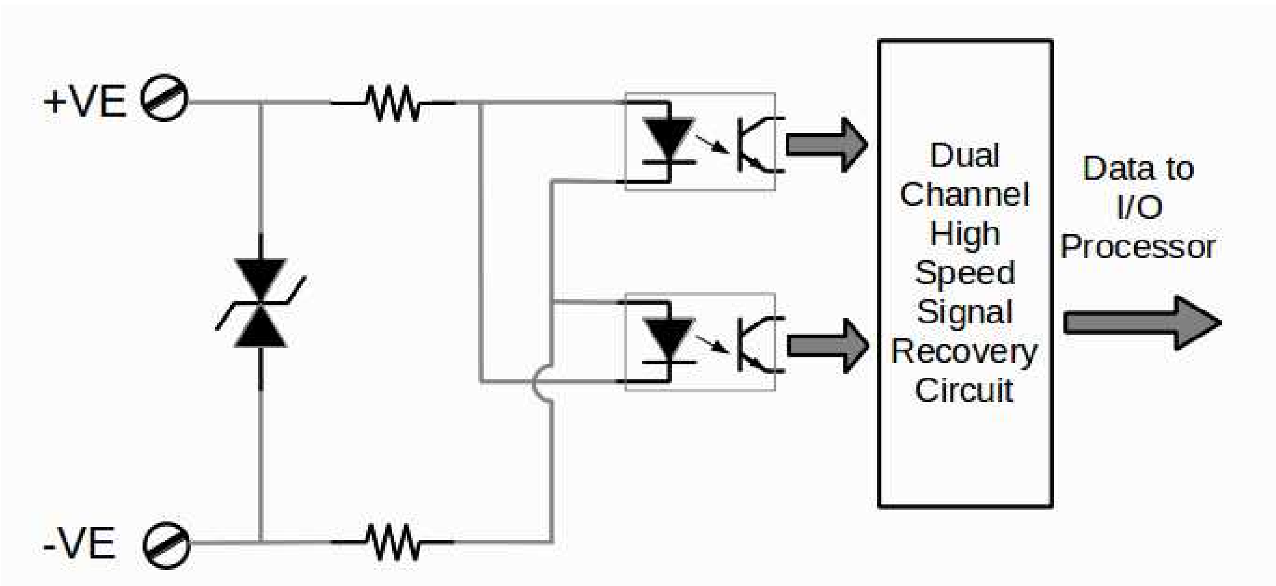
The NÅNO-RTU2 is equipped with two identical Period Inputs. Each input is Galvanically isolated and designed to work with industry standard Densitometers. Each input has a high sensitivity AC coupled input driving a constant current circuit in series with the LED of the opto-isolator. A high speed recovery circuit on the computer side of the isolator regenerates the signal and presents it to the I/O Processor where a very high resolution (nanosecond) period measurement is made.



Pin	*Period Input Channel Number*	
	Period In 1	**Period In 2**
+ve Pin	TB5-19	TB5-21
-ve Pin	TB5-20	TB5-22

3.4.5 Dual channel Galvanically isolated Meter Pulse Input

The NÅNO-RTU2 is equipped with a dual pulse input suitable for use with mechanical turbine meters, for both liquids and gases, as well as synthesized pulses from Coriolis and Ultrasonic smart meters. By utilising dual pulse trains, a high confidence level can be obtained in the signal fidelity. The inputs work with differential pre-amplifier signals for continuous line integrity monitoring, even when no pulses are being transmitted, or other variable reluctance pre-amplifiers from a variety of manufacturers. The inputs meets API ch. 5.5 level A or B and equivalent international standards, ISO 6551 and IP252. If only a single pulse stream is available, the NÅNO-RTU2 can be configured as level E mode, and the single pulse stream should be connected to Pulse Input Channel A.



Pin	*Pulse Inputs Channel A & B*	
	Pulse Input Ch A	**Pulse Input Ch B**
+ve Pin	TB5-15	TB5-17
-ve Pin	TB5-16	TB5-18

3.4.6 A single bi-directional Raw Pulse Bus

The raw pulse bus utilises differential signals to distribute physically accurate copies of pulses sent from the meter-runs to the provers. The pulses are directly generated from the hardware, they are not synthetic pulses generated by any software algorithms. These allow highly accurate dual chronometry and master metering to be performed by the 3rd party proving applications and virtual flow computers.

3.5 P511 Analog Field Connections

The P511 Analog board is an optional component. It may be fitted, omitted or replaced with one of the special function boards. Custom boards are also available, please contact the factory for more information.

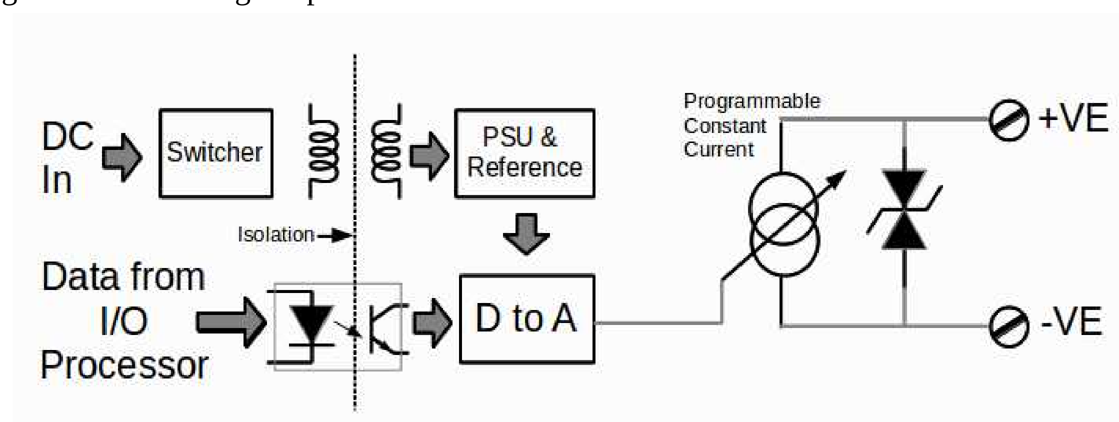
Assuming the Analog board has been specified, the following field I/O connectivity is available:-

- 2 Fully floating, current controlling, 14 bit 4-20mA Analog Outputs
- 6 Individually isolated 4-20mA (or 1-5V) high accuracy 24 bit Analog Inputs
- 2 4-wire 100 Ohm RTD measurement circuits. Note each RTD consumes one AnIn channel

Connection to the Analog expansion board is through Terminal Blocks TB3 and TB6.

3.5.1 4-20mA 14 bit Analog Outputs

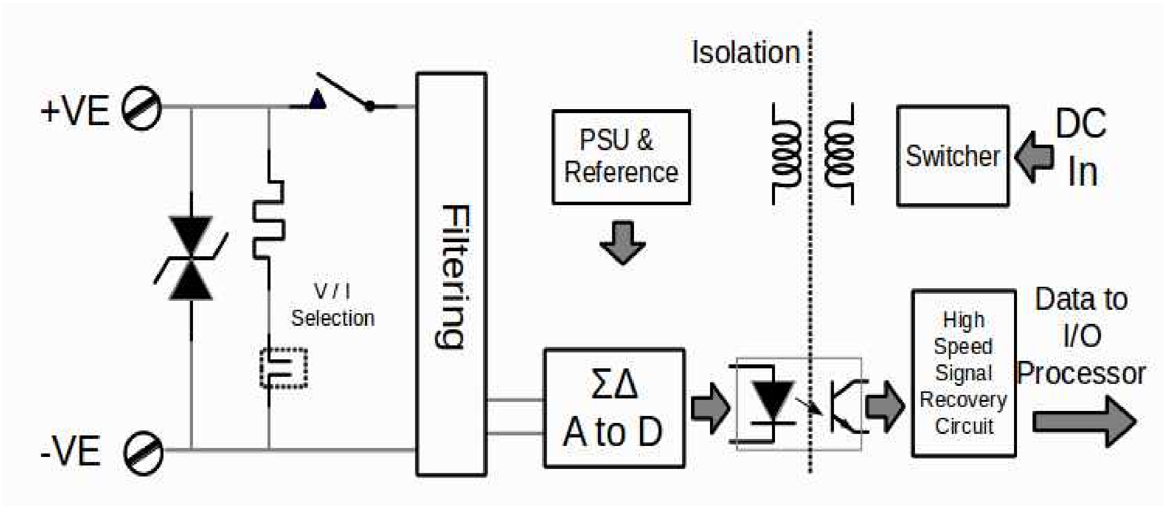
Two fully independent Galvanically isolated Analog Outputs are provided. These fully floating Analog Outputs can be connected to a positive source to provide a programmable current source or alternatively they can be connected to a negative return to give a programmable current sink. The block diagram of the Analog Output is shown below.



Pin	***Analog Output Channel No***	
	AnOut 1	**AnOut 2**
+ve Pin	TB3-11	TB3-13
-ve Pin	TB3-12	TB3-14

3.5.2 4-20mA (or 1-5 V) high accuracy 24bit Analog Inputs

The Analog board provides 6 identical, high accuracy Analog Input measurement circuits. Each input is Galvanically isolated from the other Analog inputs and every other field I/O point. The Analog Input can be used in both current mode or voltage mode (set by the removal of a jumper). In voltage mode, the Analog Inputs are very high impedance, both when powered up, and also when the unit is powered down. This allows one signal to be shared between several machines, and also allows the NÅNO-RTU2 to be used in parallel with other devices for diagnostic purposes. A block diagram of each channel is shown below.



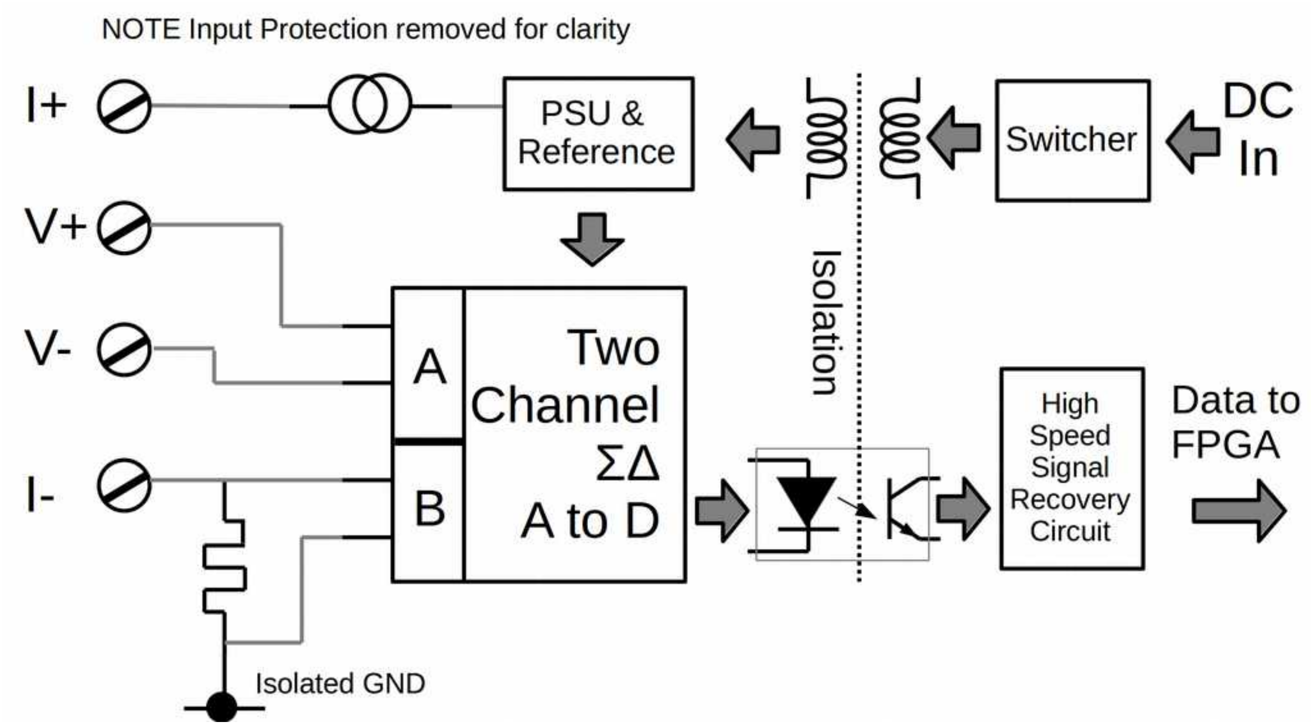
Pin	*Analog Input Channel Number*					
	AnIn 1	**AnIn 2**	**AnIn 3**	**AnIn 4**	**AnIn 5**	**AnIn 6**
+ve Pin	TB3-1	TB3-3	TB3-5	TB3-7	TB3-9	TB3-16
-ve Pin	TB3-2	TB3-4	TB3-6	TB3-8	TB3-10	TB3-17

3.5.3 4-wire 100 Ohm RTD measurement circuits

RTDs can be built with 2, 3 or 4 wire configurations. Two wire configurations are never suitable for Fiscal measurement purposes, and although 3 wire configurations can be used, in practice, wiring problems with the compensation cables can lead to unreliable results. As a result, the NÅNO-RTU2 only supports the 4-wire Kelvin connection method. This not only allows superior accuracy, but also enables signal integrity checks to be made for additional security of measurement.

The isolated power supply drives a 1mA signal through the field mounted Pt100 RTD element. This current develops a voltage across the RTD element which is measured by Channel A. The returned current is measured by developing a voltage across the internal precision shunt resistor by Channel B.

The Kelvin connections make the 4-wire RTD circuit virtually immune to cable impedance and the resistance of I.S. Barriers which may be used for hazardous area installations.



Pin	*RTD Measurement Channels 1 & 2*	
	RTD 1	**RTD 2**
I+	TB3-15	TB6-1
V+	TB3-16	TB3-9
V-	TB3-17	TB3-10
I-	TB3-18	TB6-2

Note, when RTD 1 is used, AnIn 6 is not available, and similarly, when RTD 2 is used, AnIn 5 is not available.

3.6 Jumper Settings

3.6.1 P513 Jumpers

There are no jumpers on the P513 NÅNO-RTU2 main-board, as any options are configured via the application (App).

3.6.2 P572 Communication board Settings

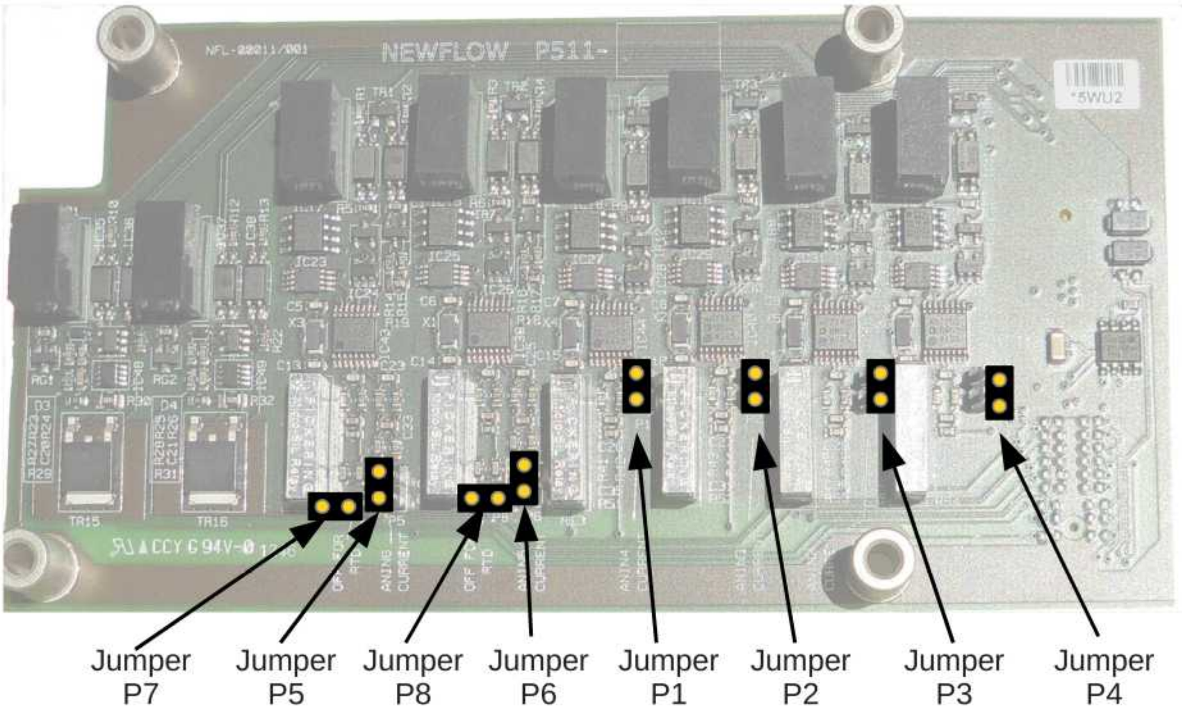
There are no jumpers on the P572 NÅNO-RTU2 Communications board, as any options are configured using MicroConf or the hexadecimal rotary Switch on the front panel, refer to section 5.2. Setting the Communication Links

3.6.3 P511 Analog Board Jumper Settings

The US version is defaulted to have all six channels in 4-20mA current mode .

The European version is configured with five Analog Input channels AnIn 1-5 all set to 4-20mA current mode and one channel (RTD 1) for 4 wire RTD temperature.

If this needs changing, refer to the drawing on the following page.



Jumper No.		RTD 1 or AnIn 6 Operating Mode
P7	**P5**	
ON	ON	AnIn 6 Current Mode
ON	OFF	AnIn 6 Voltage Mode
OFF	ON	Invalid Selection
OFF	**OFF**	**RTD 1 Mode**

Jumper No.		RTD 2 or AnIn 5 Operating Mode
P8	**P6**	
ON	**ON**	**AnIn 5 Current Mode**
ON	OFF	AnIn 5 Voltage Mode
OFF	ON	Invalid Selection
OFF	OFF	RTD 2 Mode

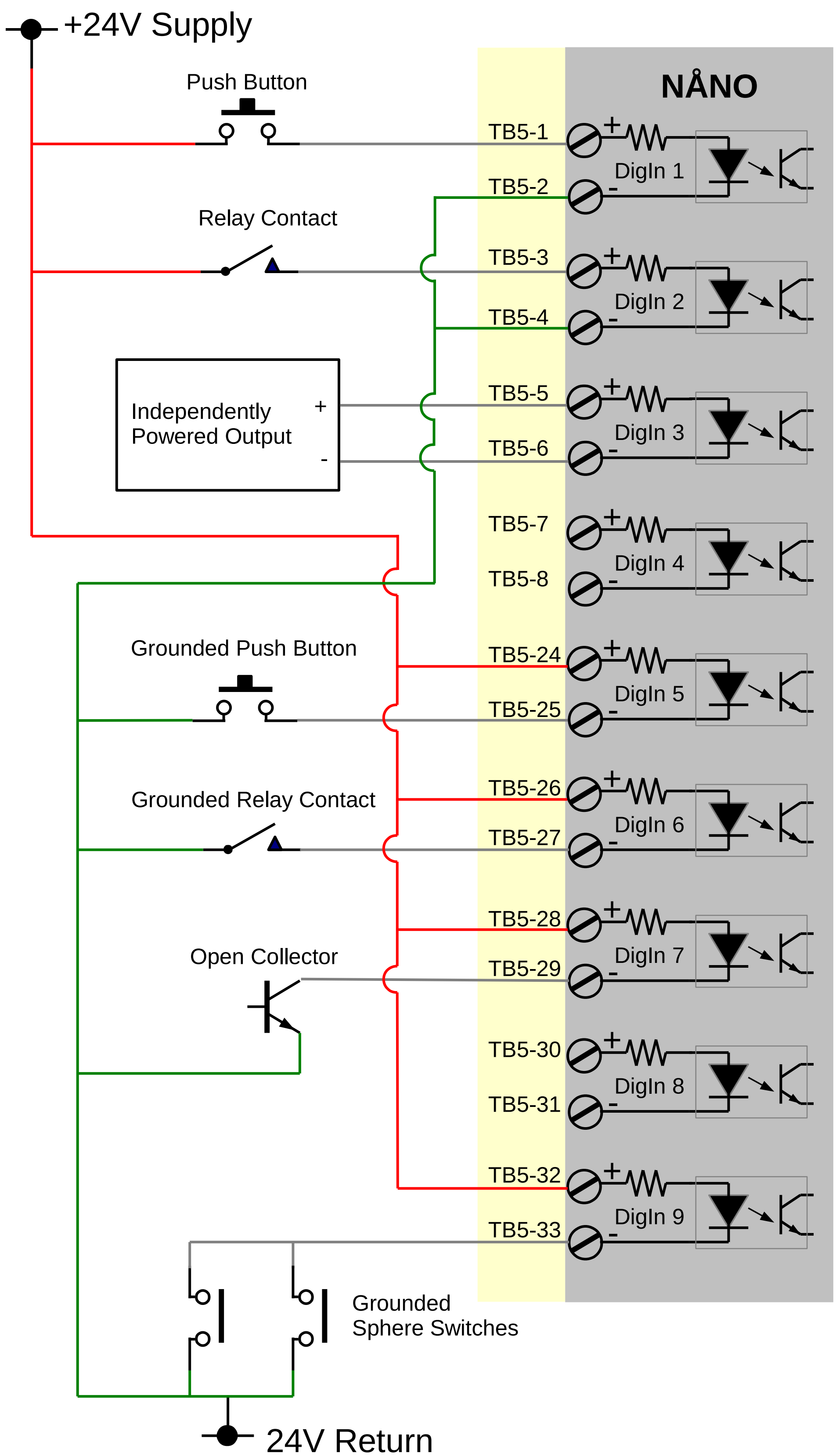
Jumper Number	Jumper **ON** = 4-20mA Mode Jumper OFF = 1-5V Mode
P1	AnIn 4 V/**I** Selection Jumper
P2	AnIn 3 V/**I** Selection Jumper
P3	AnIn 2 V/**I** Selection Jumper
P4	AnIn 1 V/**I** Selection Jumper

Refer to Appendix E for removal and re-fitting instructions and Appendix D lists the Jumpers and their functions.

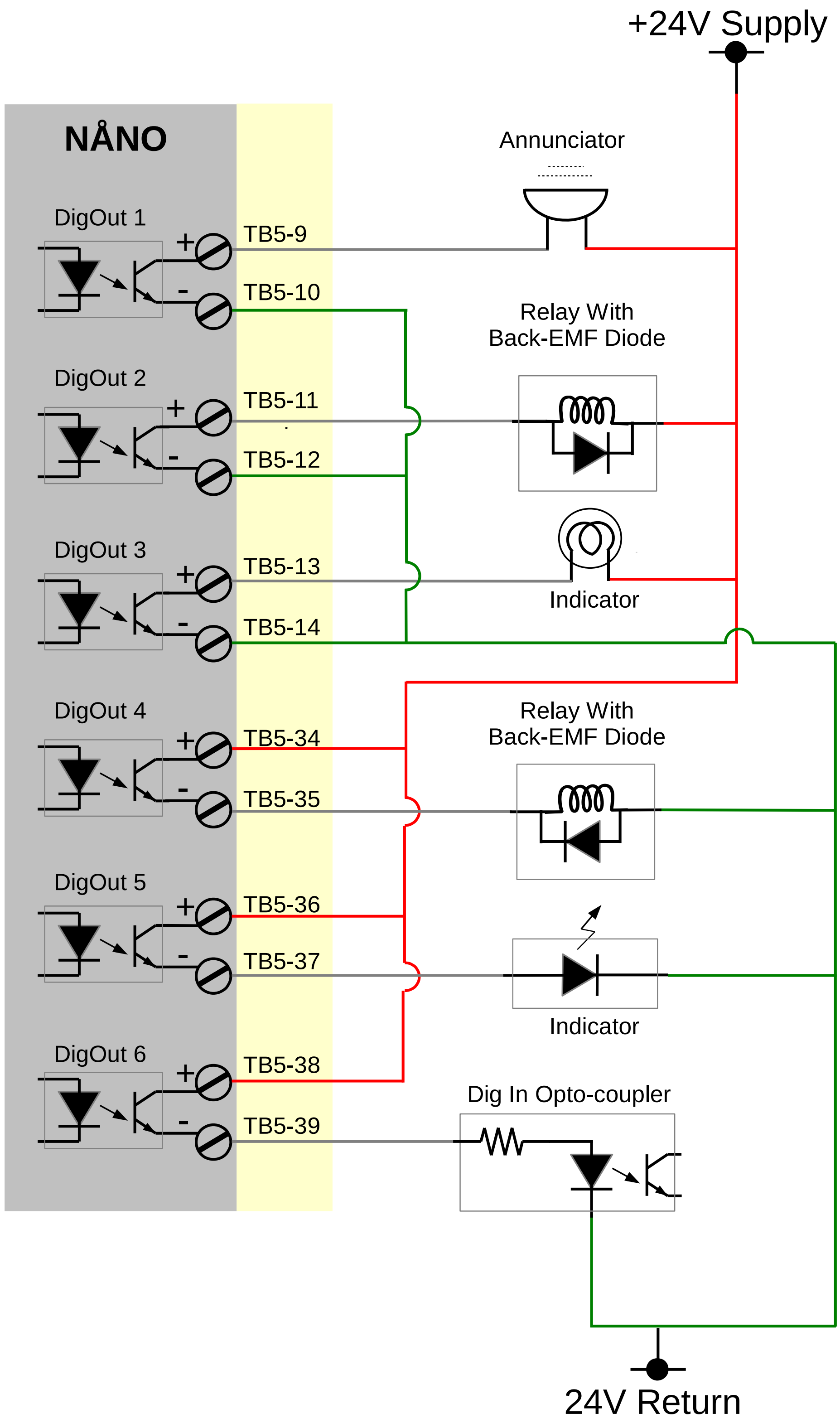
Please note, the jumpers can be factory configured in any arrangement for your convenience, please contact the factory for more information.

4 Loop Drawings

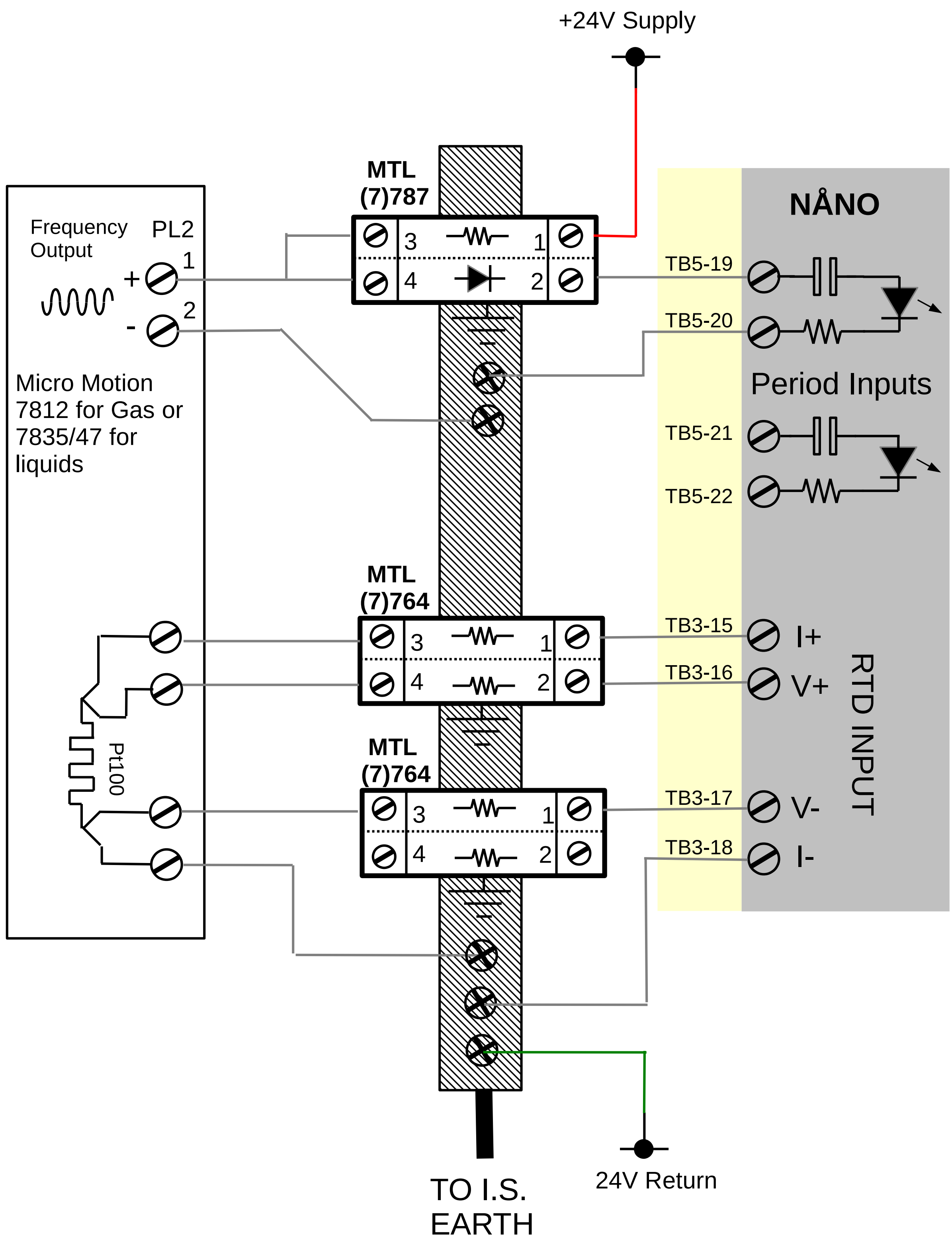
4.1 Digital Inputs



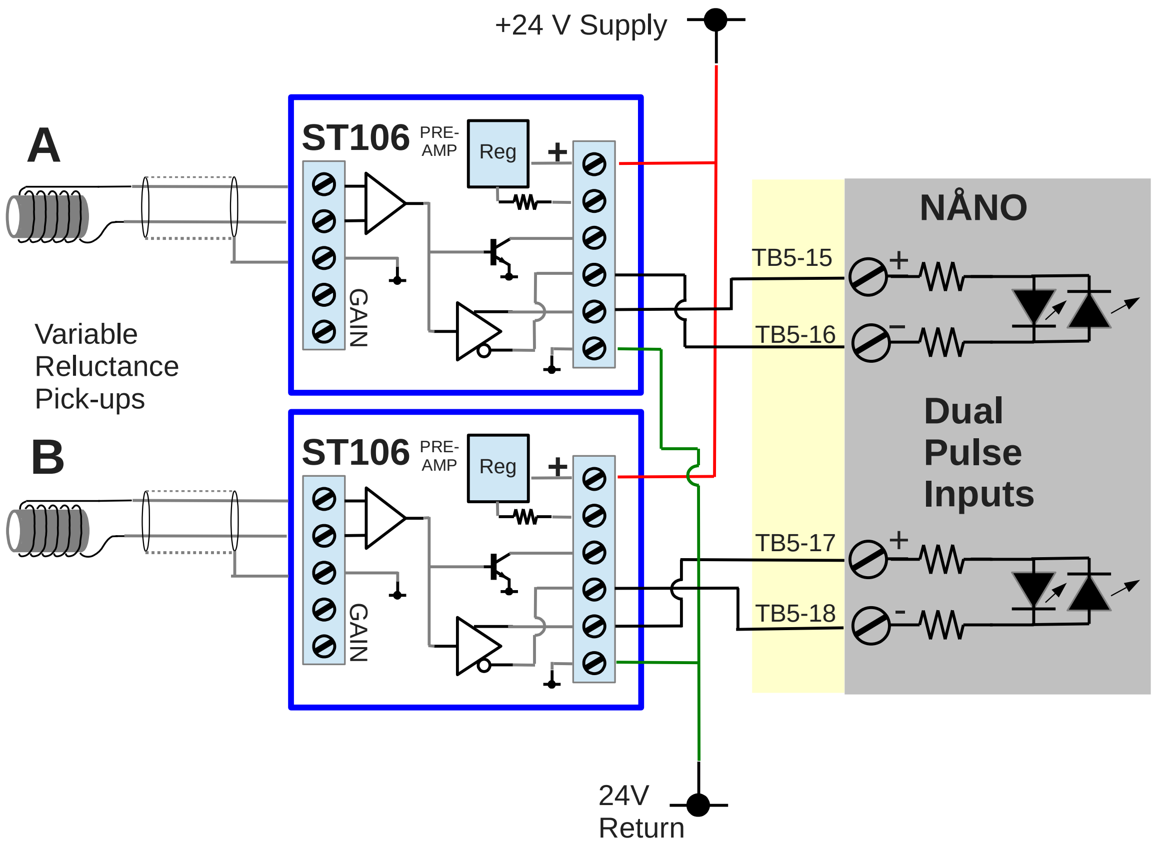
4.2 Digital Outputs

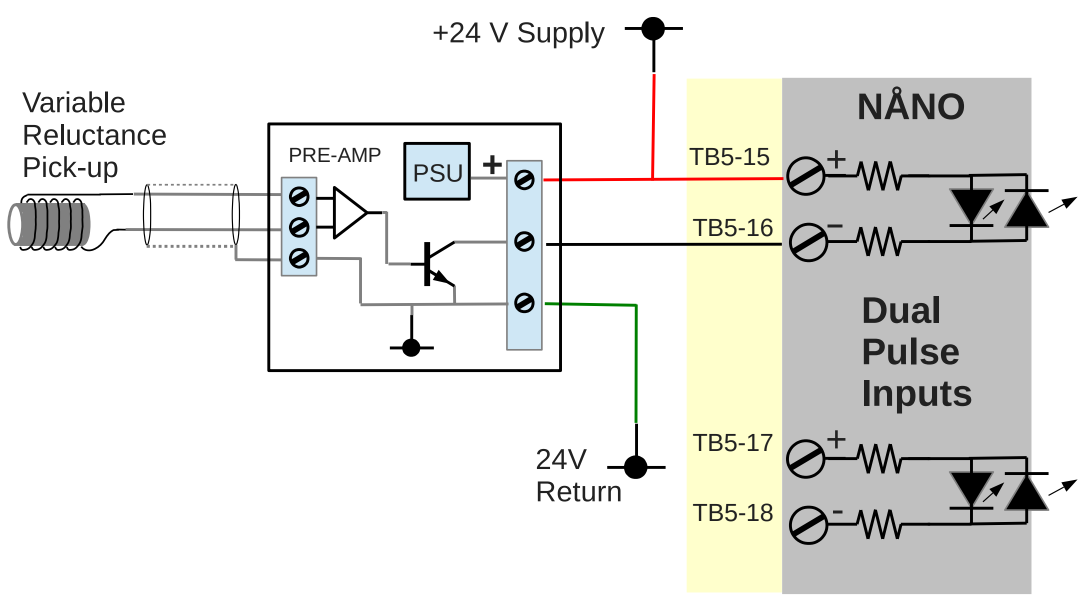


4.3 Period / Density Measurement Inputs with RTD

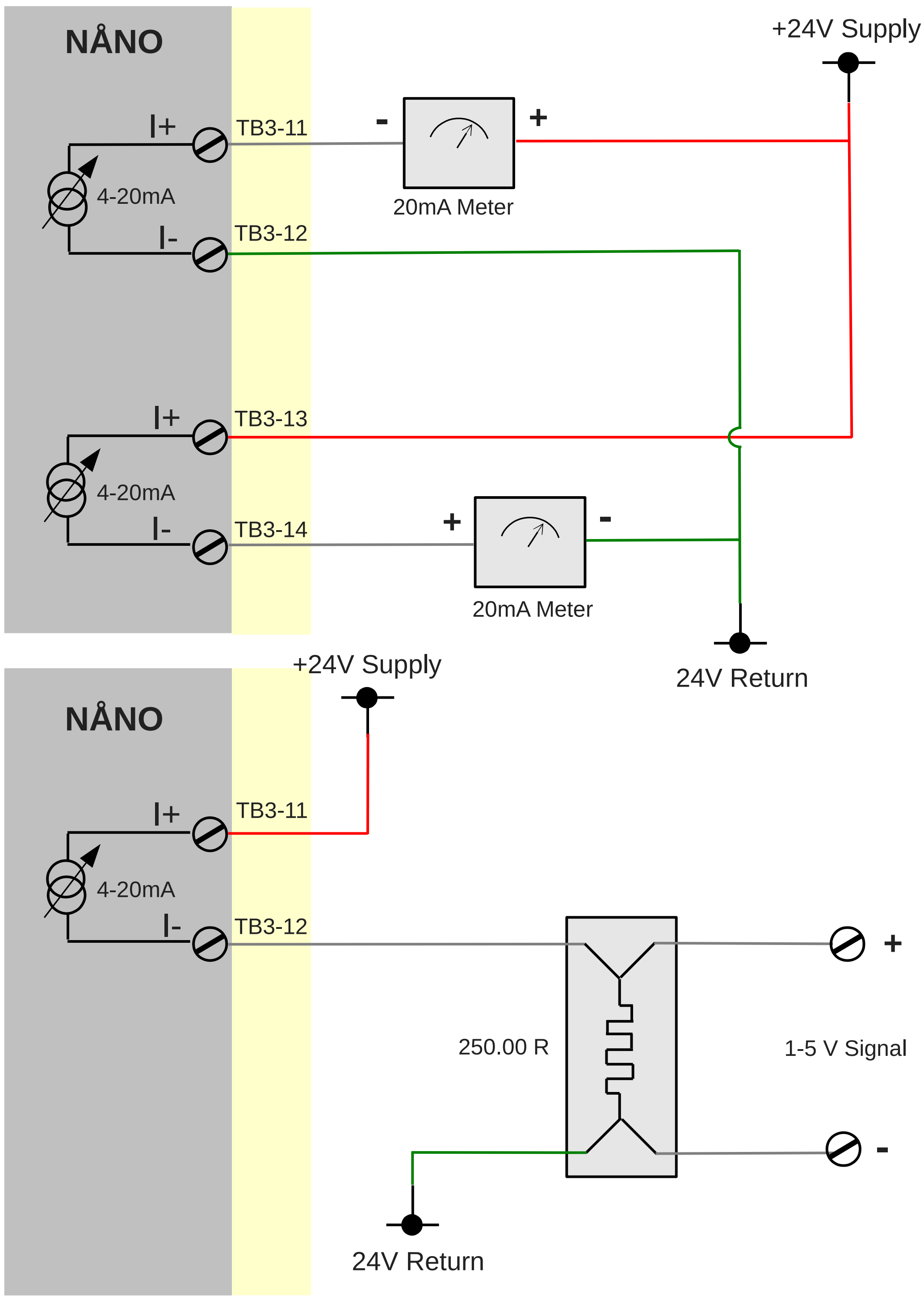


4.4 Dual Pulse Meter Input

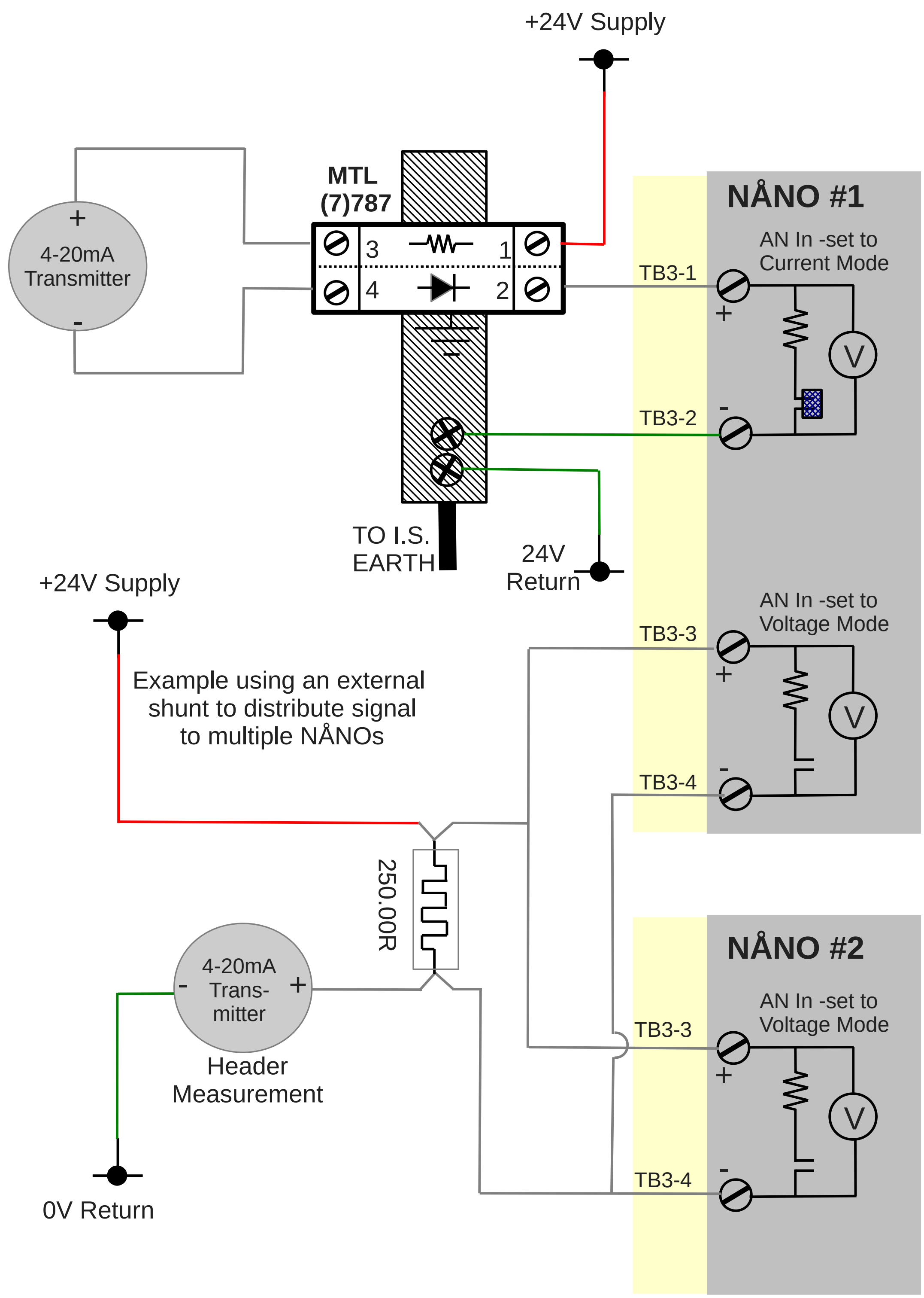




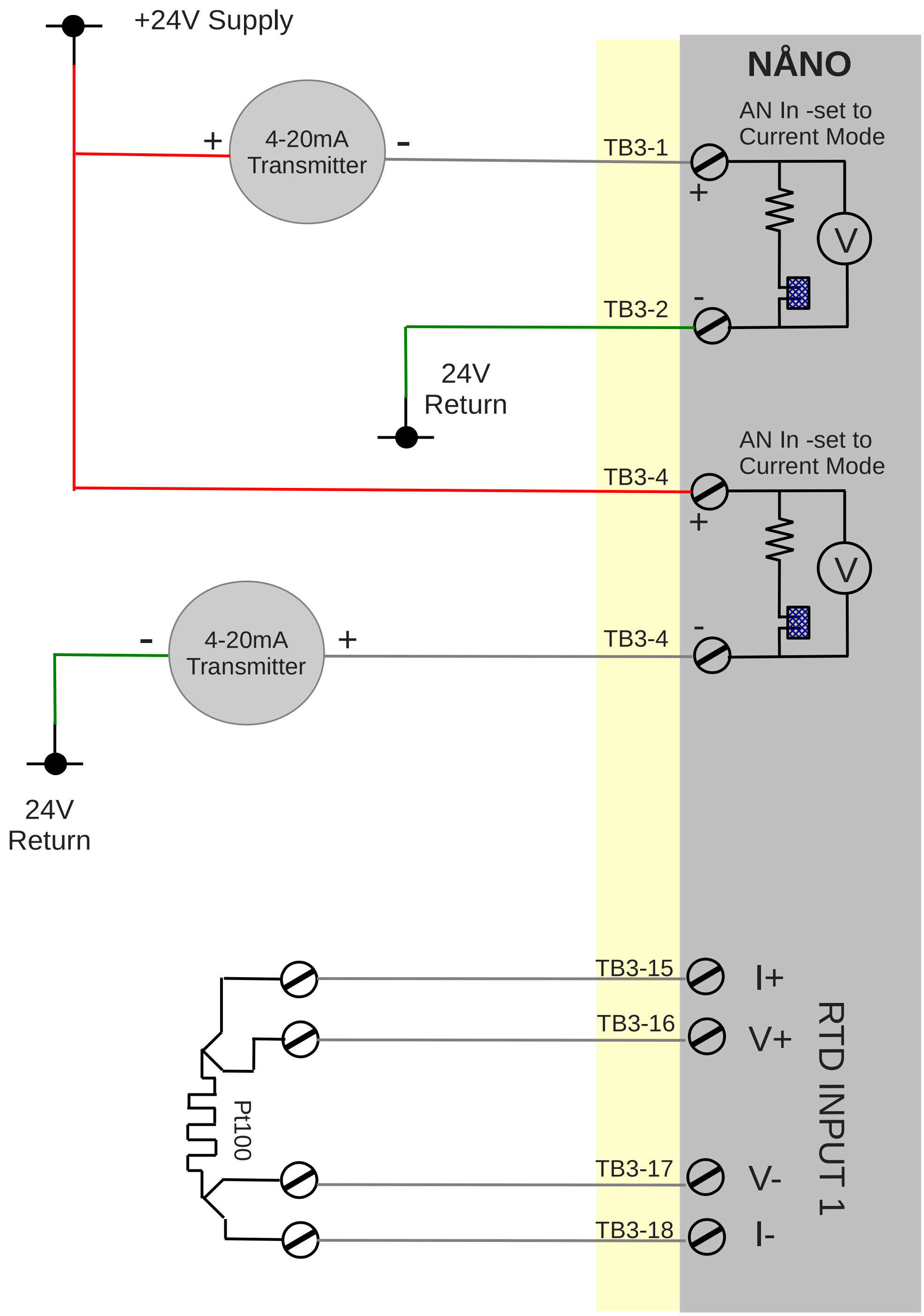
4.5 Analog Outputs



4.6 Analog Inputs

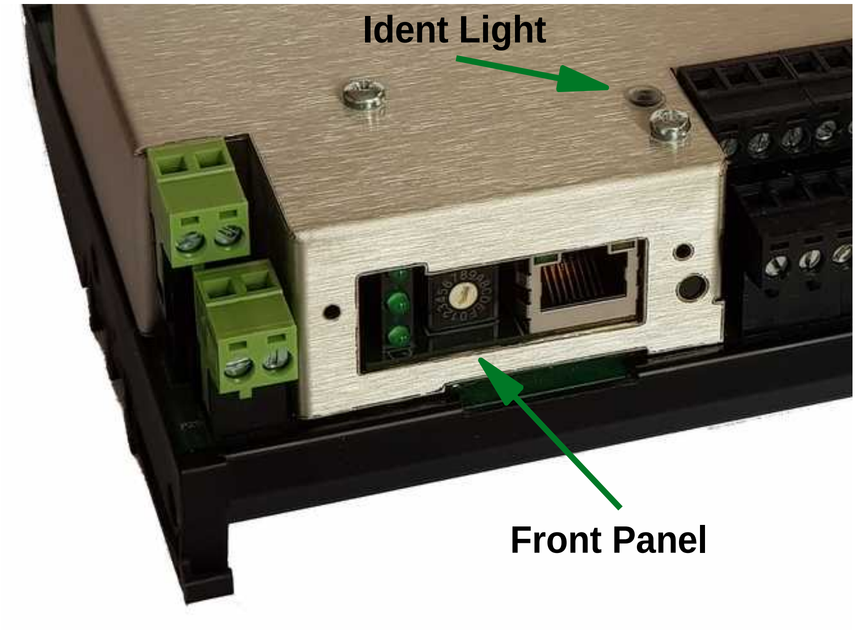


4.7 Analog Inputs, without barriers

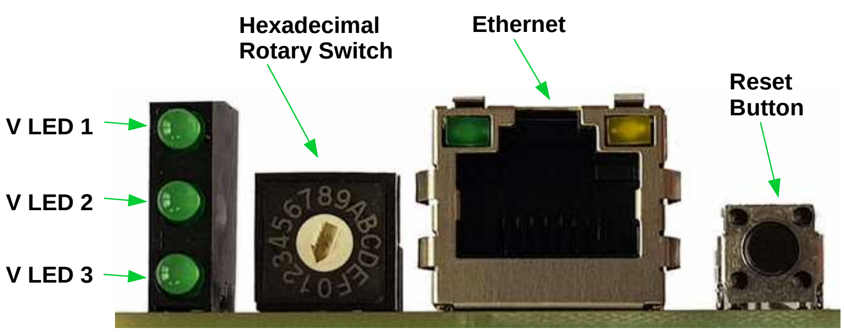


5 Setting up the NÅNO RTU

The image below shows the Ident Light and the Front Panel controls.



The image below shows the Front Panel controls with the vertical LED stack, the hexadecimal rotary switch and the reset button. To save against accidental pressing, the reset button is slightly hidden by being recessed behind a hole in the lid, which is NOT shown below for clarity.



5.1 Configuring the NÅNO-RTU2

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 the unit in PIU Mode, with 6 Current Inputs and NO Voltage Inputs

NOTE: Rotary Switch SW1 position 0 is pointing down wards.
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 Inputs
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 future use
A (10)	Reserved for future use

Table 1: Reserved Switch Positions

Rotary switch SW1 positions 1 through 9 are reserved as serial Modbus RTU Slave addresses, and are not applicable to PIU Mode

NOTE: For full details on configuring the NÅNO-RTU2, please refer to the P572 RTU2 - Software & Configuration Manual available from your vendor.

5.1.1 Ethernet Configuration

The P572 communications board has zero-conf network configuration method, and the IP address of the unit can be set using MicroConf, in the same way as a NÅNO flow computer is configured. Many of the other features, such as App management are not applicable to the NÅNO-RTU2 variant.

NOTE: Install MicroConf for easy Ethernet IP address administration.

NOTE: The Admin Password can be requested from the sales center.

5.1.2 Vertical LED lamp stack

The vertical LED stack is used to indicate the receipt of a valid data request from various sources.

- LED 1 (top LED) shows valid data received by COM2 (opto-isolated 2 Wire RS485)
- LED 2 (middle LED) shows valid data received by COM3 (4-Wire RS485)
- LED 3 (bottom LED) shows valid data received by the Ethernet port.

6 NÅNO-RTU2 Hardware Specification

6.1 Common Requirements

6.1.1 Mechanical

Length on Rail:	168mm
Height:	56mm
Width across Rail:	134mm
Weight:	650 grams
Structure:	PVC extrusion with stainless steel lid
Mounting:	35mm symmetrical Top Hat rail to EN50022 and asymmetric G-type rail to EN50035

6.1.2 Environmental

Temperature:	-40 to +85 °C operating -60 to +100 °C storage
Humidity:	Up to 95% non-condensing.
Safety classification:	For use in a safe area.
EMC:	EN55011:2009 with A1:2010, G1 Class A EN61000-4-3:2006+A1:2008+A2:2010, 10V/m EN61000-4-2:2009, ± 4kV Contact, ± 8kV Air EN61000-4-4:2004, ± 2kV DC Power, ± 1kV Signals EN61000-4-5:2006, 1kV line/line, 2kV line/earth EN61000-4-8:1993+A1:2001, 50Hz @ 30A/m

6.1.3 Power Supplies

Input Voltage range	11.5V to 28V D.C Suitable for 12V Solar powered systems
Input Current	Digital only version, typically 250mA @ 12V, 150mA @24V Analog Version, typically 350mA @ 12V, 200mA @24V
No of DC Inputs	2 off, allowing direct connection to redundant supplies
Galvanic isolation	Minimum of 50V RMS to Instrument Earth
Maximum Input Ripple	2V peak to peak
Input protection	Non-replaceable 1A Input Fuse

6.1.4 Clock

Accuracy	A capacitor supported calender is better than 10 Seconds per day, is provided on the P572 Communications board, but this is not currently supported in firmware

6.2 Serial Communications

Two serial ports are available in NÅNO-RTU2 mode.

COM2: is a half-duplex Galvanically isolated, very rugged RS485 port, and COM3: is a RS422 port driven in half-duplex mode so can act as either a 4-wire or 2-wire RS485 port. It is not opto-isolated.

Baud Rates supported	19,200 Baud, No Parity, 8 data bits, 1 stop bit (N,8,1)
Format	Modbus RTU

6.2.1 Differential Port, COM 2

Type	Ruggedized 2 Wire RS485
Isolation	Galvanically Isolated, minimum 50V RMS from Instrument Earth
Signals supplied	+ve, -ve, Screen.

6.2.2 Differential Port, COM 3

Standard supported	RS485 (2-wire and 4-wire).
Signals supplied	Tx+, Tx-, Rx+, Rx-, Screen
Biasing	Weak pull-up on receive lines

6.3 Ethernet

No of Ports	1
Speed	10 Mbps
Media Connectivity	Twisted pair utilising Standard RJ45 (on terminal Board)
Protocol	Supports TCP/IP, UDP, HTTP, XML, ModbusTCP

6.4 Field I/O Number & Type

Field I/O Type	# of Channels	Pins Used	Isolated	Use or Comment
ADC Inputs	6	12*	Yes	1-5V or 4-20mA
4 wire RTD	2	8*	Yes	1mA sense current
Density/Frequency Input	2	4	Yes	High sensitivity, AC Coupled input
Dual Pulse/Ratiometric Input	1	4	Yes	For Level A, B or E
Digital Input	9	18	Yes	Also used as Sphere Switch input
Digital O/P	6	12	Yes	General Purpose
Pulse Output	2	4	Yes	Totals outputs, can be used as Digital Outputs
Analog Outputs	2	4	Yes	Each fully isolated
Stream Watchdog/ Alarm relay	1	4	Yes	One Normally Closed and one Normally open Contact
Raw Pulse Bus	1	2	No	Differential Bus, enable & direction set by application

* Each RTD circuit consumes one Analog Input measurement circuit

The following sections 6.5 to 6.11 are common to all products. Sections 6.12 to 6.15 only apply if the optional Analog board has been ordered.

6.5 Digital Status Inputs

Configuration	Individually opto-isolated inputs
Maximum Input Voltage	30V
Minimum Input on Voltage	10V
Maximum Input off voltage	3.0V
Input Impedance	2-2.5K Ohm typical
Protection	Surge and reverse voltage protection
Additional Features	Filtering and fleeting input detection provided

6.6 Digital Status Outputs

Configuration	Individually Galvanically isolated
Max Output Current	100mA
Max Output Saturation Voltage	2.1V @ 100mA
Max Output Standoff Voltage	32V, limited by input protection
When off/Reset/Power on State	All digital outputs OFF

6.7 Frequency/Density Meter

Configuration	AC Coupled, Galvanically Isolated, with active limiting
Sensitivity	3.0V peak to peak minimum
Maximum Input Voltage	24V peak to peak
Input current	Internally limited to 3mA
Frequency Range	50Hz to 5 kHz
Accuracy of period measurement	2.5 ppm
Resolution	5 Nanoseconds

6.8 Flow Meter Pulses

Input Type	Can use "best in class" differential mode or single ended.
Configuration	Opto-coupled inputs.
Input signal levels	± 3.5V to ± 24V
Input current minimum	5mA
Frequency range	DC to 10 kHz.
Line Integrity	Dual back-to-back opto isolators, allowing full quiescent line and electronic integrity testing, when used with differential pre-amps and VS300 pulser.
Dual Pulse compliance	IP 252/76, ISO6551 or API ch. 5.5 level A or B, with line integrity, even when static

6.9 Raw Pulse Bus

Configuration	Digital Ground referenced Differential transceiver
Gating & Direction	Software controlled
Use	To bus together multiple streams to a common prover
Signalling	RS422 Compatible drive & receive levels
Max output frequency	10 KHz

6.10 Pulse Outputs

Configuration	Individually Isolated
Max Output Current	100mA
Max Output Saturation Voltage	2.1V @ 100mA
Max Output Standoff Voltage	32V, limited by TVS diode
Frequency range	DC to 100Hz

6.11 Alarm Relay

Contact Form	Both Form A (Normally Open) & Form B (Normally Closed)
Max current	1A
Max Voltage	32V, limited by input protection
Maximum Power	30VA
Control	Released on de-power or watchdog restart or software command.

The specifications below, 6.12 to 6.15, apply to the P511 general purpose analog expansion board

6.12 Analogue Inputs

Type of Inputs	1 to 5 Volt or 4-20mA nominal input type
Isolation	All channels individually isolated to 50V RMS in voltage and current input mode
Conversion Method:	24 bit Sigma-Delta ADC
Effective resolution:	More than 18 bits, auto zero, auto calibrate
Conversion time:	Less than 100 mSec per channel
Scan Rate	All channels can be acquired simultaneously
Series mode rejection:	>100 dB at 50 Hz and 60 Hz
Voltage Common mode range:	± 50V relative to computer ground or other input
Calibration Period	3 Years to ± 0.02% of reading

6.13 ADC Inputs Voltage & Current Mode

Type of Input	Differential voltage inputs
Input Range	0 to +5.25 V or 0 to 22mA
Accuracy:	± 0.005% of reading from 1.0 to 5.25 Volts at 23°C
+5°C to +45°C	± 0.020% of reading from 1.0 to 5.25 Volts and ± 0.025% of reading from 4.0 to 22.0mA
-10°C to +60°C	± 0.030% of reading from 1.0 to 5.25 Volts and ± 0.040% of reading from 4.0 to 22.0mA
-40°C to +85°C	± 0.050% of reading from 1.0 to 5.25 Volts and ± 0.065% of reading from 4.0 to 22.0mA

6.14 RTD Inputs

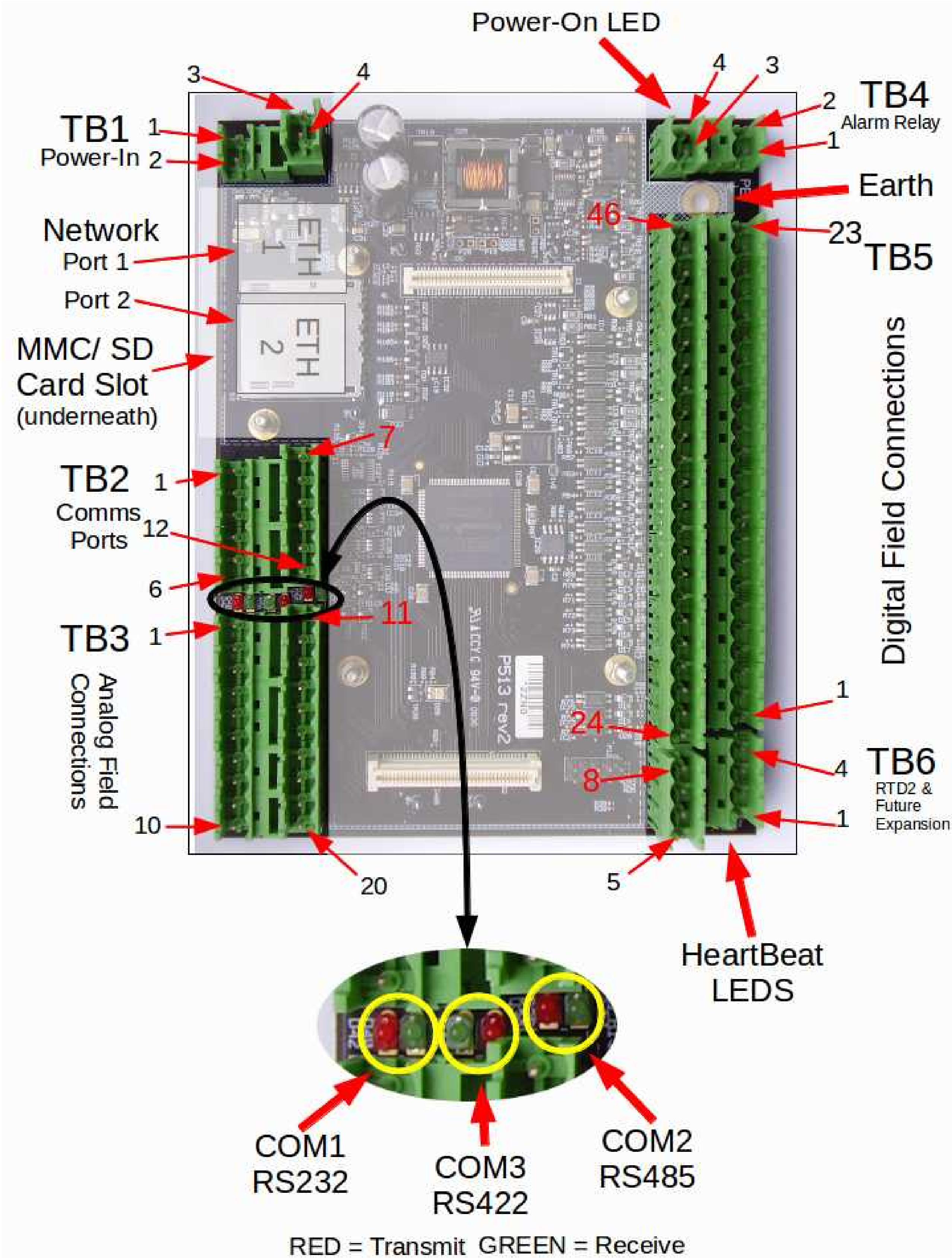
Type of Input	4 wire Kelvin connection using Pt 100 RTD
Temperature measuring range:	-100°C to +300°C
Resolution:	0.01°C
Accuracy:	± 0.05°C, -100°C to 200°C and ± 0.1°C to +300°C
PRT cables	Loop resistance up to 600 Ohms
Security	Continuous cable integrity tests for excitation current and voltages allow open and short circuit detection
RTD current sources	1mA nominal
3 Wire Mode	Not Supported

6.15 Analogue Outputs

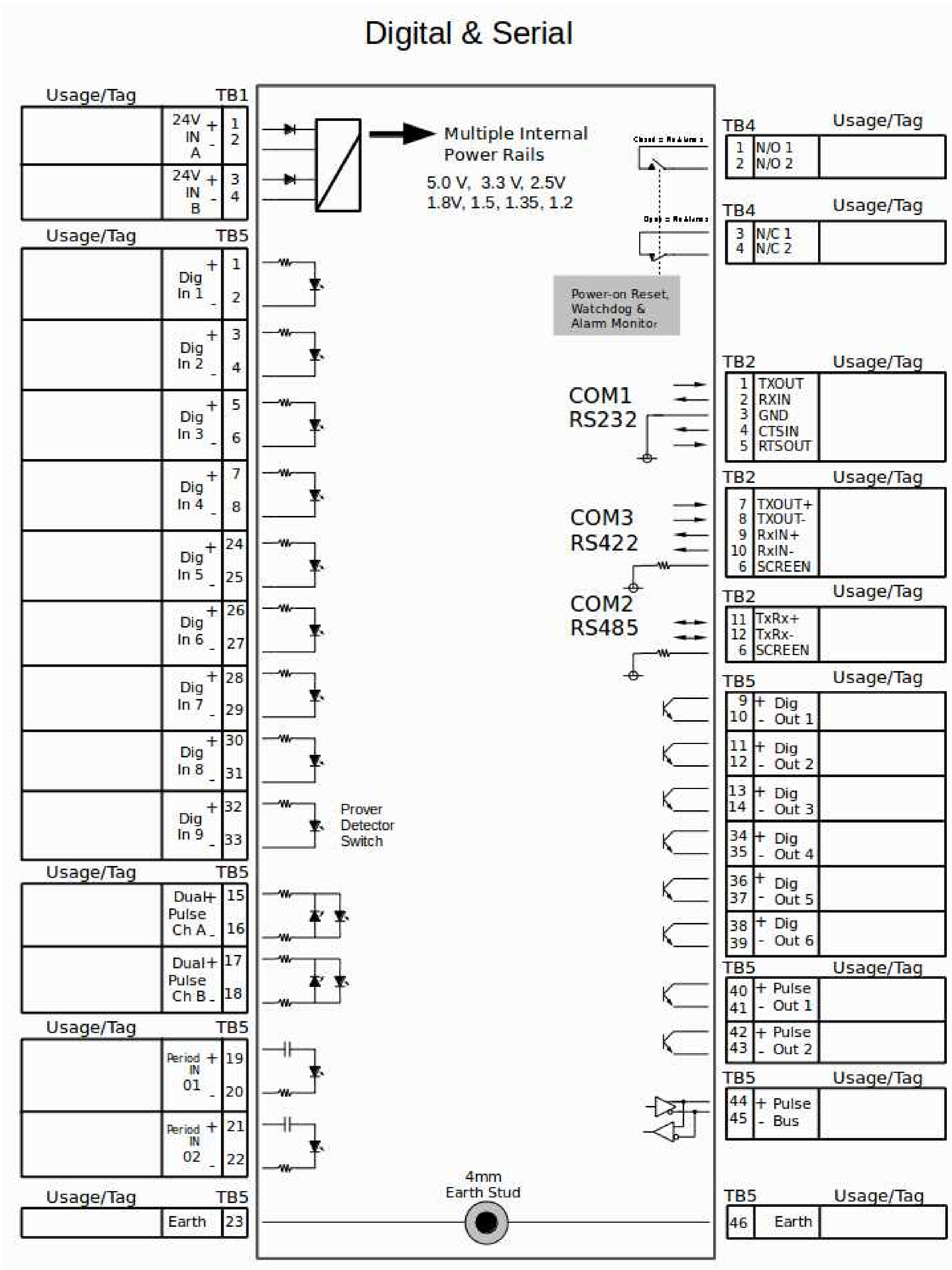
Type	Each channel is an individually isolated current controlled 0 to 21mA output, that can be used to sink or source power
Resolution:	14 bits
Accuracy:	± 0.1% at 23°C
Temperature Coefficient:	10ppm / °C
Minimum Load Loop resistance:	Safe down to zero ohms from +32V external supply
Maximum Load Loop resistance:	1000 Ohms when powered from +24V external
Maximum External Supply	32 Volts
Output Form:	Isolated active current controller
Number of field connections	2 terminals per channel
Update time	500mSec to within 1%

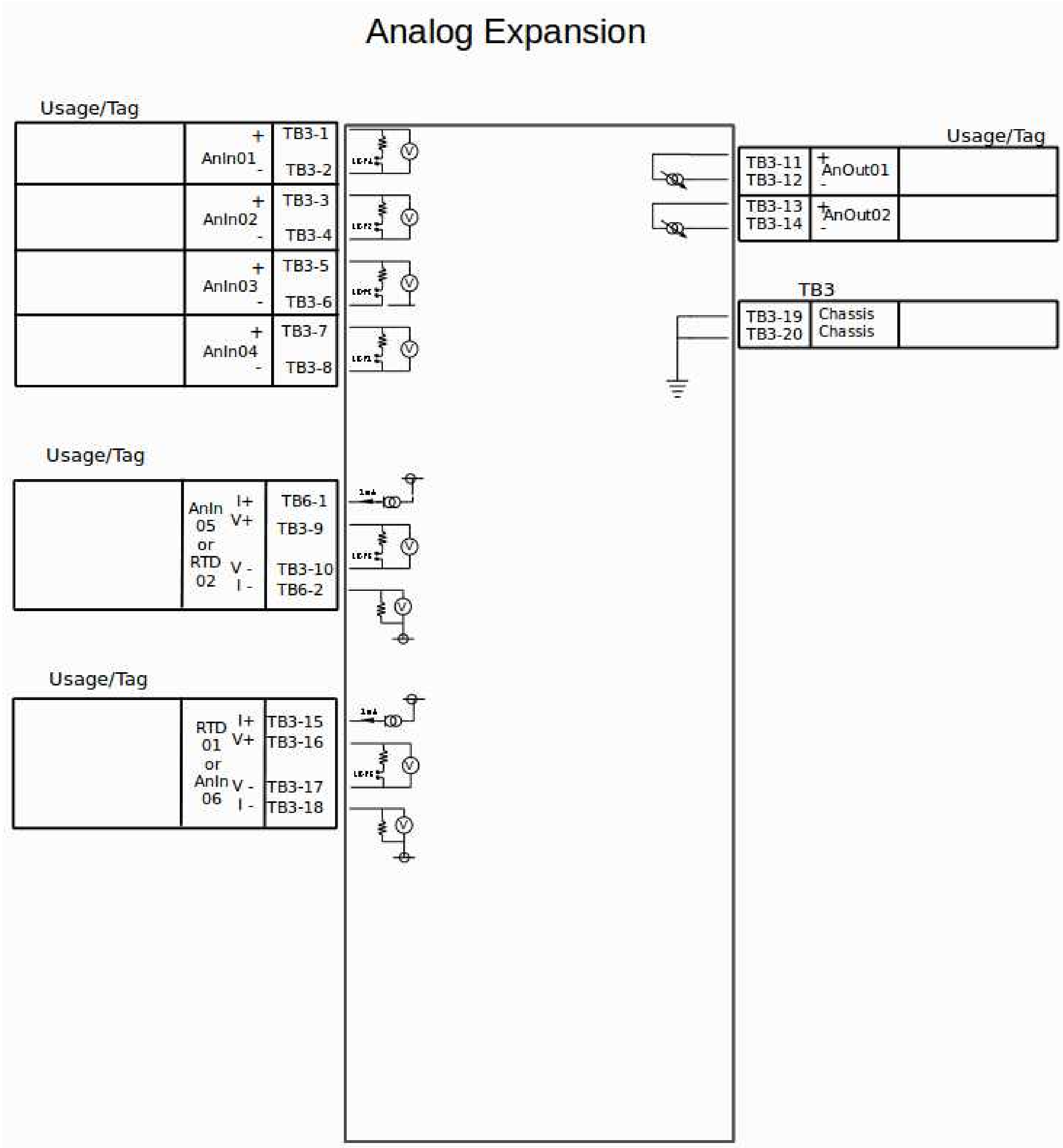
Appendix A – Terminal Block Layout

NOTE: There is only one Ethernet port available in a NÅNO-RTU2, and the MMC/SD card slot is not usable in the RTU variant.



Appendix B – Input & Output Block Diagram




Analog Expansion
Usage/Tag
AnIn01 + -
TB3-1
TB3-2
AnIn02 + -
TB3-3
TB3-4
AnIn03 + -
TB3-5
TB3-6
AnIn04 + -
TB3-7
TB3-8
Usage/Tag
AnIn 05 or RTD 02
I+
V+
V -
I -
TB6-1
TB3-9
TB3-10
TB6-2
Usage/Tag
RTD 01 or AnIn 06
I+
V+
V -
I -
TB3-15
TB3-16
TB3-17
TB3-18
Usage/Tag
TB3-11 + AnOut01
TB3-12 -
TB3-13 + AnOut02
TB3-14 -
TB3
TB3-19 Chassis
TB3-20 Chassis

Appendix C – Pin Out Assignment Schedule

Pin Out Assignment Schedule

TB1 Lower Row

Pin Number	Usage	Description
1	24V PSUA +	24V from Main Power Supply
2	24V PSUA -	

TB1 Upper Row

Pin Number	Usage	Description
3	24V PSUB +	24V from Backup Power Supply
4	24V PSUB -	

TB2 Lower Row

Pin Number	Usage	Description
1	COM1 RS232 TXOUT	General Purpose RS232 Port with handshaking, so suitable for printer driving, Modem or other communications
2	COM1 RS232 RXIN	
3	COM1 RS232 GND	
4	COM1 RS232 CTSIN	
5	COM1 RS232 RTSout	
6	COM2/3 SCREEN	

TB2 Upper Row

Pin Number	Usage	Description
7	COM3 RS422/485 TXOUT+	General Purpose RS422 or 4-wire RS485 port that can be connected as a 2-wire RS485 port
8	COM3 RS422/485 TXOUT-	
9	COM3 RS422/485 RXIN+	
10	COM3 RS422/485 RXIN-	
11	COM2 COMMS RS485 A	Ultra-hardened RS485 port for Field use
12	COM2 COMMS RS485 B	

TB3 Lower Row

Pin Number	Usage	Description
1	ANIN01 +	1-5 V or 4-20 mA Analog In
2	ANIN01 -	Isolated from other chanels
3	ANIN02 +	As above, but for Analog Input
4	ANIN02 -	Channel 2
5	ANIN03 +	As above, but for Analog Input
6	ANIN03 -	Channel 3
7	ANIN04 +	As above, but for Analog Input
8	ANIN04 -	Channel 4
9	ANIN05 + / RTD02 V+	1-5 V or 4-20 mA Analog or RTD
10	ANIN05 - / RTD02 V-	Ch2 Voltage Sensing

TB3 Upper Row

Pin Number	Usage	Description
11	ANOUT01 +	Fully Isolated current mode
12	ANOUT01 -	Analog Output
13	ANOUT02 +	As above, but for Analog Output
14	ANOUT02 -	Channel 2
15	RTD01 I+	4-wire RTD (PT100) which can be used as a sixth Analog input in either 4-20 mA or 1-5V mode
16	RTD01 V+ / ANIN06+	
17	RTD01 V- / ANIN06-	
18	RTD01 I-	
19	INSTRUMENT EARTH	
20	INSTRUMENT EARTH	Can be connected to a clean earth

TB4 Lower Row

Pin Number	Usage	Description
1	Alarm Relay N/O 1	Normally Open contacts isolated
2	Alarm Relay N/O 2	from N/C Pair

TB4 Upper Row

Pin Number	Usage	Description
3	Alarm Relay N/C 1	Normally Closed contacts isolated
4	Alarm Relay N/C 2	from N/O Pair

TB5 Lower Row

Pin Number	Usage	Description
1	DIGIN01 +	Isolated Digital Input
2	DIGIN01 -	Channel No. 1
3	DIGIN02 +	Isolated Digital Input
4	DIGIN02 -	Channel No. 2
5	DIGIN03 +	Isolated Digital Input
6	DIGIN03 -	Channel No. 3
7	DIGIN04 +	Isolated Digital Input
8	DIGIN04 -	Channel No. 4
9	DIGOUT01 +	Isolated Digital Output
10	DIGOUT01 -	Channel No. 1
11	DIGOUT02 +	Isolated Digital Output
12	DIGOUT02 -	Channel No. 2
13	DIGOUT03 +	Isolated Digital Output
14	DIGOUT03 -	Channel No. 3
15	PLSINA +	Meter Pulse Input Channel A
16	PLSINA -	
17	PLSINB +	Meter Pulse Input, use with Ch A
18	PLSINB -	for Dual Pulse Input
19	PERIODIN01 +	Isolated Density Meter input
20	PERIODIN01 -	channel No. 1
21	PERIODIN02 +	Isolated Density Meter input
22	PERIODIN02 -	channel No. 2
23	INSTRUMENT EARTH	For connection to Clean Earth

TB5 Upper Row

Pin Number	Usage	Description
24	DIGIN05 +	Isolated Digital Input
25	DIGIN05 -	Channel No. 5
26	DIGIN06 +	Isolated Digital Input
27	DIGIN06 -	Channel No. 6
28	DIGIN07 +	Isolated Digital Input
29	DIGIN07 -	Channel No. 7
30	DIGIN08 +	Isolated Digital Input
31	DIGIN08 -	Channel No. 8
32	Detector +	Sphere Switch input or Digital
33	Detector -	Input Channel No. 9
34	DIGOUT04 +	Isolated Digital Output
35	DIGOUT04 -	Channel No. 4
36	DIGOUT05 +	Isolated Digital Output
37	DIGOUT05 -	Channel No. 5
38	DIGOUT06 +	Isolated Digital Output
39	DIGOUT06 -	Channel No. 6
40	PLSOUT01 +	Isolated Pulse Output Channel
41	PLSOUT01 -	No. 1 Can be used as DIGOUT
42	PLSOUT02 +	Isolated Pulse Output Channel
43	PLSOUT02 -	No. 2 Can be used as DIGOUT
44	RAWPLS +	Bidirectional Pulse Bus for meter
45	RAWPLS -	proving
46	INSTRUMENT EARTH	For connection to Clean Earth

TB6 Lower Row

Pin Number	Usage	Description
1	RTD02 I+	RTD (PT100) Channel No.2
2	RTD02 I-	Current connections
3	Future Expansion	Not Currently Allocated
4	Future Expansion	

TB6 Lower Row

Pin Number	Usage	Description
5	Future Expansion	Not Currently Allocated
6	Future Expansion	
7	Future Expansion	
8	Future Expansion	

Appendix D – Expansion Board P511 G.P. Analog - Jumpers

Jumper (Link)	Function	**Values** (defaults are shown in **bold**)
P1	AnIn4 Mode	OFF : Voltage (1-5V) Mode **ON : Current (4-20mA) Mode**
P2	AnIn3 Mode	OFF : Voltage (1-5V) Mode **ON : Current (4-20mA) Mode**
P3	AnIn2 Mode	OFF : Voltage (1-5V) Mode **ON : Current (4-20mA) Mode**
P4	AnIn1 Mode	OFF : Voltage (1-5V) Mode **ON : Current (4-20mA) Mode**
P5 & P7	AnIn6/RTD01 Mode	**P5 OFF, P7 OFF : RTD Mode** P5 OFF, P7 ON : Voltage (1-5V) Mode P5 ON, P7 OFF : Invalid P5 ON, P7 ON : Current (4-20mA) Mode
P6 & P8	AnIn5/RTD02 Mode	P6 OFF, P8 OFF : RTD Mode P6 OFF, P8 ON : Voltage (1-5V) Mode P6 ON, P8 OFF : Invalid **P6 ON, P8 ON : Current (4-20mA) Mode**

Appendix E – Removing and replacing the boards.

If the jumpers on the Analog board need to be changed then the lid of the unit will need to be removed.

For certain metrology approved applications, alternative lid fixings may be used that cannot be removed without breaking the wire, that is used as a tamper proof "seal". In these applications, approval may need to be gained before the lid can be removed. For all other applications, the lid can be removed after 5 off, M3 Pozi-drive pan head screws are withdrawn from the top of the unit, and the M4 x 25 stand-off is unscrewed from the PE earthing stud, that secures the lid and provides and electrical connection to Protective Earth (PE) to give enhanced ESD and EMC shielding.

Removal Sequence

Removing stand-off

Firstly remove the stand-off which secures the lid earth tag.

If the adjacent connectors are fitted, a 9/32" or 7mm socket driver can be used, as illustrated above, however, if the adjacent connectors are removed, the stand-off can be easily removed using a pair of pliers.

Screw #1 is next to the Ident Light, and above the Ethernet connector. This screw is always a short M3x6mm pozidrive pan head screw with integral washer.

If no analog board or other expansion board is fitted, the other 4 screws will also be the same short screw as for position #1

If however, an Analog board or other expansion board has been specified, the other 4 screws will be M3x20mm pozidrive pan head screw with a separate spring washer.

The lid is now free and can removed by lifting it vertically away from the base.

Re-fitting Sequence

The lid should be gently slid back into position, taking care that the earth tag slips over the earth stud. The screws can be refitted in any order and the stand-off should be screwed back onto the earth stud.

Appendix F – Enclosure Label