Newflow

NÅNO

Generation 3

Hardware & Installation Manual

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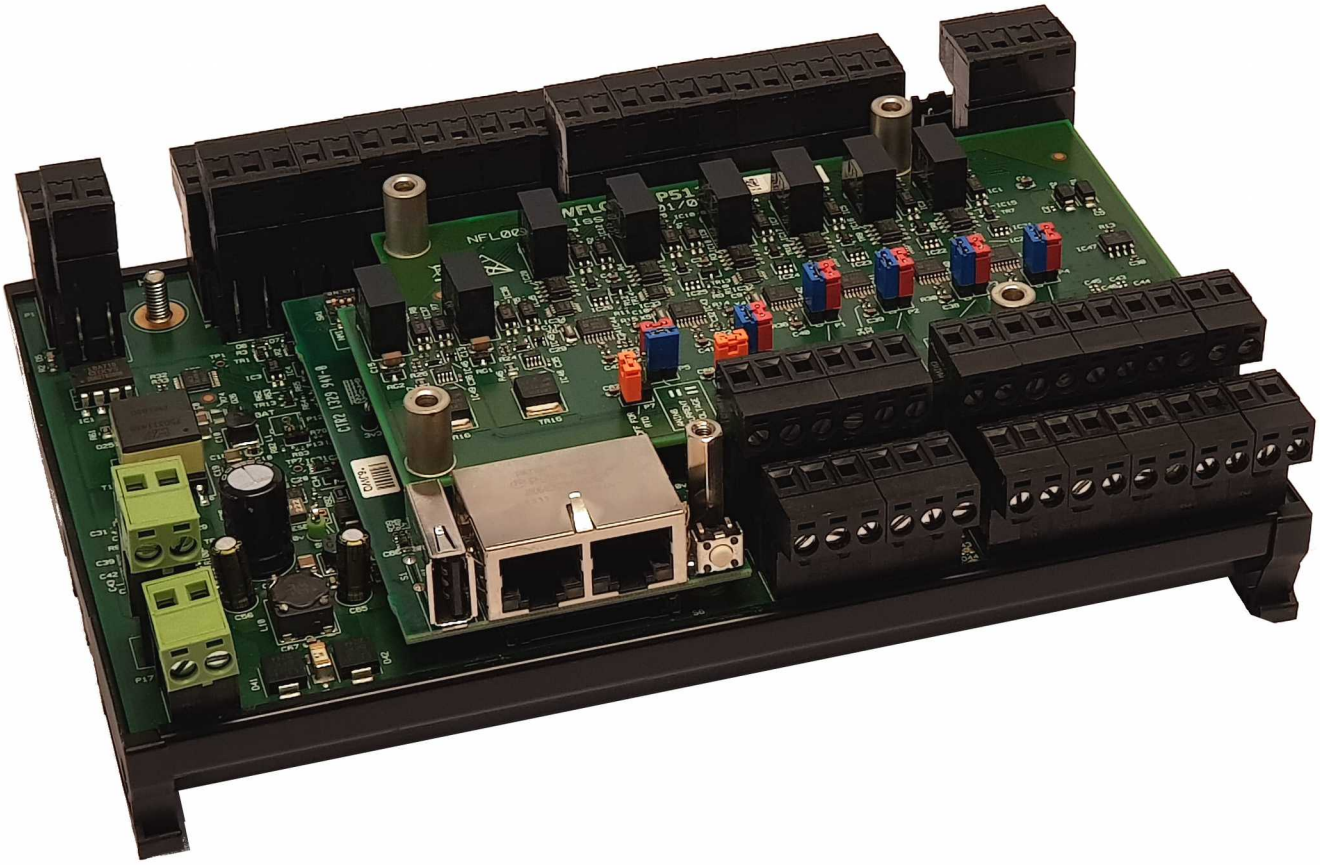


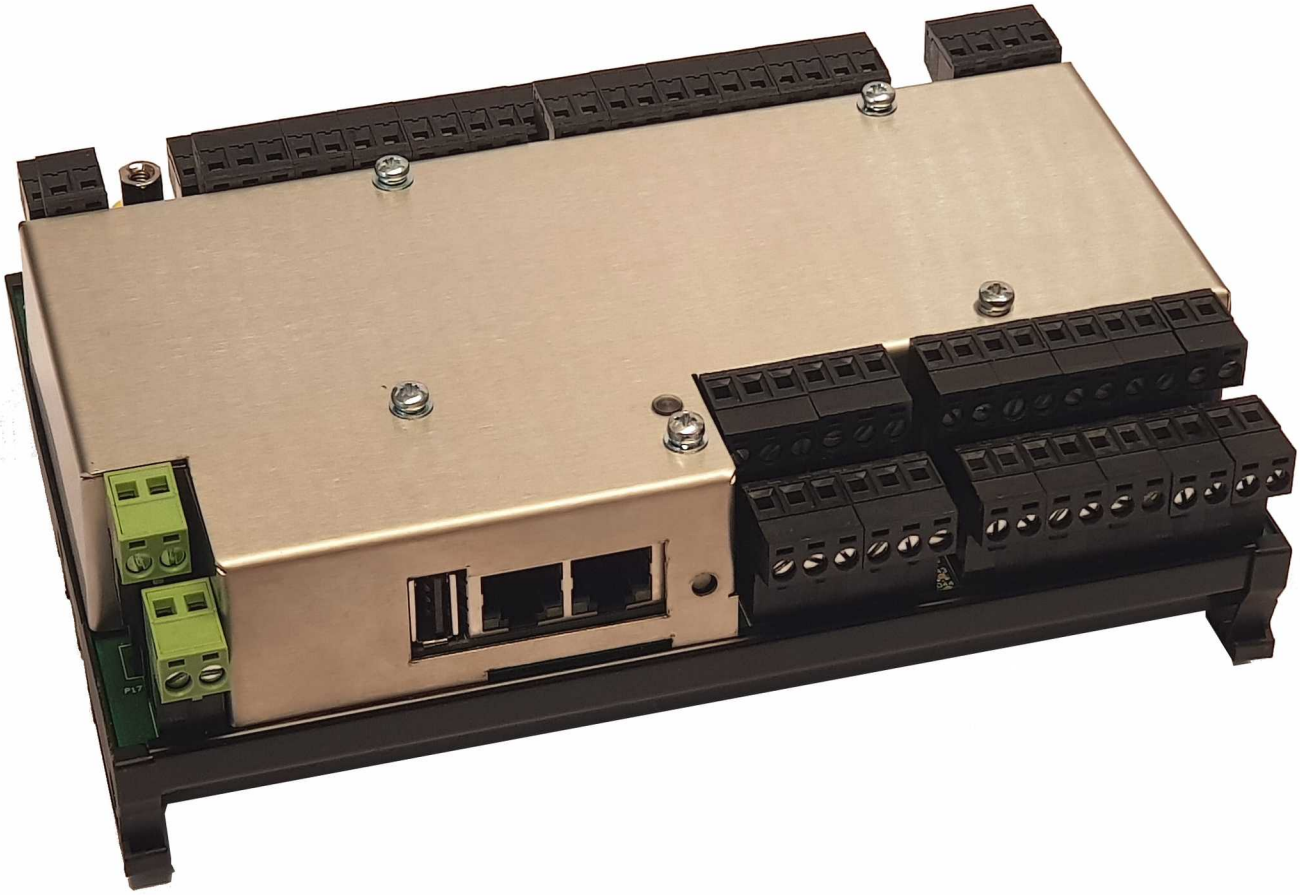


Table of Contents

1 Introduction

The Generation 3 NÅNO is backward compatible with the Generation 1 and Generation 2 designs. Applications developed for the Generation 1 & 2 units will work identically on this latest incarnation of this innovative flow measurement platform. In addition, the printed circuit boards are electrically interchangeable between the different generations.

The NÅNO is designed to operate individually as a single meter run device or in a cluster for multi-stream applications. It is a very robust and reliable unit with a very wide environmental temperature range suitable for skid mounting as well as panel mounting. The small footprint makes it ideal for cost effective refits of old technology.

The NÅNO comes with a range of applications that cover all the common fiscal hydrocarbon measurement requirements, with sophisticated applications for Oil, Gas, LPG & NLGs using American and International calculation standards in both U.S. Customary and Metric units.

To complement the range of existing applications, a true visual programming rapid application development (RAD) tool has been designed in conjunction with the NÅNO. This unique tool is Visual C||CURE and gives unprecedented flexibility for System Integrators.

The communications options are unsurpassed. Obviously the legacy communications methods such as the numerous variants of Modbus are fully supported, as well as a range of IP protocols, and the XML data exchange method is exceedingly powerful and future-proofed. In addition the in-built webserver allows a phone, tablet or PC to act as a local or remote front panel for detailed user interaction.

1.1 Warranty

The NÅNO is warranted for 3 years as standard (see our terms and conditions at www.newflow.co.uk/pdf/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.

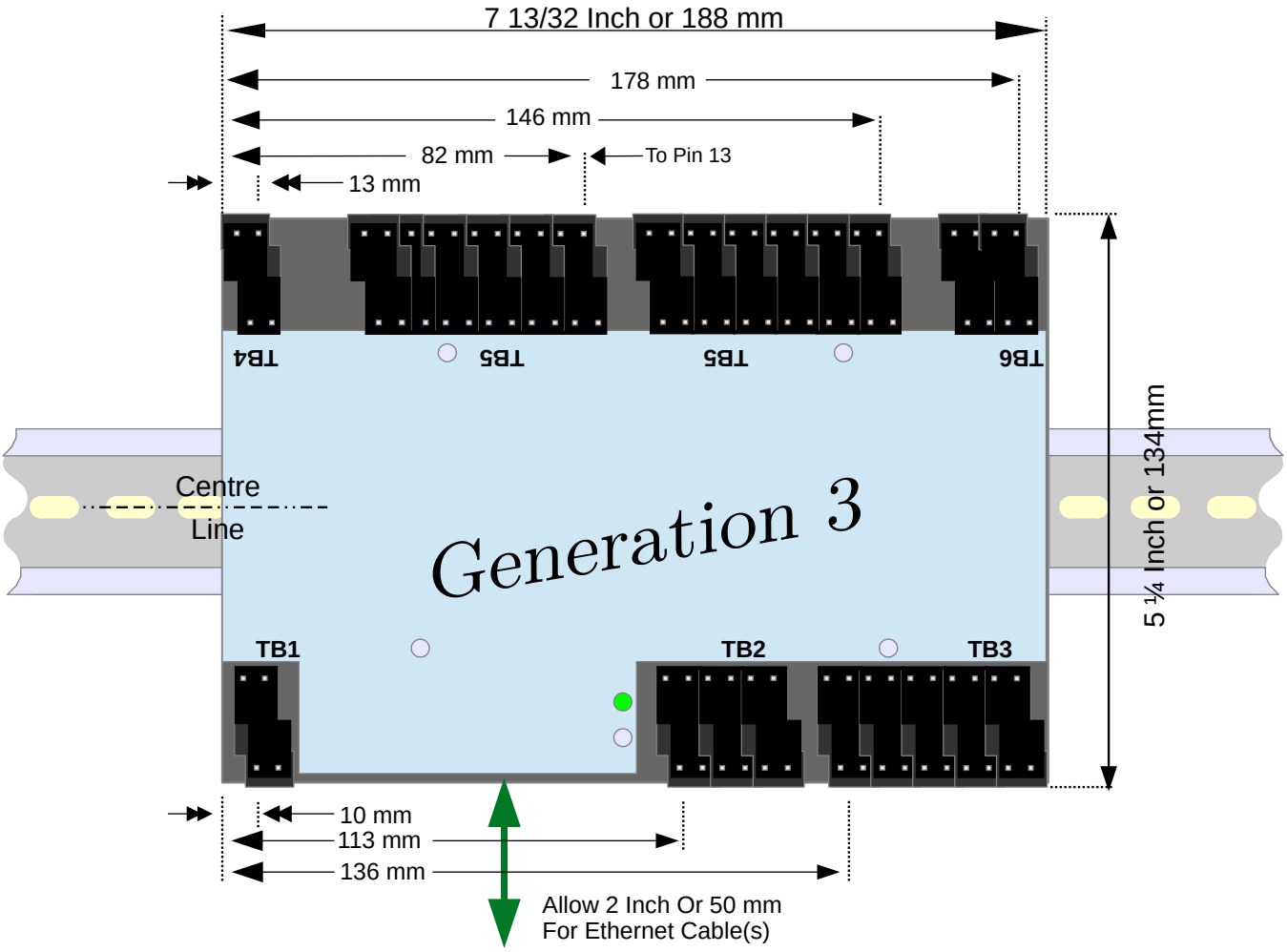
1.2 Prior to mounting the NÅNO

The NÅNO 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 3.6.1 P511 Analog Board Jumper Settings for link setting details. Please note, units can be pre-configured directly from the factory for your convenience.

2 Physically Mounting the NÅNO

The NÅNO 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 mounted on a din rail will be 2¼ inches (56mm) above the mounting surface, but note, the Field wiring emerges vertically, and we recommend at least 2 inches (50mm) of clearance above the unit for the cables. If cable tags are used, then allow additional height, as the bend radius is increased.

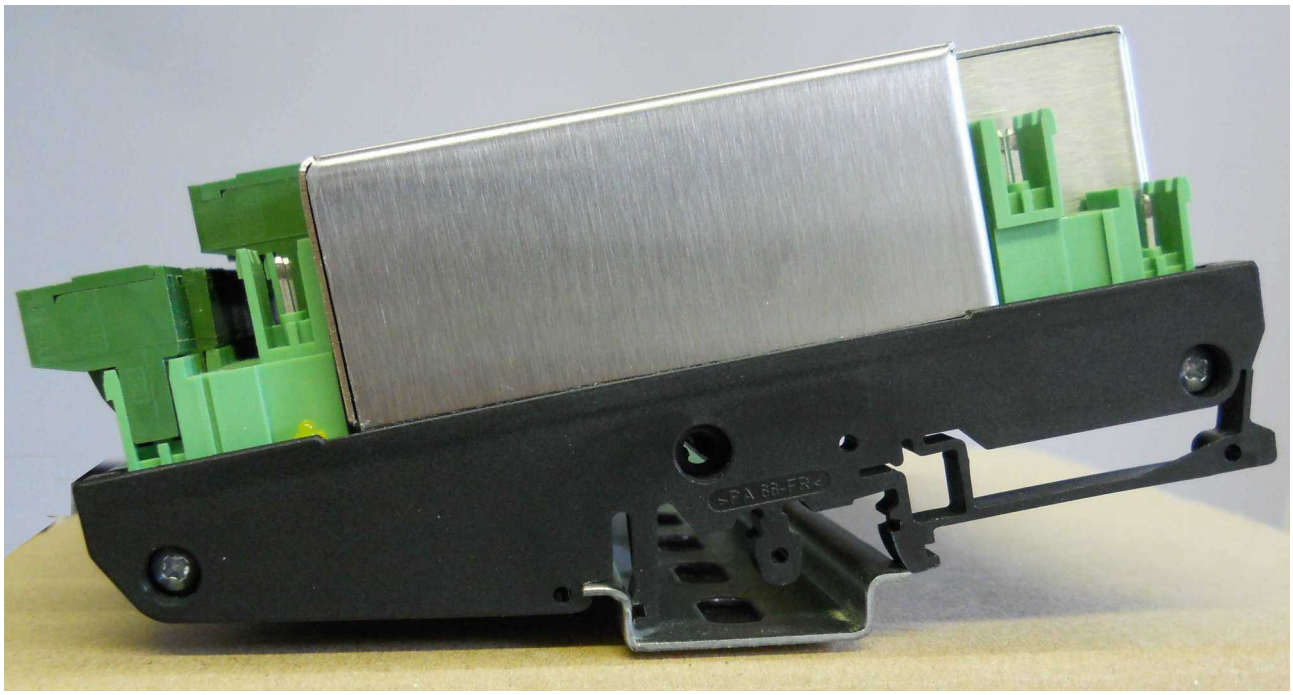
The dimensions shown on the drawing above for the 5mm terminal blocks indicate the position of Pin 1 on each terminal block, but as TB5 has been split, it also indicates the position of TB5 - Pin 13.

Each NÅNO occupies 7 and 13/32 of an inch (188mm) of rail length and takes up 5¼ inches (134mm) of width. Allow extra space for Ethernet connections. At least 2 inches of additional clearance is recommended for Ethernet Cat 5E cable, to gain sufficient bend radius.

2.1 Attaching and removing from DIN Rail

The images show a Generation 1 NÅNO, but the mountings are identical.

To attach the NÅNO 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 NÅNO has the following I/O available:

- One RS232 Serial Port (5 wire)
- Two RS422 Serial Ports (4 wire) (1 only on Generation 2 units)
- One RS485 Serial Port (2 wire, Optically Isolated)
- Two Ethernet Ports, from independent network controllers
- Nine Digital Inputs
- Six Digital Outputs
- Two Pulse Outputs. On the Generation 3 platform, these can also provide a PWM output
- Four Pulse Inputs, that can be used as single meter pulse inputs, in pairs for Dual Pulse inputs, or as Period/Density Measurement Inputs. (Only 2 meter pulses available on Generation 2 units)
- Six Analog Inputs
- Two RTD Inputs (each uses one Analog Input)
- Two Analog Outputs
- One Solid State Alarm relay with both Form A and Form B contacts
- One Raw Pulse bus bidirectional I/O

In addition, there is the facility for SD memory cards for removable data archive. The USB port is reserved for factory use only.

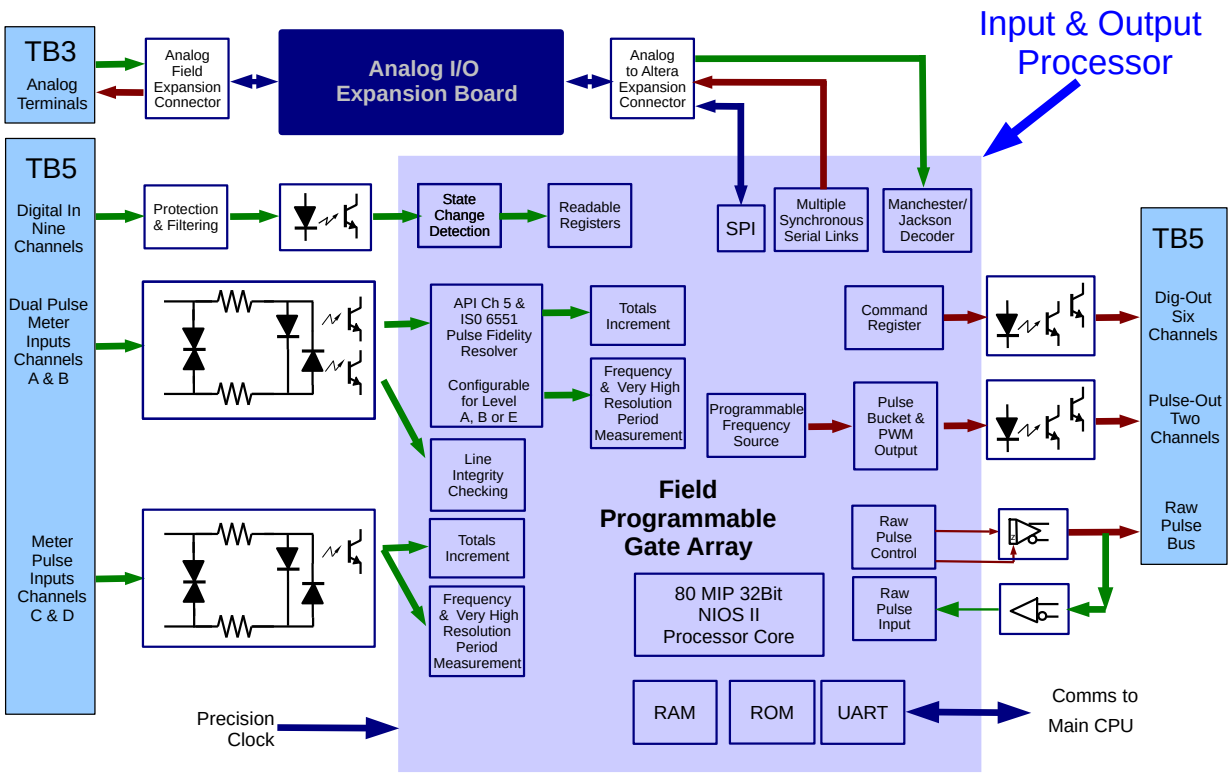
All field inputs and outputs are individually isolated and, after isolation, are fed to the I/O processor.

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
- Pulse Width Modulated output from the Pulse Outputs
- Prover gating and dual chronometry timers & counters
- SPI and asynchronous serial links

All the real-time I/O is handled by a high performance 100 MIPS NIOS II processor, which is capable of handling the interrupt load from 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.

Gen3 Field I/O Block Diagram

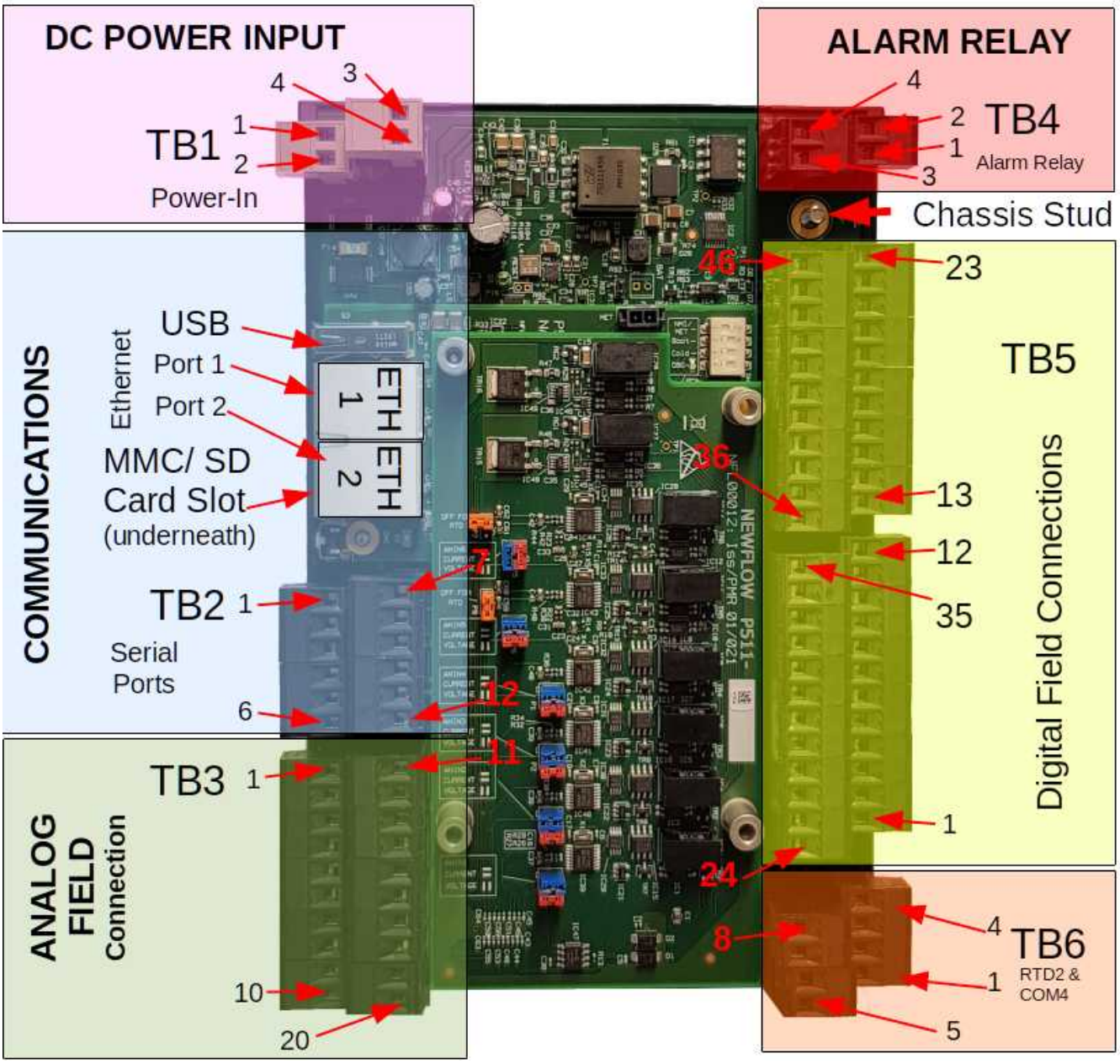


All of the specific hardware listed above, together with the asynchronous serial ports, the program storage, working RAM and the NIOS II 32 bit processor have all been designed and compiled to fit within a single Intel/Altera field programmable gate array. This device is known as the I/O Processor. The NÅNOconf software allows users to load new or different versions of the Intel/Altera program, so that the I/O can be infinitely reconfigured, if so required.

3 Wiring the NÅNO

The connectors on the NÅNO 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
- TB6, with COM4 and RTD2 excitation



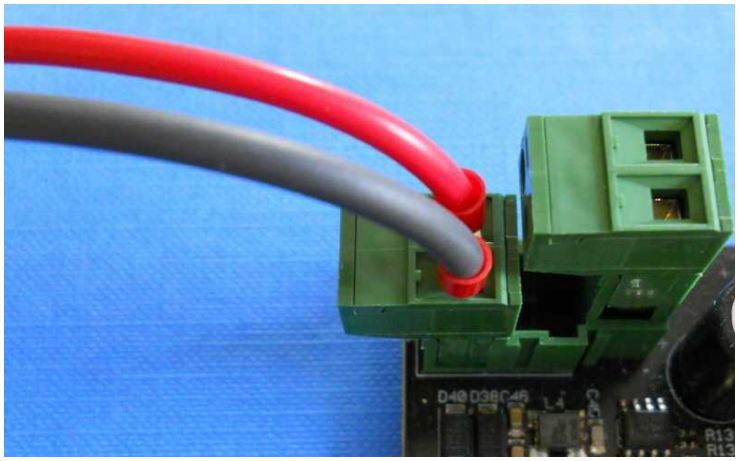
3.1 Connecting Power

The NÅNO is designed to be powered by a 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 will remain powered.

The inputs are protected against reversed polarity and can operate with a voltage of between 11.5V to 30V (therefore suitable for float charged 12V lead-acid rechargeable batteries). The unit consumes approximately 4.25 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 Pins 3 & 4.



3.2 Alarm Relay

The NÅNO is equipped with a solid state alarm relay with two sets of complementary contacts. When one set is open, the other set will be closed, and vice versa.

The A contact set are open when in an alarm condition and closed when the system is running normally.

The B contact set are closed when in an alarm condition and open when the system is running normally.

The two sets of contacts are fully isolated from each other and all other connections on the NÅNO.

Pin	***Alarm Relay***	
	A Contacts Alarm = Open No Alarms = Closed	**B Contacts** Alarm = Closed No Alarms = Open
Contact	TB4-1	TB4-3
Contact	TB4-2	TB4-4

3.3 Serial Communications

Each NÅNO is provided with four high speed rugged serial ports, one RS232, two RS422 and one Galvanically isolated RS485 port.

3.3.1 RS232 Port (COM1)

The RS232 port (COM1) is provide with flow control handshaking for use with printers and modems but can be used in 3-wire mode.

Pin No	*Signal Name*	*Signal Description*
TB2-1	COM1 RS232 TxOUT	Serial Data Output
TB2-2	COM1 RS232 RxIN	Serial Data Input
TB2-3	COM1 RS232 SIG-GND	Signal Ground
TB2-4	COM1 RS232 CTSIN	CTS Input, can control transmitted data
TB2-5	COM1 RS232 RTSOUT	RTS Output, signals when data available for Transmission

3.3.2 RS485 Port (COM2)

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 (TxRx+)
TB2-12	COM2 RS485 B	Bi-directional Differential Signal B (TxRx-)
TB2-6	COM2/3 SIG-GND	Signal Ground (Interconnects ground to limit common mode voltages)

3.3.3 RS422 Ports

The RS422 ports can be used in several ways.

They can be used as a 4-wire point-to-point RS422, 4 wire RS485 or 2 wire RS485.

In multi-drop modes, the NÅNO can be either bus master or bus slave.

3.3.3.1 COM3

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 SIG-GND	Signal Ground (Interconnects ground to limit common mode voltages)

3.3.3.2 COM4

Pin No	*Signal Name*	*Signal Description*
TB6-5	COM4 RS422/485 TxOUT+	Differential Data Output +ve
TB6-6	COM4 RS422/485 TxOUT-	Differential Data Output -ve
TB6-7	COM4 RS422/485 RxIN+	Differential Data Input +ve
TB6-8	COM4 RS422/485 RxIN-	Differential Data Input -ve
TB6-3	COM4 SIG-GND	Signal Ground (Interconnects ground to limit common mode voltages)
TB6-4	Chassis	EMC Chassis Connection

To use the RS422 ports in 2 wire RS485 mode, connect the TxOUT+ to the RxIN+ (this becomes RS485 TxRx+) and connect the TxOUT- to the RxIN- (this becomes RS485 TxRx-).

3.4 Digital Field Connections

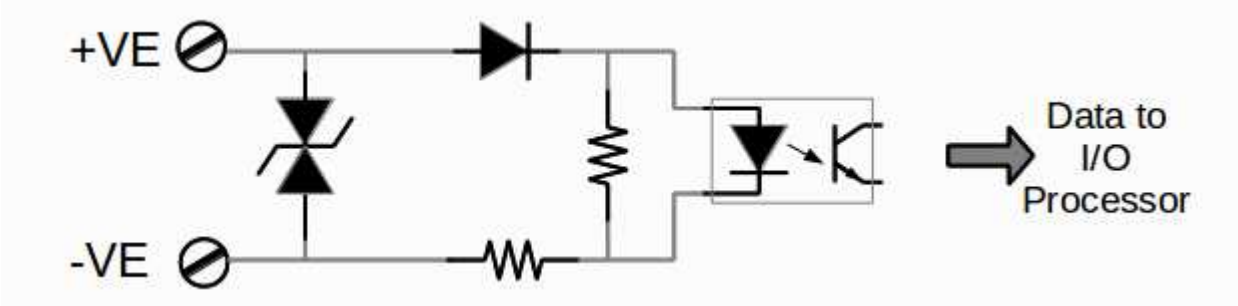
The digital I/O described below is common to all NÅNO variants.

The NÅNO has the following digital field I/O connectivity:

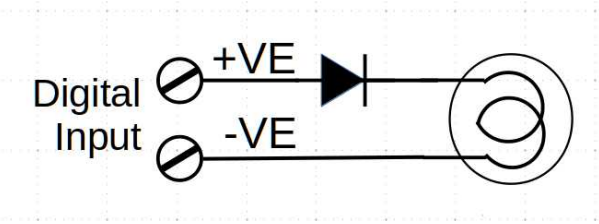
- Nine Individually Galvanically isolated Digital Inputs
- Six Individually Galvanically isolated Digital Outputs
- Two Individually Galvanically isolated High Speed Pulse Outputs
- Four Galvanically isolated Meter Pulse Inputs. Two of the four inputs can be used together as a high integrity dual pulse input or they can all be used individually. In addition any channel can be used as a densitometer input.
- A single bi-directional raw pulse bus. This is not isolated and only intended for connection to another NÅNO, therefore maintaining full system isolation.

3.4.1 Digital Inputs

There are nine 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.



From an operation perspective, 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.

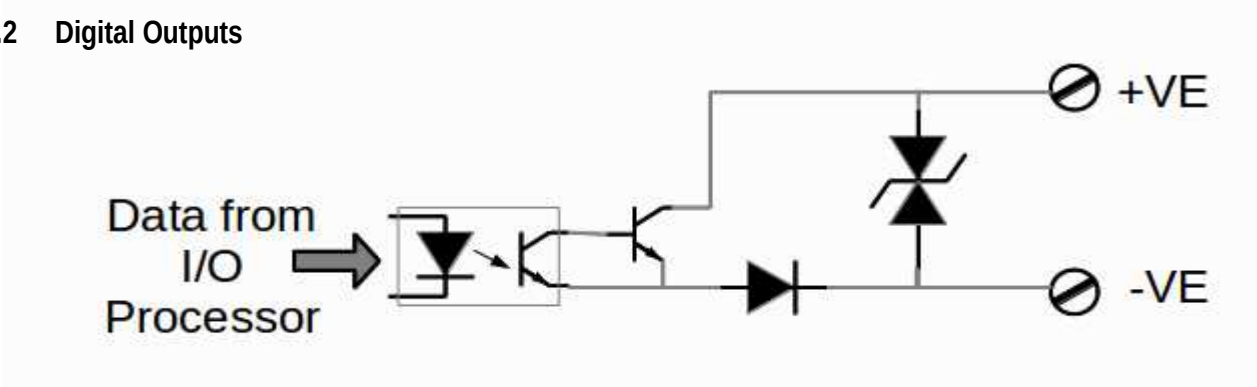


A digital input is active when a voltage of the correct polarity is connected between the two input connections and the "light bulb" is illuminated

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.

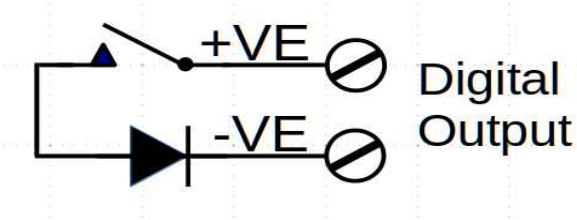
3.4.2 Digital Outputs



There are six 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.

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.

3.4.3 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.

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

3.4.4 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. The Pulse Outputs can be used to deliver an exact number of pulses at a given frequency, or can be set to provide a Pulse Width Modulated (PWM) output from 0% to 100%.

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

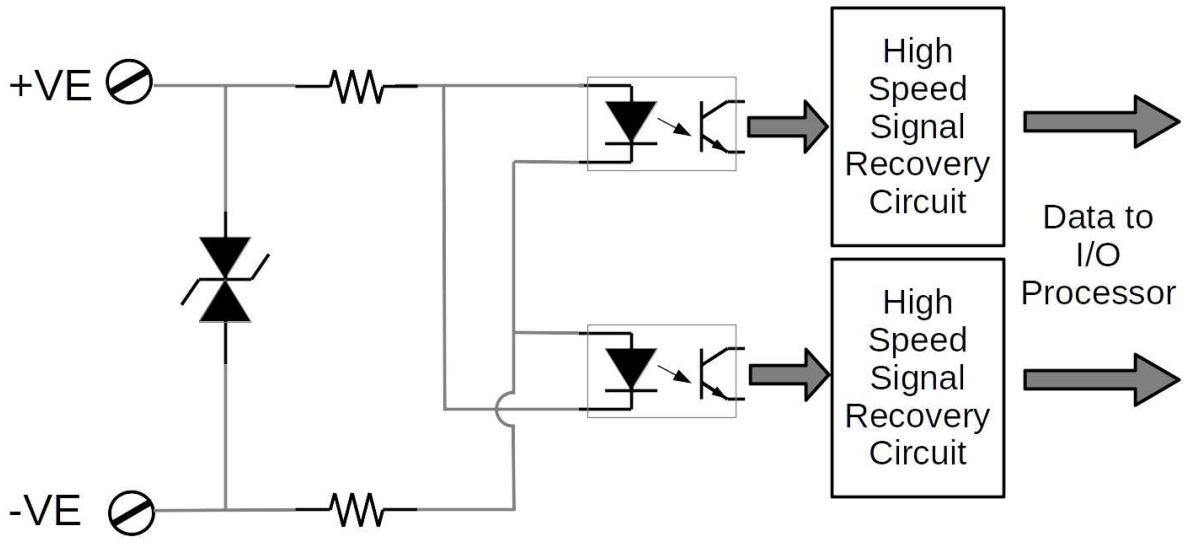
3.4.5 Galvanically isolated Meter Pulse Input

There are two blocks of meter pulse inputs. One block supports Dual Pulse Level A, B & E with continuous line integrity, when used with a suitable pre-amplifier, such as the ST106 pre-amplifier. The second block supports two additional single pulse meter inputs, and does not support Dual Pulse or line integrity checks. All channels have the ability to support very high resolution (nanosecond) period measurement suitable for use with Densitometers.

3.4.5.1 Dual Pulse Meter Inputs, Channels A & B

The NÅNO 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.

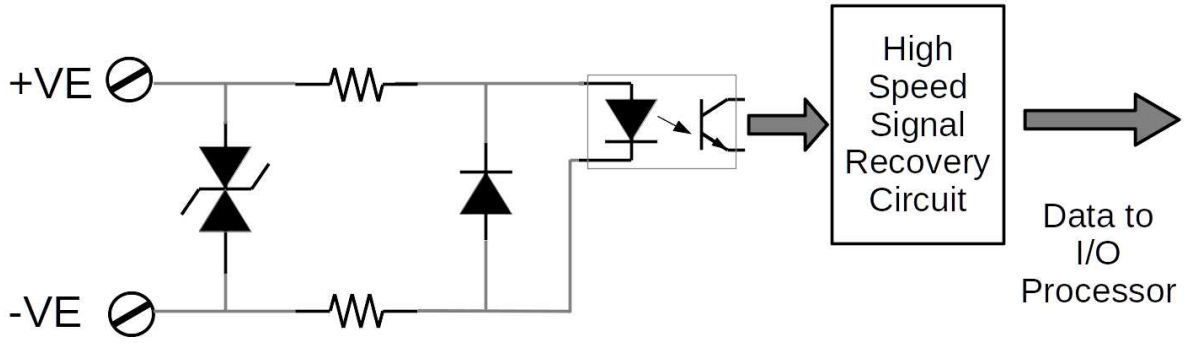
The inputs meet API Ch 5.5 level A or B and equivalent international standards, ISO 6551 and IP252. The NÅNO can also be configured as level E mode, and two signal pulse streams can be measured. The drawing below shows the equivalent input circuit, that feeds the dual pulse resolver.



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

3.4.5.2 Twin Single Meter Pulse Inputs, Channels C & D

The single meter pulse input blocks are similar to the dual pulse input blocks but do not have the reverse input, used for line integrity.



Pin	*Pulse Inputs Channel C & D*	
	Pulse Input Ch C	**Pulse Input Ch D**
+ve Pin	TB5-19	TB5-21
-ve Pin	TB5-20	TB5-22

3.4.6 The 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 prover. 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 meter proves to be performed by the NÅNO or other prover computers. The use of differential signals rather than open-collector signals creates less EMC noise and provide a much higher level of signal integrity.

3.5 P511 Analog Field Connections

The P511 Analog board is an optional component. It may be fitted or omitted.

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

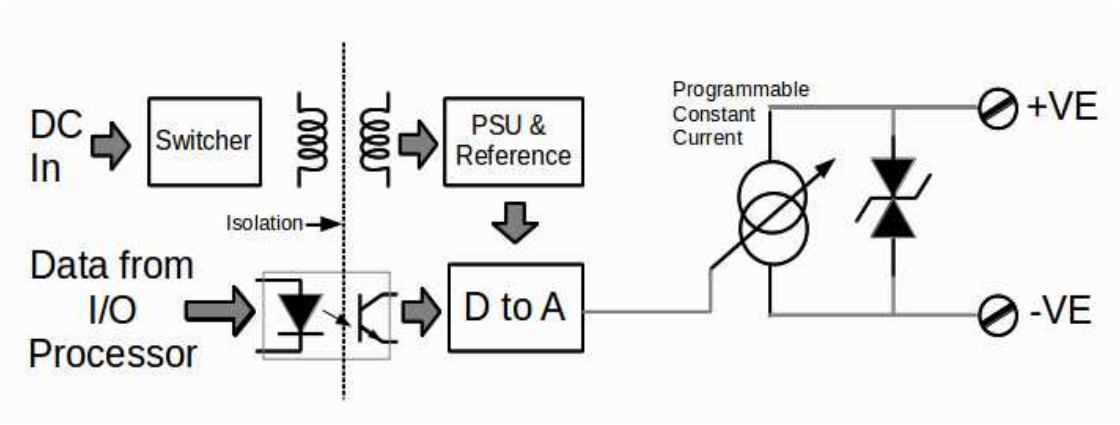
- Two Fully floating, current controlling, 14 bit 4-20mA Analog Outputs
- Six Individually isolated 4-20mA (or 1-5V) high accuracy 24 bit Analog Inputs
- Two 4-wire 100 Ohm RTD measurement circuits
  Note that each RTD consumes one Analog Input channel

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.

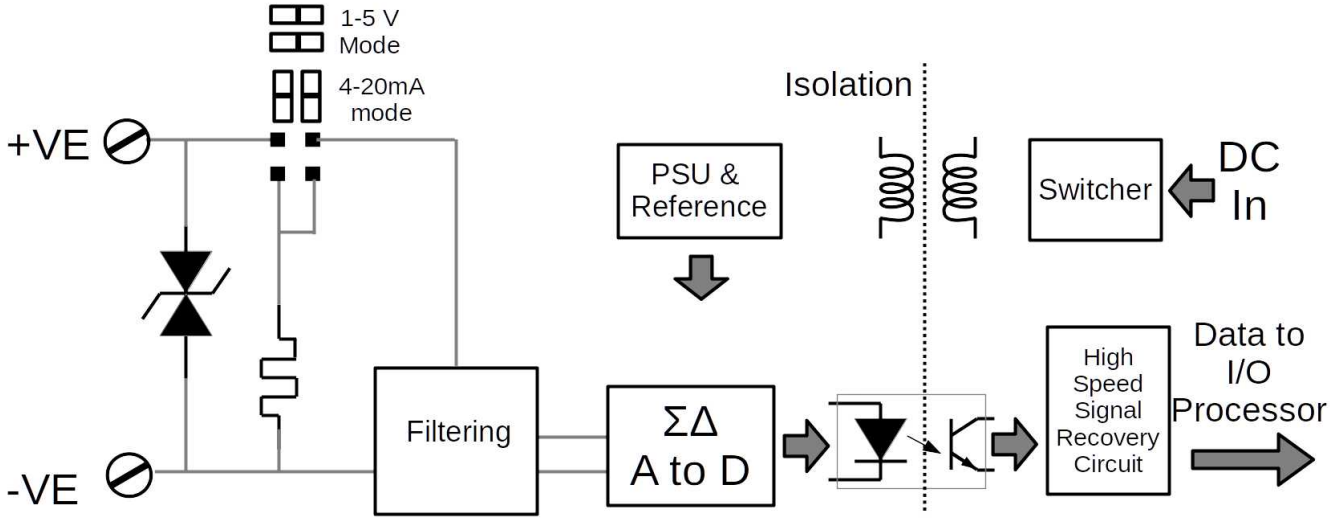


Pin	*Analog Output Channel Number*	
	AnOut 1	**AnOut 2**
+ve Pin	TB3-11	TB3-13
-ve Pin	TB3-12	TB3-14

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 position of a pair of jumpers).

A block diagram of each channel is shown below.



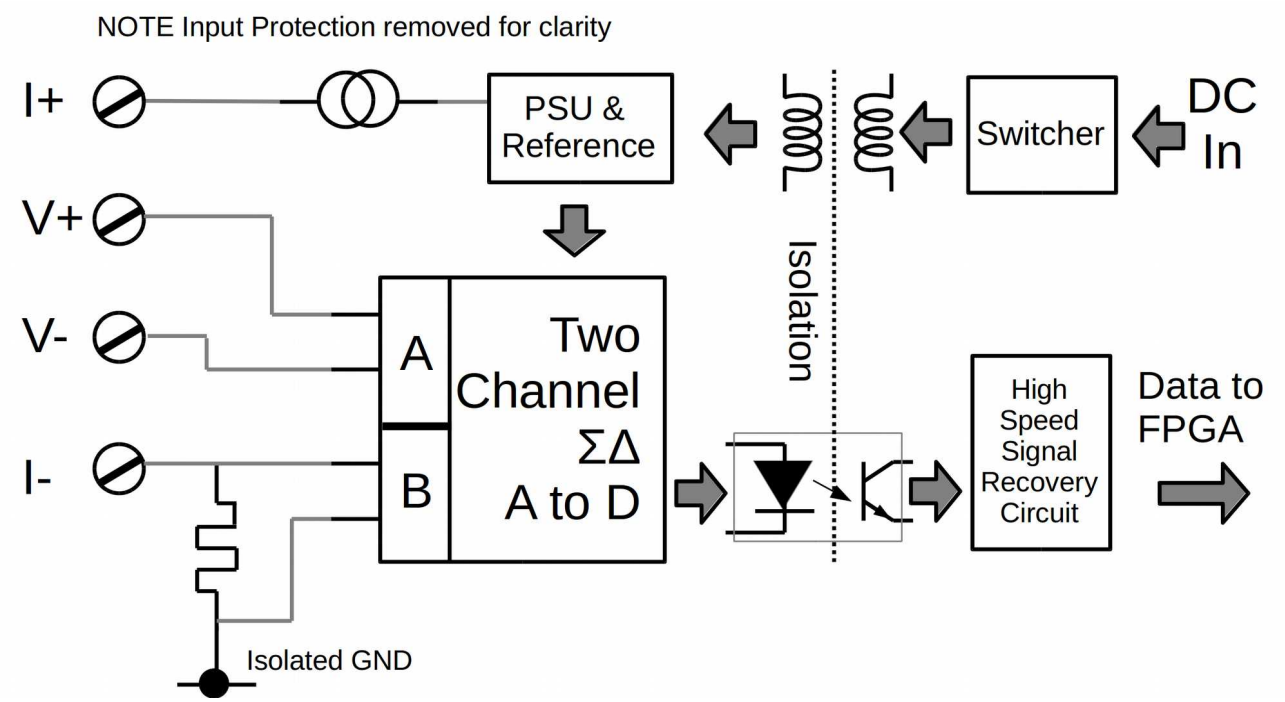
Pin	*Analog Input Channel Number*					
	AnIn 1	**AnIn 2**	**AnIn 3**	**AnIn 4**	**AnIn 5**	**AnIn 6**
+ve Pin	TB3-1	TB3-3	TB3-5	TB3-7	TB3-9	TB3-16
-ve Pin	TB3-2	TB3-4	TB3-6	TB3-8	TB3-10	TB3-17

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 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 that 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 & Switch Settings

3.6.1 P513 Main I/O Board Settings

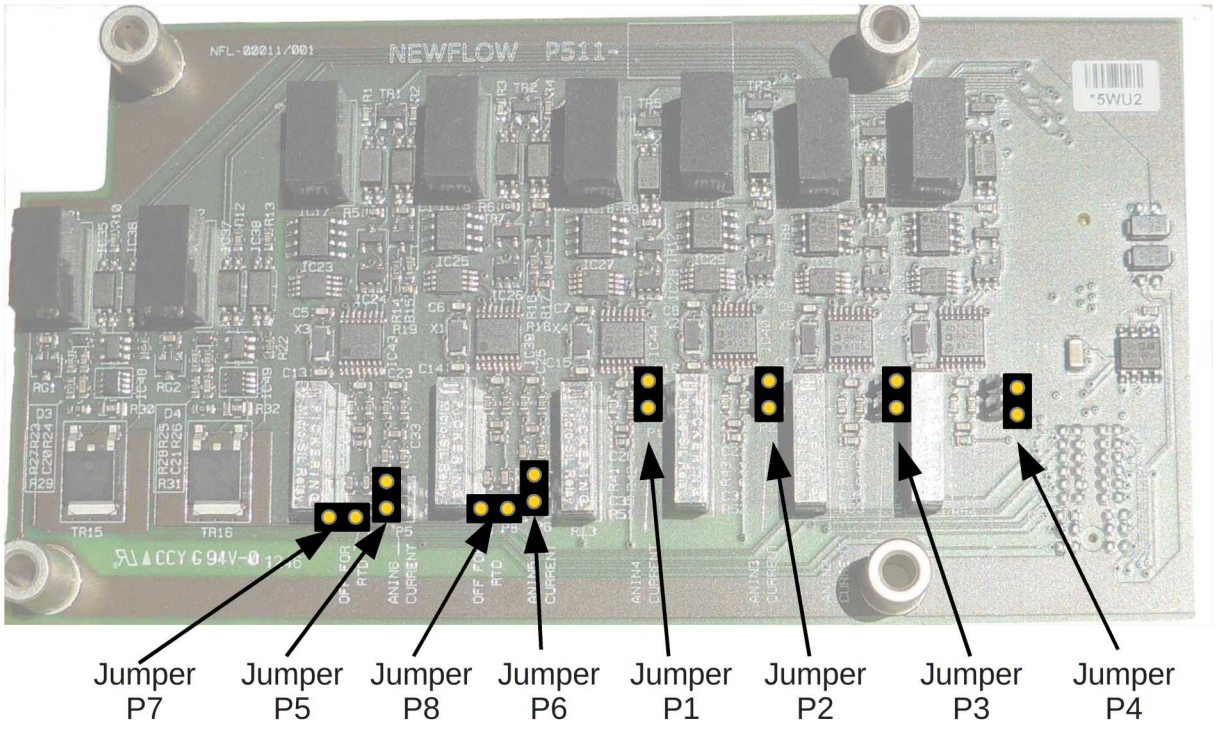
The P513 Main I/O board does not have any jumpers, as any options are configured in software by the application (App).

3.6.2 P511 Analog Board Jumper Settings

There are two versions of the Analog board . The later version use pairs of jumpers for the voltage or current selection, rather than a single jumper.

By default the P511 board is configured with 5 Analog Input channels AnIn 1-5 all set to 4-20mA current mode and one channel (RTD 1) configured for 4-wire RTD temperature.

3.6.2.1 Single Jumper Version

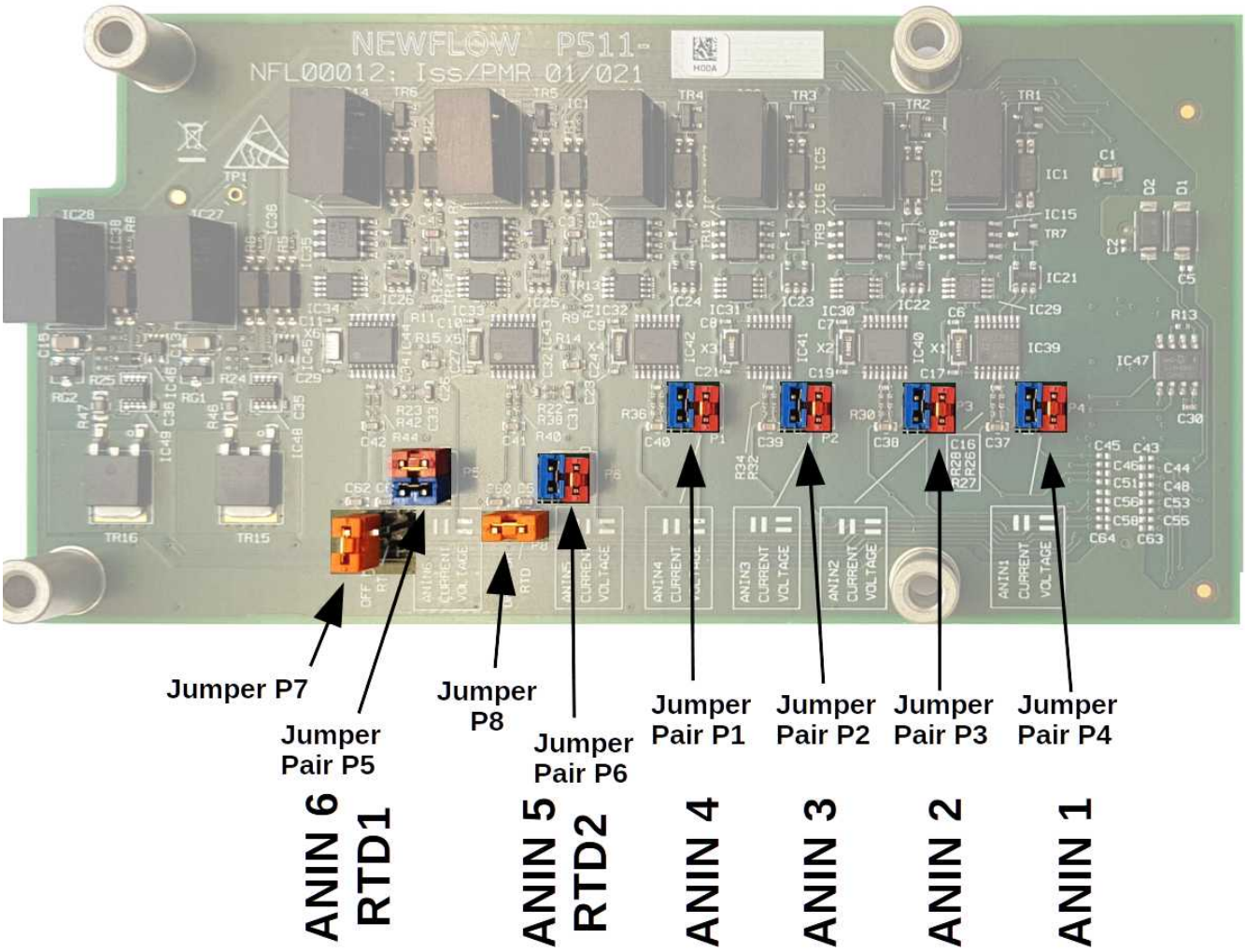


Jumper No.		RTD 1 or AnIn 6 Operating Mode
P7	**P5**	
ON	ON	AnIn 6 Current Mode
ON	OFF	AnIn 6 Voltage Mode
OFF	ON	Invalid Selection
OFF	**OFF**	**RTD 1 Mode**

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

3.6.2.2 Twin Jumper Version



NOTE: In the photograph above, AnIn1 to AnIn5 are in 4-20mA current mode and AnI6 is in RTD mode

Jumpers P1, P2, P3 P4, P5 & P6 are fitted in pairs. With the NÅNO in "landscape" these pairs of jumpers should be fitted vertically for 4-20mA Current mode and horizontally for 1-5V Voltage mode.

4 to 20mA Current mode orientation, vertical.

1 to 5V Voltage mode orientation, horizontal.

If channels AnIn5 or AnIn6 need to be in RTD mode, then select Voltage mode (P6 or P5 horizontal) and jumpers P8 or P7 need to be off.

If changes are needed to the Jumpers settings, the lid will require to be removed. Refer to Appendix D for Lid removal and re-fitting instructions.

NOTE: Analog board settings can be specified when placing an order for the NÅNO.

3.6.3 P514 CPU Switch Settings

There are two versions of the CPU board. These are schematically and functionally identical, but some components are now in a different PCB package. We took the opportunity to fit a physically larger DIP switch, for ease of use. In normal operation the DIP switch should be set with all 4 switches OFF.

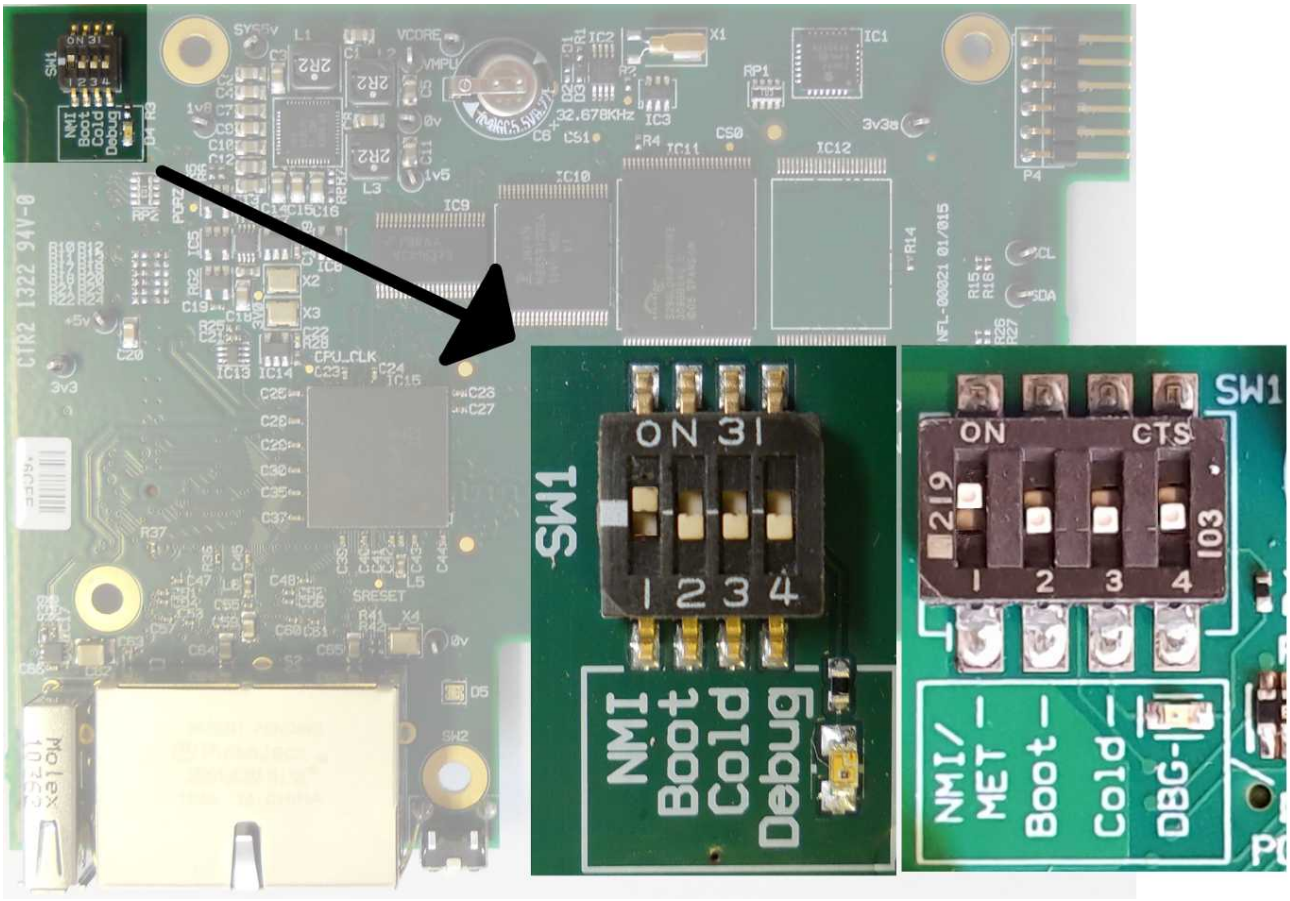
SW1-1, labelled NMI/MET (or NMI), is the metrology enforcement switch. When this switch is set to ON (upwards in the photograph) then any data points configured at metrology security level in the application **can** be changed. SW1-1 is set to ON in the photograph, shown below. To enforce the metrology settings, so they **cannot** be changed, the switch SW1-1 must be set in the OFF position.

SW1-2, labelled Boot, is currently reserved for future expansion.

SW1-3, labelled Cold, can be used in conjunction with the IDENT button to clear persistent storage. The password file is cleared down and only the admin and default password (00000000) is retained, the application is replaced by the default app & the event and alarm logs are cleared. In addition the network settings are reset to their default value, ETH1 is set to DHCP for the IP address and ETH2 is set to be static and assigned an IP address of 10.250.250.250.

SW1-4, labelled DBG (DeBuG), is only used by the factory. If it is accidentally selected, the debug LED D4 will be illuminated.

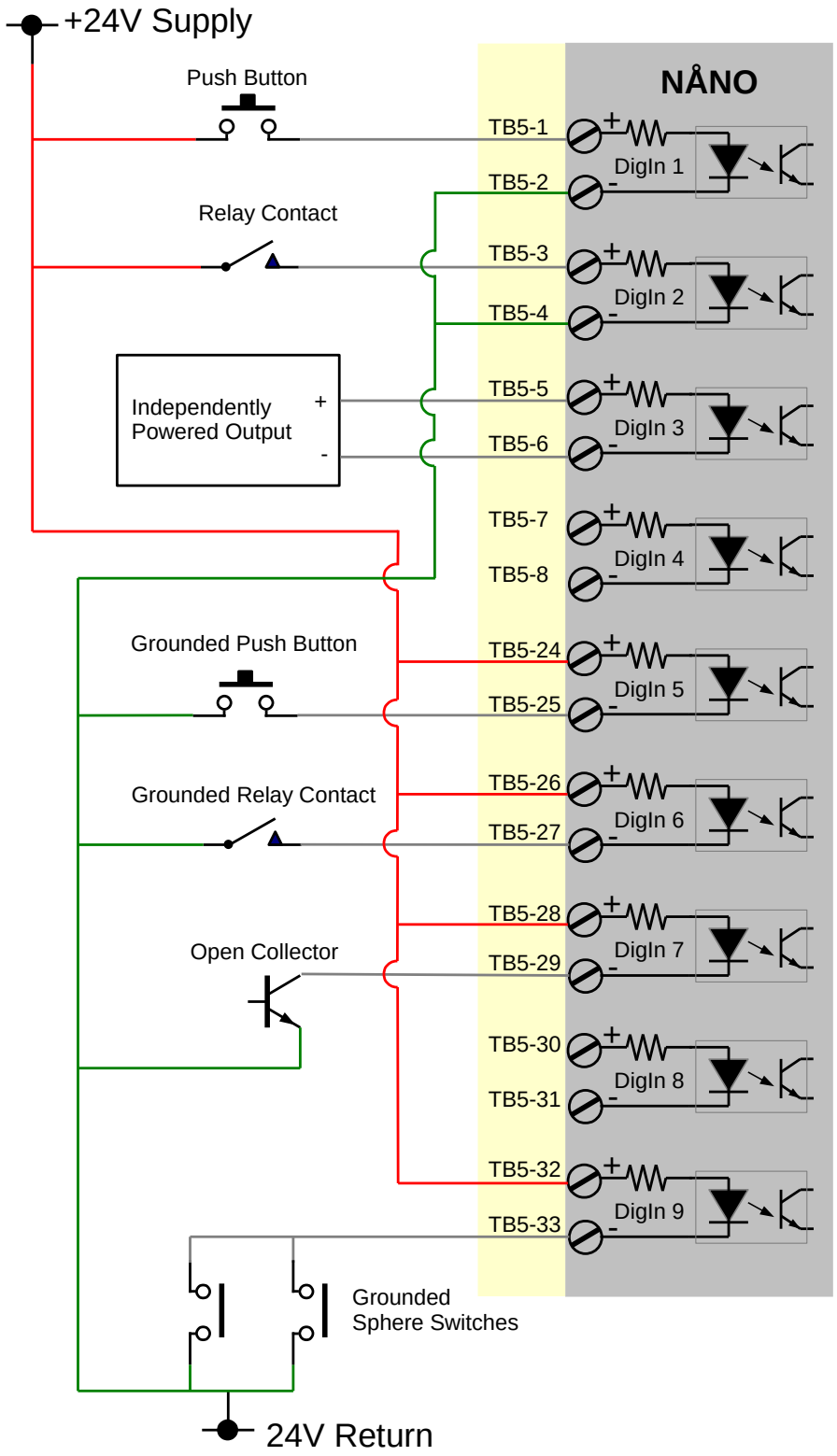
3.6.3.1 P514 CPU Photograph



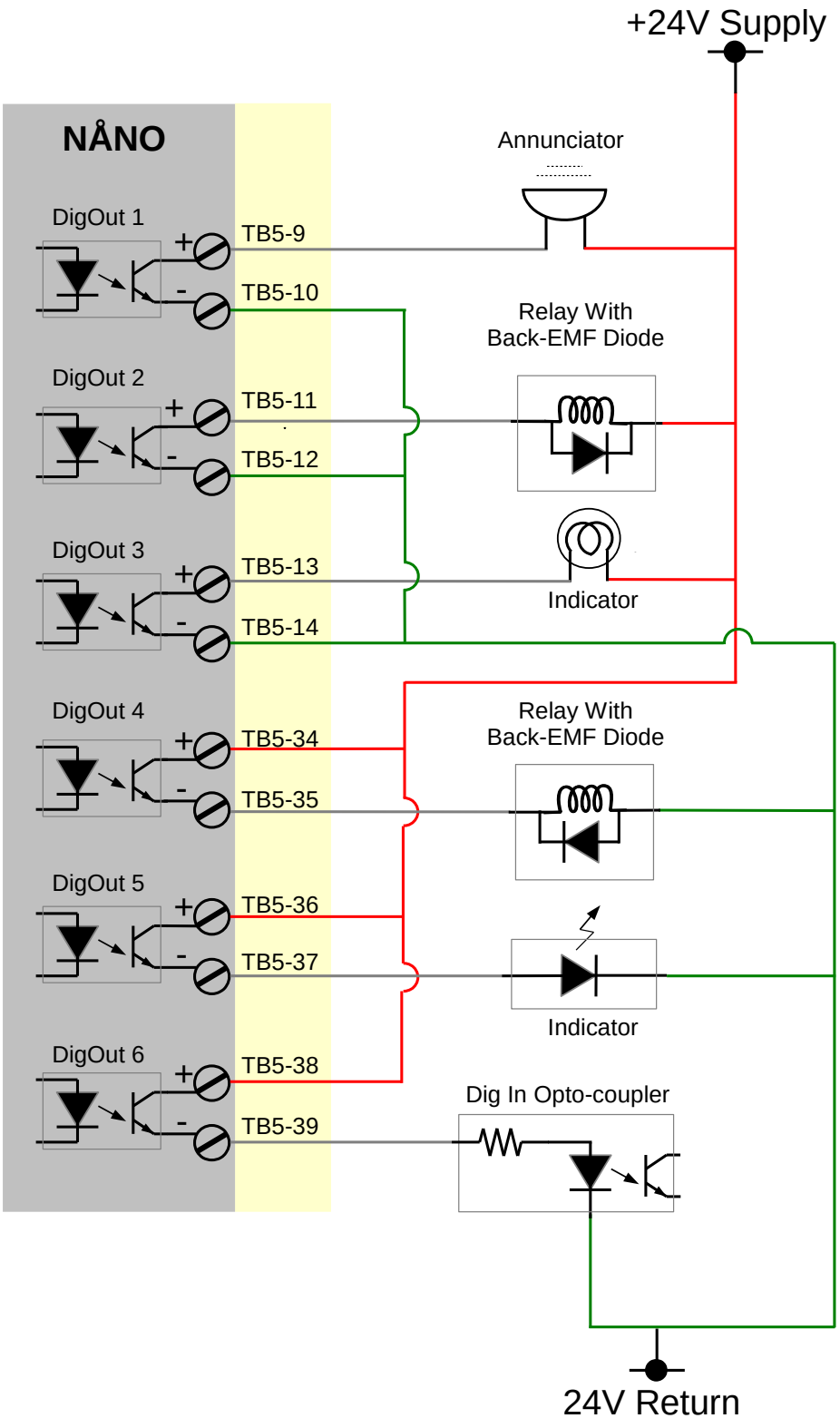
The inset images show the two different switches that are fitted to the P514 NÅNO CPU Board.

4 Loop Drawings

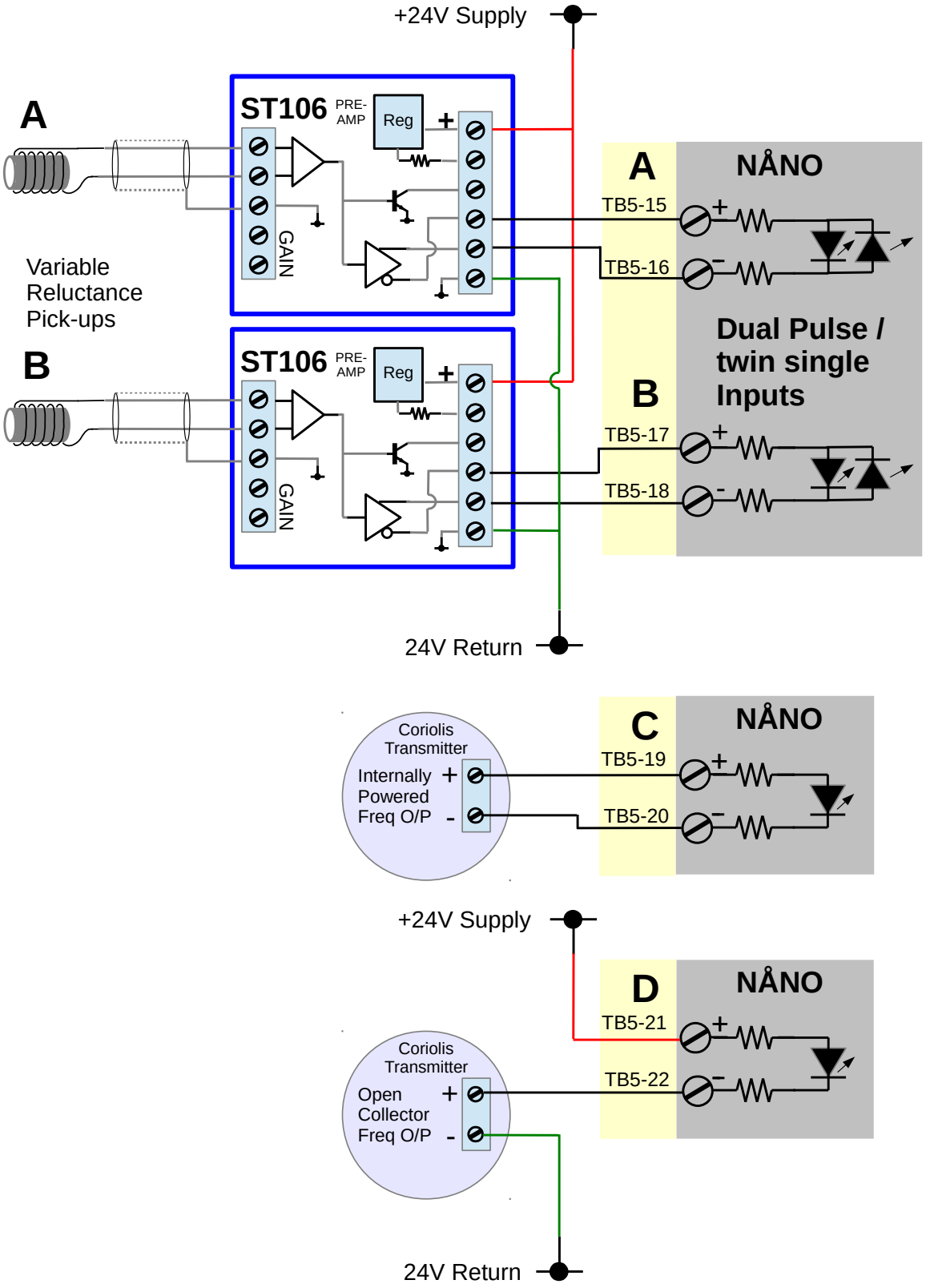
4.1 Digital Inputs



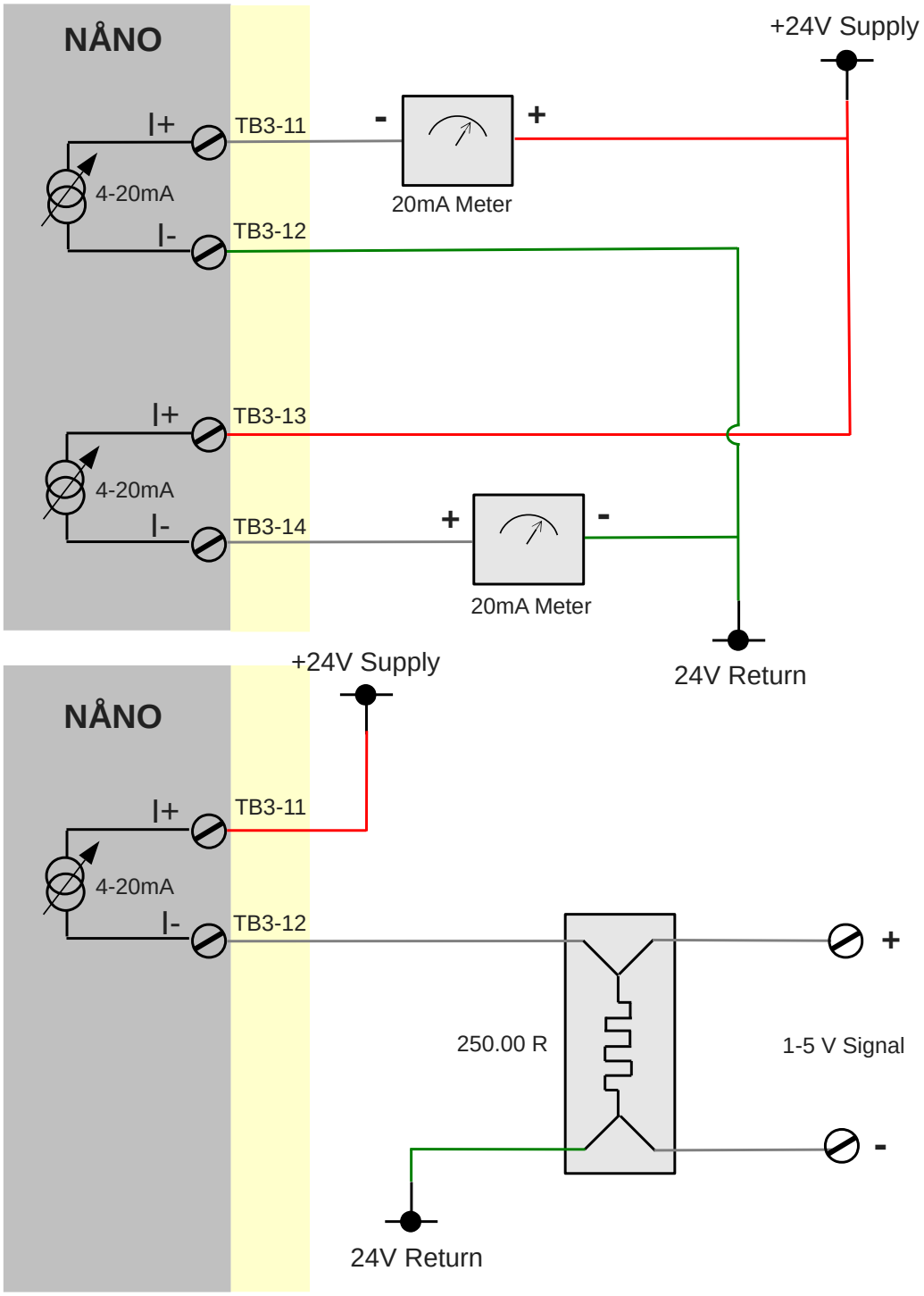
4.2 Digital Outputs



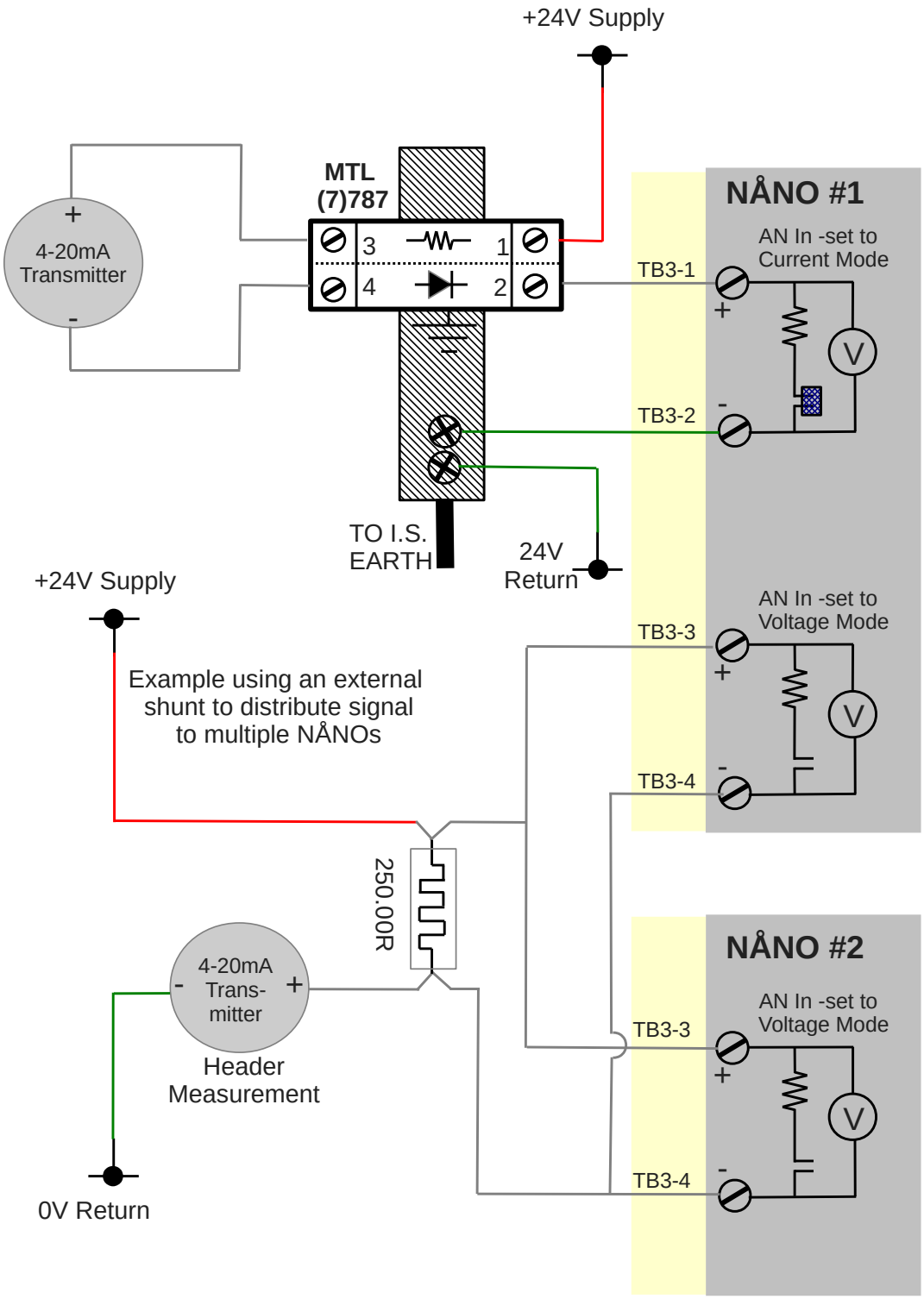
4.3 Meter Pulse Inputs



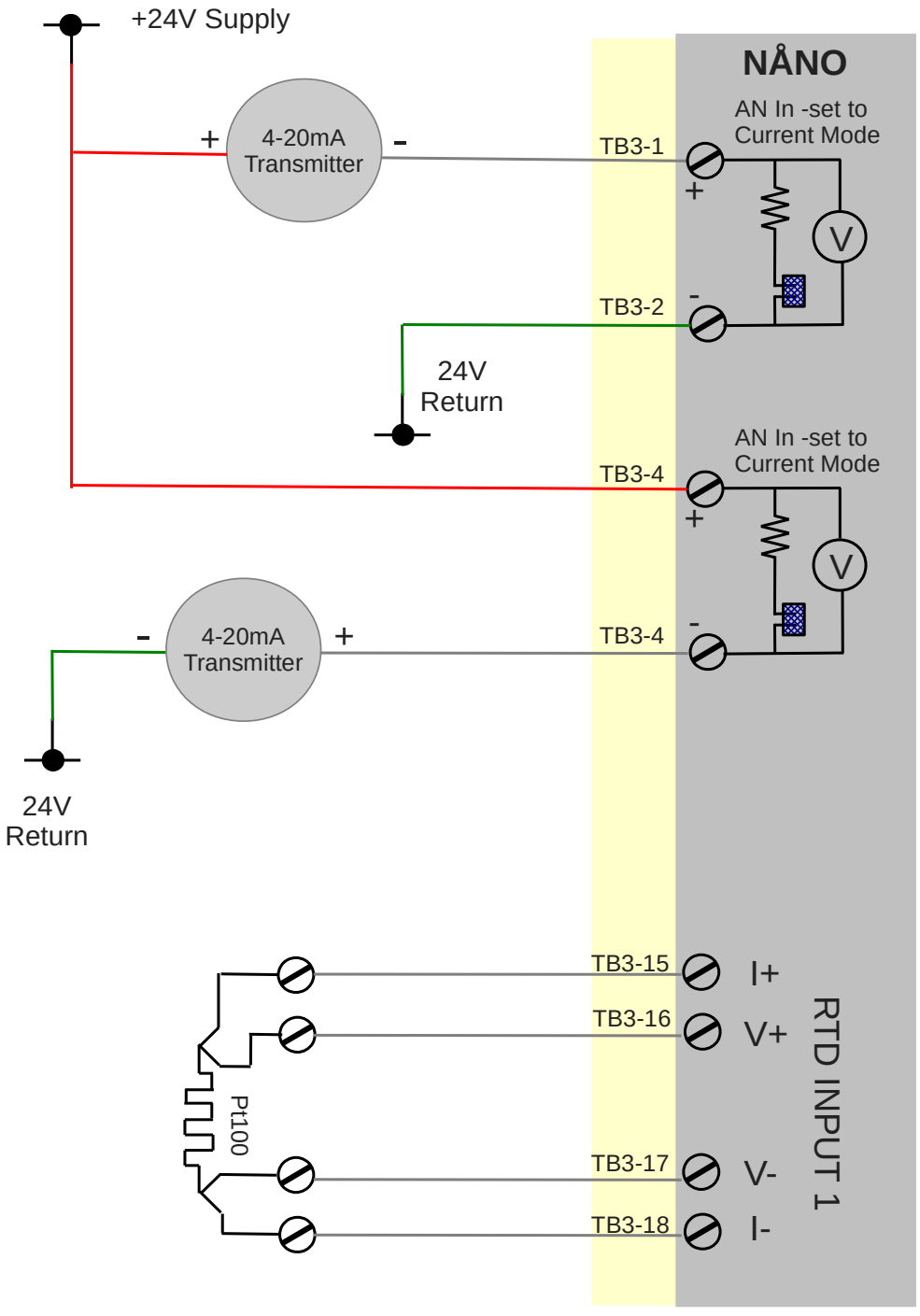
4.4 Analog Outputs



4.5 Analog Inputs



4.6 Analog Inputs, without barriers



5 NÅNO Hardware Specification

5.1 Common Requirements

5.1.1 Mechanical

Length on Rail	188mm
Height	56mm
Width across Rail	134mm
Weight	725 grams
Structure	PVC extrusion with stainless steel lid
Mounting	35mm symmetrical Top Hat rail to EN50022 and asymmetric G-type rail to EN50035

5.1.2 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
Environmental & EMC	IEC 60068-2-1 Cold IEC 60068-2-2 Dry heat IEC 61000-2-1 AC mains voltage variation- NMRO(GB) IEC 60654-2 DC mains voltage variation IEC 61000-4-11 AC mains voltage dips, short interruptions and reductions - NMRO(GB) IEC 61000-4-4 Bursts (transients) on signal, data and control lines IEC 61000-4-5 Surges on signal, data and control line IEC 61000-4-5 Surges on AC and DC mains power lines IEC 61000-4-29 DC mains voltage dips, short interruptions and (short term) variations. Needs the P578 to met the one second interruption) IEC 61000-4-17 Ripple on DC mains power IEC 61000-4-3 Electromagnetic fields of general origin and specifically caused by wireless communication networks IEC 61000-4-6 Conducted (common mode) currents generated by RF EM fields
Metrological Approvals	MID and other approvals available on request

5.1.3 Power Supplies

Input Voltage & Current	11.5V to 30V D.C 4.5 W nominal, 6 W Max Suitable for 12V Solar powered systems Digital only version is typically less than 3 Watts
No of DC Inputs	Two off, allowing direct connection to redundant supplies
Galvanic isolation	Minimum of 50V RMS to Instrument Ground
Maximum Input Ripple	2V peak to peak
Input protection	Non-replaceable 1A Input Fuse

5.1.4 Clock

Accuracy, Powered Off	A capacitor supported calender is better than 10 Seconds per day, and ensures logs and reports are in sequential time/date order following a power interruption
Accuracy, Powered On	0.5 Seconds per day over full temp range

5.2 Processor & Memory

CPU	800 MHz ARM Cortex-A8 highly integrated SoC processor system
Memory	
SRAM	Not required by design, no batteries needed
FRAM	128 KBytes (Standard Build) or 512 KBytes (Extended Option)
NOR Flash	128 MBytes
DRAM	256 MBytes, DDR3 with 400MHz bus interface
Silicon Serial No	Globally unique 48 bit address and 2 Kbit EEPROM, 200 year retention

5.3 Serial Communications

There are four serial ports provided for external connections, and one on-board serial port for the optional integrated display.

One external serial port is a Galvanically isolated, very rugged RS485 port intended for connection to a primary metering element mounted in the field, but can be used for any purpose, such as a gas chromatograph, printer or DCS.

The three other external serial ports are a conventional RS232 and two RS422 ports. The RS422 ports can be connected in 2-wire RS485 mode.

Baud Rates supported	50 to 115,200 Baud
Format	Software configurable

5.3.1 Single Ended Port, COM1

Standard supported	RS232
Signals supplied	Tx, Rx, RTS, CTS and GND. Hardware handshaking or 3-wire mode, software selectable

5.3.2 Differential Port, COM2

Type	Ruggedised 2 Wire RS485
Isolation	Galvanically Isolated, minimum 50V RMS from Instrument Ground
Signals supplied	A, B, Screen

5.3.3 Differential Port, COM3

Standard supported	RS422, RS485 (2-wire and 4-wire). Software selectable as point to point, 4-wire multidrop and 2-wire multidrop
Signals supplied	Tx+, Tx-, Rx+, Rx-, Screen
Biasing	Weak pull-out on receive lines

5.3.4 Differential Port, COM4

Standard supported	RS422, RS485 (2-wire and 4-wire). Software selectable as point to point, 4-wire multidrop and 2-wire multidrop
Signals supplied	Tx+, Tx-, Rx+, Rx-, Screen
Biasing	Weak pull-out on receive lines

5.4 Ethernet

No of Ports	2
Speed	10/100 Mbps, half and full-duplex supported
Media Connectivity	Twisted pair utilising Standard RJ45
Protocol	Supports TCP/IP, UDP, HTTP, FTP, NTP, XML, OPC UA, OPC XML-DA, ModbusTCP and others

5.5 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
Meter Pulse Inputs	4	8	Yes	Two channels can be used together as a Dual Pulse Input. All inputs have high resolution period measurement and are suitable for use with a Densitometer
Digital I/P	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 and in PWM Mode
Analog Outputs	2	4	Yes	Each fully isolated
Stream Watchdog/ Alarm solid-state relay	1	4	Yes	One Normally Closed and one Normally open Contact
Raw Pulse I/O	1	2	No	Differential Bus, enable & direction set by application

* Each RTD circuit consumes one Analog Input measurement circuit

The digital elements, 5.6 to 5.12 are common to all products.

5.6 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	Fleeting input detection provided

5.7 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

5.8 Meter Pulse Inputs & Period Measurement

Input Type	Channels A & B can use differential or single ended inputs, Channels C & D are single ended only
Configuration	Opto-coupled inputs.
Input signal levels	3.5V to 24V
Input current minimum	2.5mA
Input Impedance	1 KOhm
Frequency range	DC to 10 KHz
Line Integrity	Inputs A & B feature back-to-back optos, allowing full quiescent line and electronic integrity testing, when used with differential pre-amps such as the ST106
Dual Pulse compliance	Inputs A & B support IP 252/76, ISO6551 or API Ch 5.5 level A or B, with line integrity, even when static
Accuracy of period measurement	2.5 ppm
Period resolution	5 nSec

5.9 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

5.10 Pulse Outputs

Configuration	Individually Isolated
Max Output Current	100mA
Max Output Saturation Voltage	2.1V @ 100mA
Max Output Standoff Voltage	32V, limited by input protection
Frequency range	DC to 100Hz
PWM Mode	0% to 100% in 0.2% steps

5.11 Alarm Relay

The relay used for the Gen3 hardware is a PhotoMOS solid state change-over relay.

Contact Form	Both Form A (Normally Open) & Form B (Normally Closed)
Max current	1A (De-rate to 0.5A for operation above 75°C ambient)
Max Voltage	32V, limited by input protection
Isolation	100V
Control	Released on de-power or watchdog restart or software command

5.12 Analog Inputs

The specifications below, 5.13 to 5.16, refer to the optional P511 analog expansion board. Higher stability and lower cost variants are available, contact the factory for more information. For other expansion boards, refer to the appropriate manual.

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

5.13 ADC Inputs Voltage & Current Mode

Type of Input	Differential voltage inputs
Input Range	0 to +5.15 V or 0 to 21.5mA

5.13.1 Accuracy at different operating temperatures

+5°C to +45°C	± 0.020% of reading from 1.0 to 5.15 Volts and ± 0.025% of reading from 4.0 to 21.5mA
-25°C to +55°C	± 0.025% of reading from 1.0 to 5.15 Volts and ± 0.030% of reading from 4.0 to 21.5mA
-40°C to +85°C	± 0.050% of reading from 1.0 to 5.15 Volts and ± 0.065% of reading from 4.0 to 21.5mA

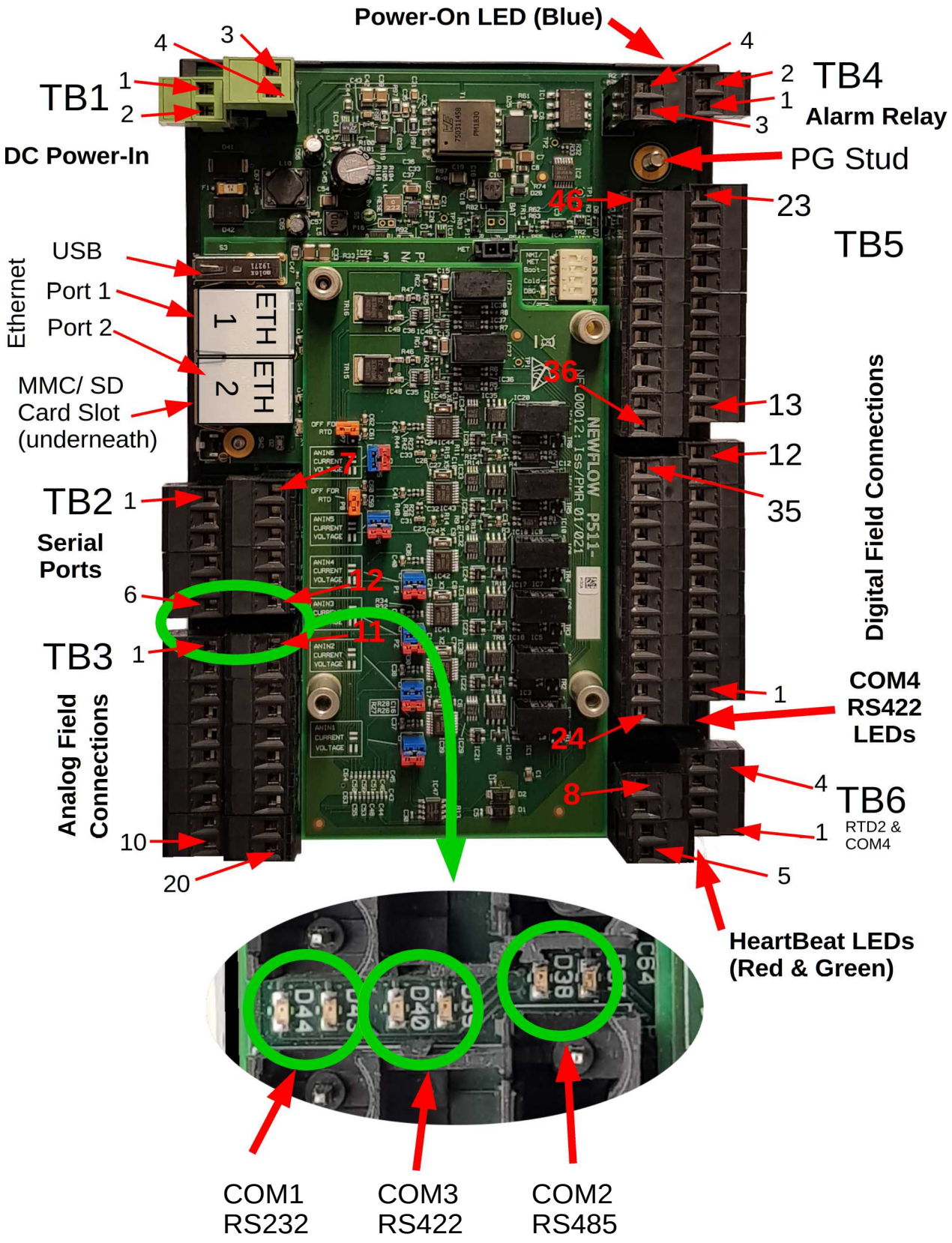
5.14 RTD Inputs

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 to 200 and ± 0.1°C to +300°C
RTD cables	Loop resistance up to 500 Ohms
Security	Continuous cable integrity tests for excitation current and voltages allow open & short circuit detection
RTD current sources	1mA nominal
3 Wire Mode	Not Supported

5.15 Analog 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	500 mSec to within 1%

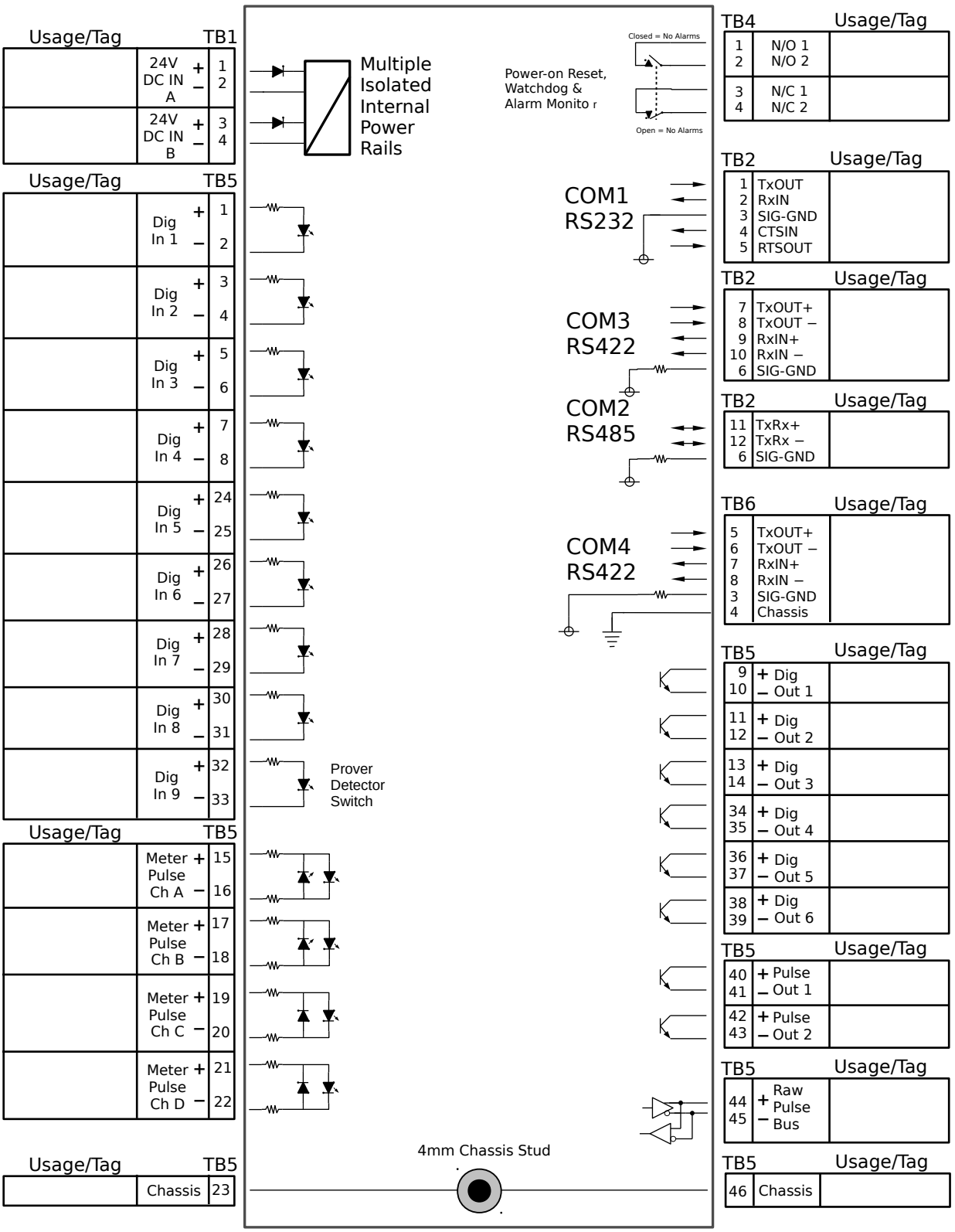
Appendix A – Terminal Block Layout



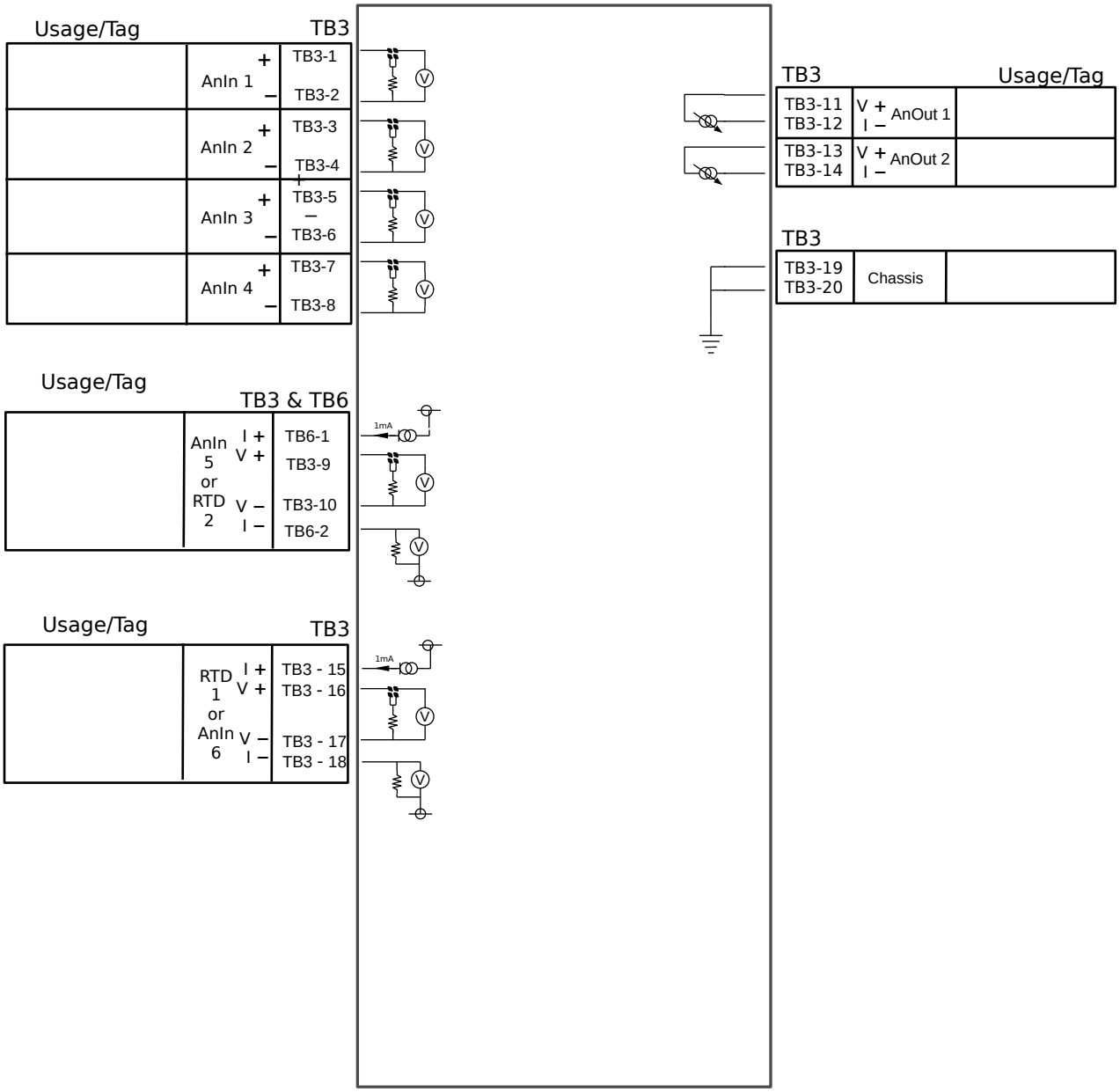
NOTE: The communication tell-tale LEDs for COM1, COM2, COM3 & COM4 show RED for data transmitted from the NÅNO and GREEN for data received by the NÅNO.

Appendix B – Input & Output Block Diagram

Digital & Serial



Analog Expansion



Appendix C – Pin Out Assignment Schedule

TB1 Lower Row

Pin	Usage	Description
1	24V PSU A +24V	DC Input +ve pin
2	24V PSU A 0V	DC Input −ve pin

TB1 Upper Row

Pin	Usage	Description
3	24V PSU B +24V	Alternate DC Input +ve pin
4	24V PSU B 0V	Alternate DC Input −ve pin

TB2 Lower Row

Pin	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 SIG-GND	
4	COM1 RS232 CTSIN	
5	COM1 RS232 RTSOUT	
6	COM2/3 SIG-GND	

TB2 Upper Row

Pin	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 RS485 TxRx+	Ultra-hardened RS485 port for Field use
12	COM2 RS485 TxRx−	

TB3 Lower Row

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

TB3 Upper Row

Pin	Usage	Description
11	AnOut 1+	Fully Isolated current mode Analog Output
12	AnOut 1−	
13	AnOut 2+	As above, but for Analog Output Channel 2
14	AnOut 2−	
15	RTD 1 I+	4-wire RTD (PT100) which can be used as a sixth Analog input in either 4-20 mA or 1-5V mode
16	RTD 1 V+ / AnIn 6+	
17	RTD 1 V- / AnIn 6−	
18	RTD 1 I-	
19	Chassis	EMC Chassis connection
20	Chassis	EMC Chassis connection

TB4 Lower Row

Pin	Usage	Description
1	Alarm Relay A Contact	When in Alarm, A Contacts are Open, otherwise they are Closed
2	Alarm Relay A Contact	

TB4 Upper Row

Pin	Usage	Description
3	Alarm Relay B Contact	When in Alarm, B Contacts are Closed, otherwise they are Open
4	Alarm Relay B Contact	

TB5 Lower Row

Pin	Usage	Description
1	DigIn 1+	Isolated Digital Input Channel No. 1
2	DigIn 1−	
3	DigIn 2+	Isolated Digital Input Channel No. 2
4	DigIn 2−	
5	DigIn 3+	Isolated Digital Input Channel No. 3
6	DigIn 3−	
7	DigIn 4+	Isolated Digital Input Channel No. 4
8	DigIn 4−	
9	DigOut 1+	Isolated Digital Output Channel No. 1
10	DigOut 1−	
11	DigOut 2+	Isolated Digital Output Channel No. 2
12	DigOut 2−	
13	DigOut 3+	Isolated Digital Output Channel No. 3
14	DigOut 3−	
15	PulseIn A+	Meter Pulse Input Channel A
16	PulseIn A−	
17	PulseIn B+	Meter Pulse Input, use with Ch A for Dual Pulse Input
18	PulseIn B−	
19	PulseIn C+	Meter Pulse Input Channel C
20	PulseIn C−	
21	PulseIn D+	Meter Pulse Input Channel D
22	PulseIn D−	
23	Chassis	EMC Chassis connection

TB5 Upper Row

Pin	Usage	Description
24	DigIn 5+	Isolated Digital Input Channel No. 5
25	DigIn 5−	
26	DigIn 6+	Isolated Digital Input Channel No. 6
27	DigIn 6−	
28	DigIn 7+	Isolated Digital Input Channel No. 7
29	DigIn 7−	
30	DigIn 8+	Isolated Digital Input Channel No. 8
31	DigIn 8−	
32	DigIn9 / Detector+	Sphere Switch input or Digital Input Channel No. 9
33	DigIn 9 / Detector−	
34	DigOut 4+	Isolated Digital Output Channel No. 4
35	DigOut 4−	
36	DigOut 5+	Isolated Digital Output Channel No. 5
37	DigOut 5−	
38	DigOut 6+	Isolated Digital Output Channel No. 6
39	DigOut 6−	
40	PulseOut 1+	Isolated Pulse Output Channel No. 1 Can be used as DIGOUT
41	PulseOut 1−	
42	PulseOut 2+	Isolated Pulse Output Channel No. 2 Can be used as DIGOUT
43	PulseOut 2−	
44	RAWPLS+	Bidirectional Pulse Bus for meter proving
45	RAWPLS−	
46	Chassis	EMC Chassis connection

TB6 Lower Row

Pin	Usage	Description
1	RTD 2 I+	RTD (PT100) Channel No.2 Current connections
2	RTD 2 I−	
3	COM4 SIG-GND	Signal Ground
4	Chassis	EMC Chassis connection

TB6 Lower Row

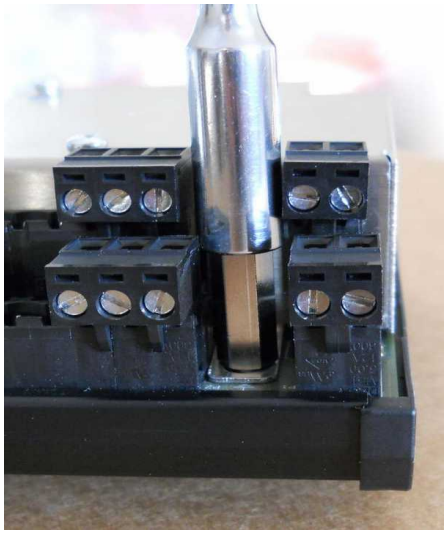
Pin	Usage	Description
5	COM4 RS422/485 TxOUT+	A second General Purpose RS422 or 4-wire RS485 port that can be connected as a 2-wire RS485 port
6	COM4 RS422/485 TxOUT−	
7	COM4 RS422/485 RxIN+	
8	COM4 RS422/485 RxIN−	

Appendix D – Removing & Replacing the Lid

If the jumpers on the Analog board, or the Metrology Enforcement Switch needs to be changed then the lid of the unit will need to be removed.

For certain metrology approved applications, a tamper proof "seal" may be fitted over a screwhead. 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 Pozidriv pan head screws are withdrawn from the top of the unit, and the M4 x 25 stand-off is unscrewed from the PG grounding stud, that secures the lid and provides and electrical connection to Protective Ground (PG) to give enhanced ESD and EMC shielding.

Removal Sequence



Firstly remove the stand-off which secures the lid ground 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 Status LED, and above ETH2 Ethernet connector. This screw is always a short M3 x 6mm Pozidriv 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 M3 x 20mm Pozidriv pan head screw with an integral 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 grounding tag slips over the ground stud. The screws can be refitted in any order and the stand-off should be screwed back onto the ground stud.

Appendix E – NÅNO Label Drawings