

SECTION 4

NV10 USB MANUAL SET

MECHANICAL AND ELECTRICAL MANUAL

INTELLIGENCE IN VALIDATION

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NV9 USB MANUAL SET – SECTION 4

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4. MECHANICAL AND ELECTRICAL MANUAL

This section is one part of a complete manual set. Design Engineers who are designing a host machine cabinet, or looking to integrate the NV10 USB validator into an existing cabinet should read this section. This section contains all of the mechanical and electrical information a designer needs to effectively integrate the NV10 USB validator into a host machine.

4.1 Introduction

The NV10 USB validator is made up of two basic components: the NV10 USB validator unit and a removable bezel (as shown below):



The NV10 USB validator is a device that can accept and validate bank notes of mixed denominations.



**NV10 USB
Rear View**



**NV10 USB
Side View**



**NV10 USB
Front View**

**Information**

Validator compatibility.

The NV10 USB validator is pin for pin compatible with the NV7 / NV8 / NV9 / NV10 series of validators, but **NOT** with earlier versions of the product (NV2 – NV5).

The NV10 USB Validator leaves the factory preset to at least one currency and one firmware interface so that it is ready for immediate installation. The NV10 USB validator works with any NV10 USB currency dataset created by Innovative Technology Ltd - datasets can be downloaded from the Support section of the ITL website.

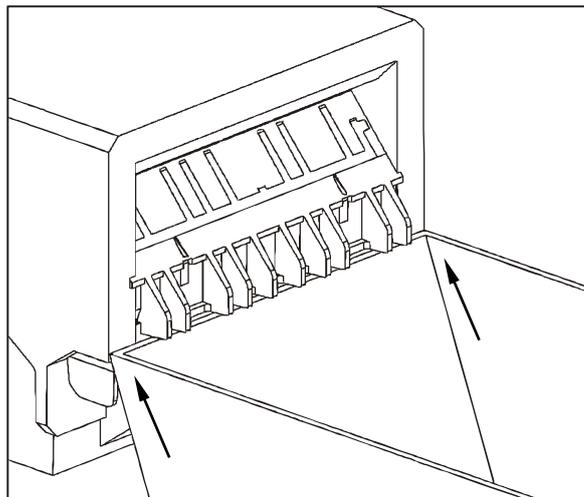
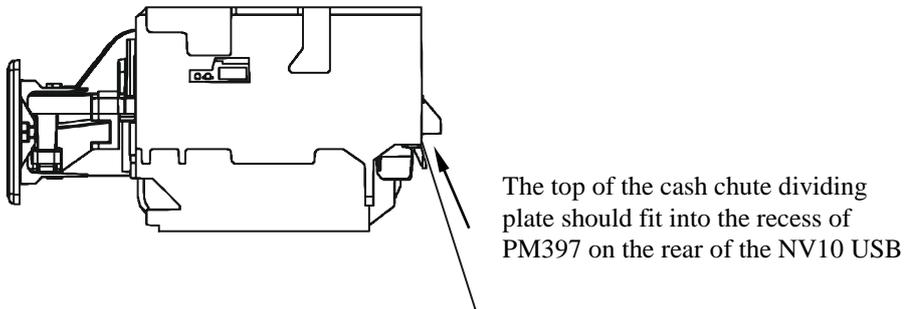
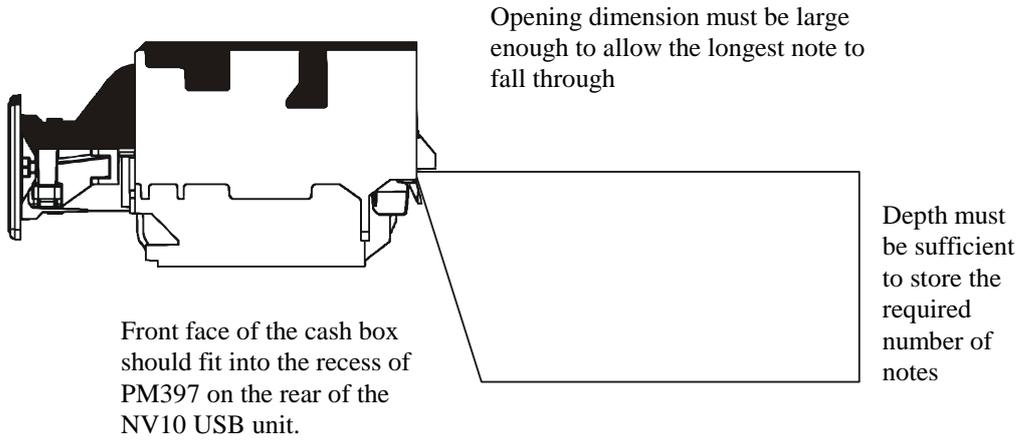
4.2 Assembly and Fitting Instructions

Installing the NV10 USB is a simple operation; the validator can only be installed **horizontally**:

1. The validator will be fitted with a suitable bezel.



2. Cash box advice



**Information**

Check website for options.

There are variants of bezel available for the NV10 USB validator. Please check the ITL website (www.innovative-technology.co.uk) for up to date information on the options available.

The technical drawings which can be found at the end of this section show all the dimensional information needed to mount the unit.

**WARNING!**

Do not attempt disassembly

Do not attempt to disassemble the NV10 USB validator unit – trying to do so could cause personal injury and will damage the unit beyond repair.



4.3 Technical Specifications

The full technical specifications for the NV10 USB Validator can be found in Section 6, Appendix B of this manual set. A brief summary is given here:

DC Voltage	Minimum	Nominal	Maximum
Absolute limits	10.8 V	12 V	14.2 V
Absolute limits (when fitted with IF5 interface)	18 V	---	48 V DC or 34 V AC
Supply ripple voltage	0 V	0V	0.25 V @ 100 Hz
Supply Current			
Standby	200 mA		
Running	1 A		
Peak (motor stall)	1.5 A		

Interface Logic Levels	Logic Low	Logic High
Inputs	0 V to +0.5 V	+3.7 V to +12 V
Outputs (2.2 kΩ pull-up)	+0.6 V	Pull-up voltage of host interface
Maximum current sink	50 mA per output	



WARNING!
Use suitable power supply

Ensure that the supply voltage to the NV10 USB is not lower than 10.8 V and that the power supply can provide sufficient current to avoid incorrect operation and excessive note rejects.

We recommend that your power supply is capable of supplying 12V DC at 3 A.

- For 12V operation, use TDK Lambda model SWS50-12. This power supply is available from a variety of suppliers including Farnell (stock code 1184645) and RS (stock code 466-5869).

4.4 Cable Specifications

The **minimum** specification for wire used in power cables for the NV10 USB validator is given here:

Minimum AWG	Nominal current rating	Peak current rating	Cable rating	Insulation rating
30	1.0 A	1.5 A	2 A	80 °C

Do not use wire of an inferior specification, as this can cause operating problems with the validator.



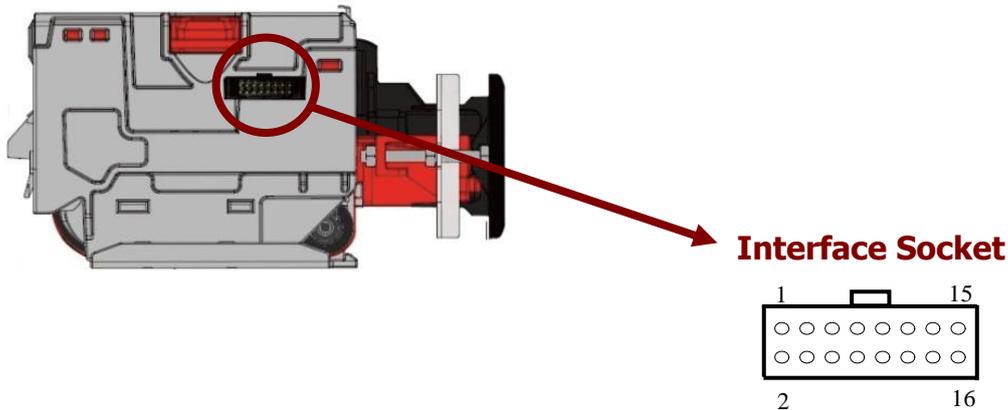
4.5 Electrical Interfaces

The NV10 USB Validator has a single connector that is used to allow interfacing and programming.

 Information
 Power always required regardless of connection type.

Power is always required on pins 15 and 16 of the 16 way connector.

The connector is a 16 pin socket located on the side of the validator. This connector is used to interface the NV10 USB to the host machine. The pin numbering of the socket is shown below, as well as an overview of the socket connections:

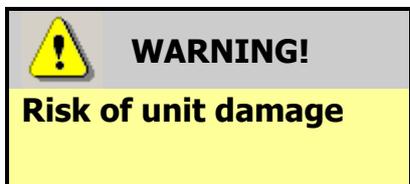


Pin	Description
1	Serial Data Out (Tx)
5	Serial Data In (Rx)
11	USB Data +
12	USB Data -
13	USB Power (+5V)
15	+ V
16	0V / Ground Connection

To use a USB connection with the NV10 USB, a USB cable with a 16 way connector on one end (ITL Part Number CN392) should be used. The CN392 cable fits into the 16 way connector and allows high speed programming and serial communications when used in SSP, ccTalk and SIO modes.

When using the USB connection, power must be supplied to the NV10 USB using the CN392 cable.

The socket connections for the natively supported protocols are shown in the tables below, as is a summary of the interface units needed for other types of operation:



Do not make any connections to the interface socket pins marked '**Do not connect**' – making connections to these pins could cause severe damage to the unit.

NV10 USB eSSP Interface:

Pin	Name	Type	Description
1	Vend 1	Output	Serial data out (Tx)
2	Factory use only		Do not connect
3			
4			
5	Inhibit 1	Input	Serial data in (Rx)
6	Factory use only		Do not connect
7			
8			
9			
10			
11	USB D+	Data	USB Data +
12	USB D-	Data	USB Data -
13	USB Vcc	Power	USB +V (+5V)
14	Factory use only		Do not connect
15	V In	Power	+V
16	GND	Ground	GND

We have now developed encrypted SSP (eSSP) for the NV10 USB banknote validator as it is our opinion that encrypted SSP is now necessary in this advanced technological age. The encryption of SSP protocol will ensure superior protection and reliability of the data, which is transferred between validator and host machine. The encryption key is 128 bits long, and is divided into two parts. The lower 64 bits are fixed and specified by the machine manufacturer, allowing the manufacturer to control which devices are used in their machines. The higher 64 bits are securely negotiated by the slave and host at power up, ensuring each machine and each session are using different keys. This encryption algorithm is approved by the US military for its advanced security.

NV10 USB SSP Interface:

Pin	Name	Type	Description
1	Vend 1	Output	Serial data out (Tx)
2	Factory use only		Do not connect
3			
4			
5			
5	Inhibit 1	Input	Serial data in (Rx)
6	Factory use only		Do not connect
7			
8			
9			
10			
11	USB D+	Data	USB Data +
12	USB D-	Data	USB Data -
13	USB Vcc	Power	USB +V (+5V)
14	Factory use only		Do not connect
15	V In	Power	+V
16	GND	Ground	GND

NV10 USB ccTalk Interface:

Pin	Name	Type	Description
1	Vend 1	Output	Serial data – must also be connected to pin 5
2	Factory use only		Do not connect
3			
4			
5			
5	Inhibit 1	Input	Serial data – must also be connected to pin 1
6	Factory use only		Do not connect
7			
8			
9			
10			
11	USB D+	Data	USB Data +
12	USB D-	Data	USB Data -
13	USB Vcc	Power	USB +V (+5V)
14	Factory use only		Do not connect
15	V In	Power	+V
16	GND	Ground	GND



NV10 USB SIO Interface:

Pin	Name	Type	Description
1	Vend 1	Output	Serial data
2	Factory use only		Do not connect
3			
4			
5	Inhibit 1	Input	Serial data
6	Factory use only		Do not connect
7			
8			
9			
10			
11	USB D+	Data	USB Data +
12	USB D-	Data	USB Data -
13	USB Vcc	Power	USB +V (+5V)
14	Factory use only		Do not connect
15	V In	Power	+V
16	GND	Ground	GND



NV10 USB Pulse Interface:

Pin	Name	Type	Description
1	Vend 1	Output	Credit pulse stream output
2	Factory use only		Do not connect
3			
4			
5	Inhibit 1	Input	Inhibit Channel 1 by holding this pin HIGH
6	Inhibit 2	Input	Inhibit Channel 2 by holding this pin HIGH
7	Inhibit 3	Input	Inhibit Channel 3 by holding this pin HIGH
8	Inhibit 4	Input	Inhibit Channel 4 by holding this pin HIGH
9	Busy	Output	Busy signal – output is pulled low when the validator is busy
10	Escrow	Input	Enable Escrow function by holding this pin LOW
11	Factory use only		Do not connect
12			
13			
14			
15	V In	Power	+V
16	GND	Ground	GND

When operating in Pulse mode the NV10 USB outputs a number of pulses on Vend 1. The number of pulses for each channel is different and set to default values within the dataset. The number of pulses and the pulse duration can be modified using the Bank Note Validator Currency Manager Software, and a maximum of 16 channels can be used.

NV10 USB Multi Drop Bus (MDB) Interface:

MDB is a serial bus interface commonly used in electrically controlled vending machines. This is a 9600 Baud Master – Slave system where the NV10 USB validator is a slave to master controller.

To use the NV10 USB with MDB protocol, an **IF5** external interface convertor is required. The IF5 regulates the power supply and opto-isolates the communication lines. The NV10 USB validator supports the MDB Protocol Version 1, Level 1.



NV10 USB Parallel Interface:

Pin	Name	Type	Description
1	Vend 1	Output	Channel 1 credit, 100ms active low pulse
2	Vend 2	Output	Channel 2 credit, 100ms active low pulse
3	Vend 3	Output	Channel 3 credit, 100ms active low pulse
4	Vend 4	Output	Channel 4 credit, 100ms active low pulse
5	Inhibit 1	Input	Inhibit Channel 1 by holding this pin HIGH
6	Inhibit 2	Input	Inhibit Channel 2 by holding this pin HIGH
7	Inhibit 3	Input	Inhibit Channel 3 by holding this pin HIGH
8	Inhibit 4	Input	Inhibit Channel 4 by holding this pin HIGH
9	Busy	Output	Busy signal – output is pulled low when the validator is busy
10	Escrow	Input	Enable Escrow function by holding this pin LOW
11	Factory use only		Do not connect
12			
13			
14			
15	V In	Power	+V
16	GND	Ground	GND

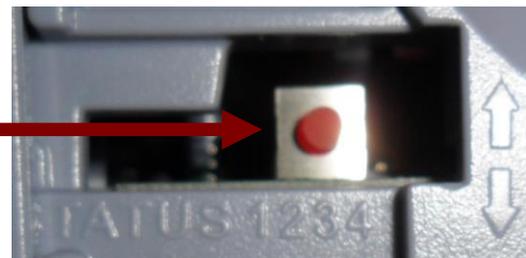
When operating in Parallel mode the NV10 USB will issue a 100ms active LOW pulse on the relevant vend line, and a maximum of 4 channels can be used. There is also the option to use a binary output where the NV10 USB will output a binary pattern on vend lines 1 – 4. Binary mode can be set as an option using a configuration card or with the Bank Note Validator Currency Manager Software.

4.6 Configuration Button

The NV10 USB does not use DIP switches to configure the unit – configuration and setting is carried out by using a Configuration Button mounted on the right hand side of the unit:



Configuration Button



There are several functions available when using the Configuration Button, and these are listed in the next table:

	<p>WARNING!</p>
<p>Risk of unit damage</p>	

When in programming mode, do not turn off the power before the operation is complete as this will make the unit unusable.

NV10 USB Configuration Button Functions

Action	Power Status	Function	Confirmation
Press and hold (more than 2 seconds) until the bezel illuminates, then release	Powered ON	Sets validator to Programming mode (SSP)	Bezel will flash quickly and validator will restart
Press once (less than 1 second)	Powered ON	Enables Configuration Card programming – press again to cancel this mode	Bezel will flash on and off slowly while in this mode
Press twice (within half a second)	Powered ON	Shows current interface type	Bezel will flash – see the flash count table below
Press and hold as validator is powered up	Powered OFF / ON	Resets to default (factory) settings	---

NV10 USB Programming Mode - Press and hold the configuration button for approximately 2 seconds while the NV10 USB is powered up (until the bezel LED illuminates). The Bezel LED will flash rapidly as the button is released to indicate that SSP is being loaded. Once this process has finished the NV10 USB will reset. The NV10 USB will now be in Programming Mode (SSP) and allow connection to a PC via a CN392 cable, DA2 adapter or connection to a DA3.

Pressing and holding the button again will return the NV10 USB to its original interface.

Configuration Card Programming Mode - Press the configuration button once while the NV10 USB is powered up. If done correctly, the Bezel LED will flash every second. This indicates that the validator is ready for the insertion of a Configuration Card to change the Firmware Protocol in the NV10 USB. (See subsection 4.7 of this manual for more details).

This mode can be cancelled by pressing the configuration button once.

Encryption Key Reset Function (ccTalk) - This function will only be possible if the NV10 USB is programmed to operate in ccTalk mode, as it is not possible to reset the key from SSP mode.

Press and hold the configuration button while the NV10 USB powered is off. Apply the power and keep the button pressed for several seconds. Release the button and the ccTalk Encryption key will now be restored to the default setting.



Current Setting Indicator Mode - Quickly pressing the configuration button twice will cause the bezel LEDs to flash – the number of flashes indicates which interface is currently selected:

Flash Count	Interface
1	SSP
2	Pulse
3	MDB
6	ccTalk
7	SIO
8	Parallel

The NV10 USB Validator leaves the factory preset to at least one currency and one interface so that it is ready for immediate installation. The installed dataset and interface are detailed on the product label located on the top of the validator.

4.7 Programming

Full details on programming the NV10 USB Validator using software can be found in Section 3 of this manual set (ITL Software Support Guide).

It is also possible to program the NV10 USB by the use of a configuration card. Summary information on configuration card programming can be found in Section 6, Appendix E of this manual set. More detailed information can be found in Section 5 of this manual set, or in ITL technical document GA713; the current version of this document can be downloaded from the Support section of the ITL website.



Information

Validator specific.

The configuration card template contained in document GA713 is specific to the NV10 USB validator, and cannot be used for other products within the ITL range of validators.

If you use a configuration card to program the NV10 USB and there is an error, the card will be ejected and the bezel LEDs will flash slowly as shown in the table below:

Number of flashes	Indicated error
2	Invalid card read – card entered wrong way around, misread or wrong card version used
3	No interface selection was detected on the card
4	Multiple interface selections detected
5	Invalid interface detected – the selected interface is not available for this validator
6	Selected interface is not compatible with this validator version
7	Pulse configuration error – selected pulse options are invalid
8	ccTalk configuration error – the selected ccTalk options are invalid (ccTalk 8 bit chk not allowed without ccTalk plain)
9	Low power mode not available for this validator version



4.8 Basic Operation

The NV10 USB validator can accept and validate bank notes of mixed denominations, and works with any NV10 USB currency dataset created by Innovative Technology Ltd.

Validated bank notes exit the rear of the NV10 USB so it is important that there is sufficient space for the “initial exit” and “final exit” of notes from the NV10 USB note path , before entry into the cash box/chute without any obstructions (see Appendix C – Cash box Advice). For help on installing the NV10 USB into a new design please contact : support@innovative-technology.co.uk.

The NV10 USB Validator has inbuilt fault detection. If there is a configuration or other error, the NV10 USB front bezel will flash in a particular sequence.

A summary of the Bezel Flash Codes for the NV10 USB is shown below:
support@innovative-technology.co.uk.

Flashes		Indicated Error	Comments
Long	Short		
0	0	None	
1	2	Note path jam	Remove obstruction and follow the cleaning procedure in Section 2 of this manual set
	3	Unit not initialised	Contact ITL technical support
	4	Internal sensor unable to calibrate	Ensure note path is firmly closed, then cycle the power to the unit. If the problem persists contact ITL technical support
3	1	Firmware checksum error	Download new firmware
	2	Interface checksum error or unable to set programmed interface	
	3	EEPROM checksum error	
	4	Dataset checksum error	
4	1	Power supply too low	Check power supply
	2	Power supply too high	



4.9 Spare Parts

ITL Part Number	Description	Details
CN392	Power and USB Communication Cable	USB 2.0 Compliant Type A to 16 way header cable
<p>The diagram illustrates the CN392 cable assembly. It features a USB Type A connector (CON1) on one end and a 16-pin header (CON2) on the other. The main cable is a standard USB lead with a maximum diameter of 5.0mm, shielded, and black in color. The total length of the cable is 1500mm. At the USB connector end, there are two terminals: T1 for Red +12V and T2 for Black 0V. The wires are stripped and tinned. A black heat shrink sleeve, 25mm long, is spaced every 150mm along the cable. At the header end, the white and green wires are twisted together. A detailed inset labeled 'Figure 1' shows the internal wiring connections: Black USB GND is connected to CON1.1, Black 0V is connected to CON4.16, and the USB Screen is insulated using heat shrink. Dimensions include 1500mm for the main cable length, 20mm for the USB connector length, and 15mm for the heat shrink sleeve segments.</p>		
<p>Comments: Please consult the tables on the next page for pin out and connector information.</p>		



CN392 Parts List

Qty	Description	Supplier	Alternative
1	USB 2.0 lead with type A plug	Molex 88728-3400	RS 324-8362
2	8 way 2 row 2.54mm pitch friction lock housing	Molex 90142-0016	Leotronics 2652-2161
9	Gold plated crimp socket 22-24 AWG	Molex 90119-2110	Leotronics 2653-2000
2	Black heat shrink sleeving	---	---
2	26 AWG stranded single core cable, PVC insulated	---	---

CN392 Connectivity

CON1	CON2	Gauge	Colour	Comments
Pin				
1	13		Red	USB +V (+5V)
2	12		White	USB Data – (twist together with Data +)
3	11		Green	USB Data + (twist together with Data -)
4	16		Black	USB GND - see figure 1 for connection detail
Screen	16		Black	See figure 1 for connection detail
---	16	26 AWG	Black	0V - see figure 1 for connection detail
---	15	26 AWG	Red	+12V - see figure 1 for connection detail
Notes: CON2 pins 1 - 4 have crimps fitted but these are not connected. CON2 pins 5 -10 and 14 have no crimps fitted				



WARNING!

Use correct wire gauges

If you choose to make your own cables, you must make sure that the wire gauges are suitable for use with the validator. The minimum wire gauge for the CN392 cable is **30 AWG**, with **26 AWG** being recommended.



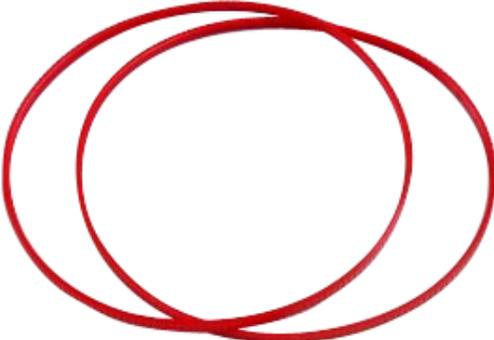
Bezels		
ITL Part Number	Description	
PA231	Standard Bezel	
PA266	Extended Bezel	



Information

Check website for options.

There are many variants of bezel available for the NV10 USB validator. Please check the ITL website (www.innovative-technology.co.uk) for up to date information on the options available.

Drive Belts		
FD107	NV10 USB Red Drive Belt	



Accessories		
ITL Part Number	Description	
CN392	ITL to USB Cable	
PM599	Anti Strim Shield	
PA258	NV4 to NV10 USB Adaptor Plate	



4.10 Guidance Notes

Cleaning

The NV10 USB Validator has been designed in a way to prevent damage and airborne contamination reaching the optical sensors; however, depending upon the environment the NV10 USB may require occasional cleaning or belt changing. This section is one part of a complete manual set: typically, a field service engineer who is maintaining the product would use this section.



Caution!

Do not use solvent based cleaners on any part of the NV10 USB unit.

Do not use solvent based cleaners such as alcohol, petrol, methylated spirits, white spirit or PCB cleaner. Using these solvents can cause permanent damage to the unit; only use a mild detergent solution as directed below.

To clean the NV10 USB, remove the bezel, open the note path by pushing downwards on both Red catches and the inwards towards the body of the NV10 USB (see Figure 10) and lift and expose the note paths, place them on a clean dry surface. The note path will now be exposed for cleaning, (see Figure 11).

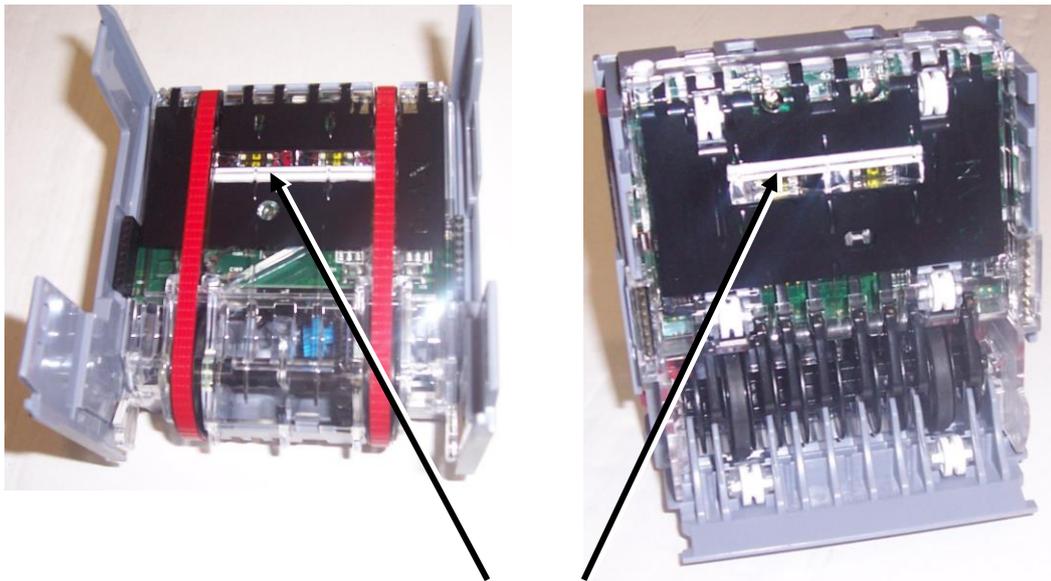


Figure 10 – NV10 USB Release Catches



Carefully wipe the surfaces with a soft lint free cloth that has been dampened with a water and mild detergent solution (i.e. household washing up liquid). Take particular care around all the sensor lenses (see Figure 11), ensuring they are clean and dry. If a lens has become badly scratched do not attempt to polish it. Contact ITL for further advise, as there may be damage to the optical properties of the lens.

CUTION: WHEN CLEANING THE “RECESSED” FRONT SENSOR, USE A SMALL SOFT BRUSH OR COTTON WOOL BUD.



Optical Sensors

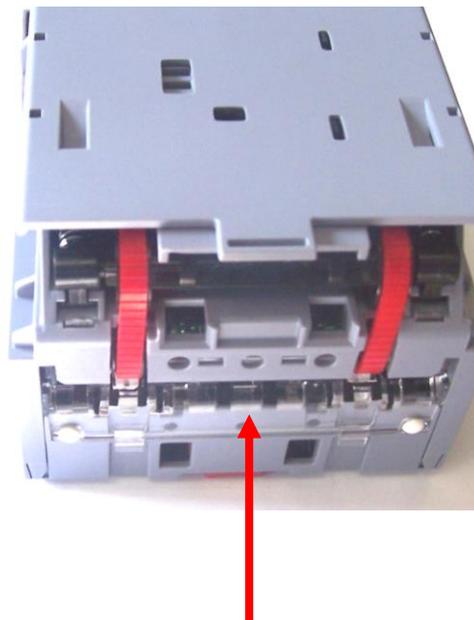
Figure 11 – NV10 USB Sensor Location

	<p>WARNING!</p>
<p>Disconnect power BEFORE any cleaning operation</p>	

Unless stated otherwise, you should disconnect the power **BEFORE** carrying out any cleaning operations to avoid the risk of causing damage to the validator.

Belt Cleaning

- Ensure the validator is enabled (i.e. Bezel lights are illuminated).
- Remove Bezel.
- Insert a piece of paper, narrower than the width between the two red belts, in the centre of the note path to activate the drive motor.
- Use a lint free cloth dampened with a water and mild detergent solution such as household washing up liquid and hold it against each drive belt as it turns.
- Repeat steps 3 and 4 until all dust and debris has been removed from both belts.
- Repeat step 3 using a DRY lint free cloth to remove any excess moisture.



Insert Paper

Figure 12 – Belt Access



Caution!

Do not use solvent based cleaners on any part of the NV9 USB unit.

Do not use solvent based cleaners such as alcohol, petrol, methylated spirits, white spirit or PCB cleaner. Using these solvents can cause permanent damage to the unit; only use a mild detergent solution as directed below.

Re-Initialisation

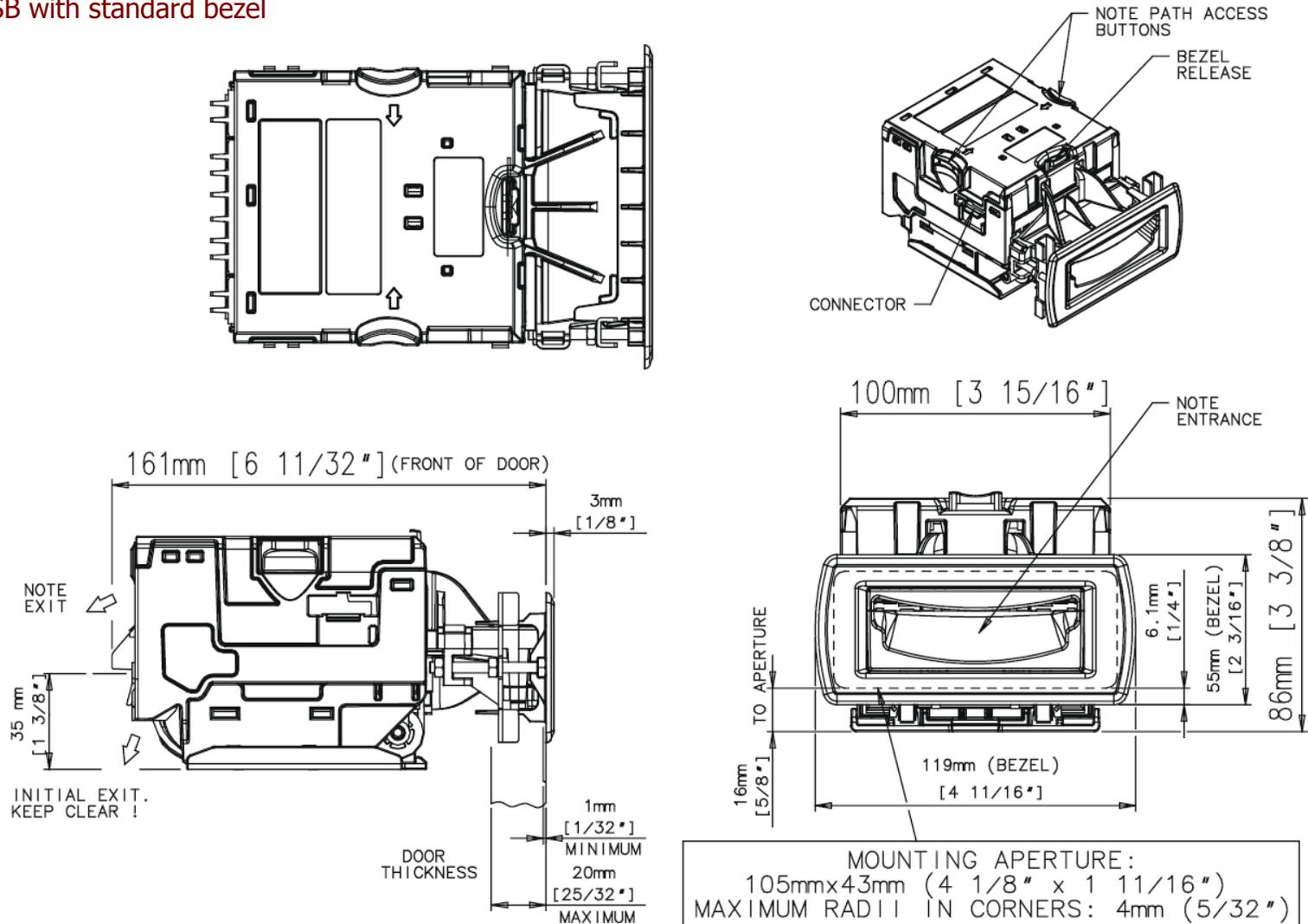
The NV10 USB validator has an in-built self-calibration system that keeps the optical sensors in optimum operating condition. However if the NV10 USB is disassembled for any reason it also will need to be re-initialised - re-initialisation can only be carried out by ITL's technical support team.



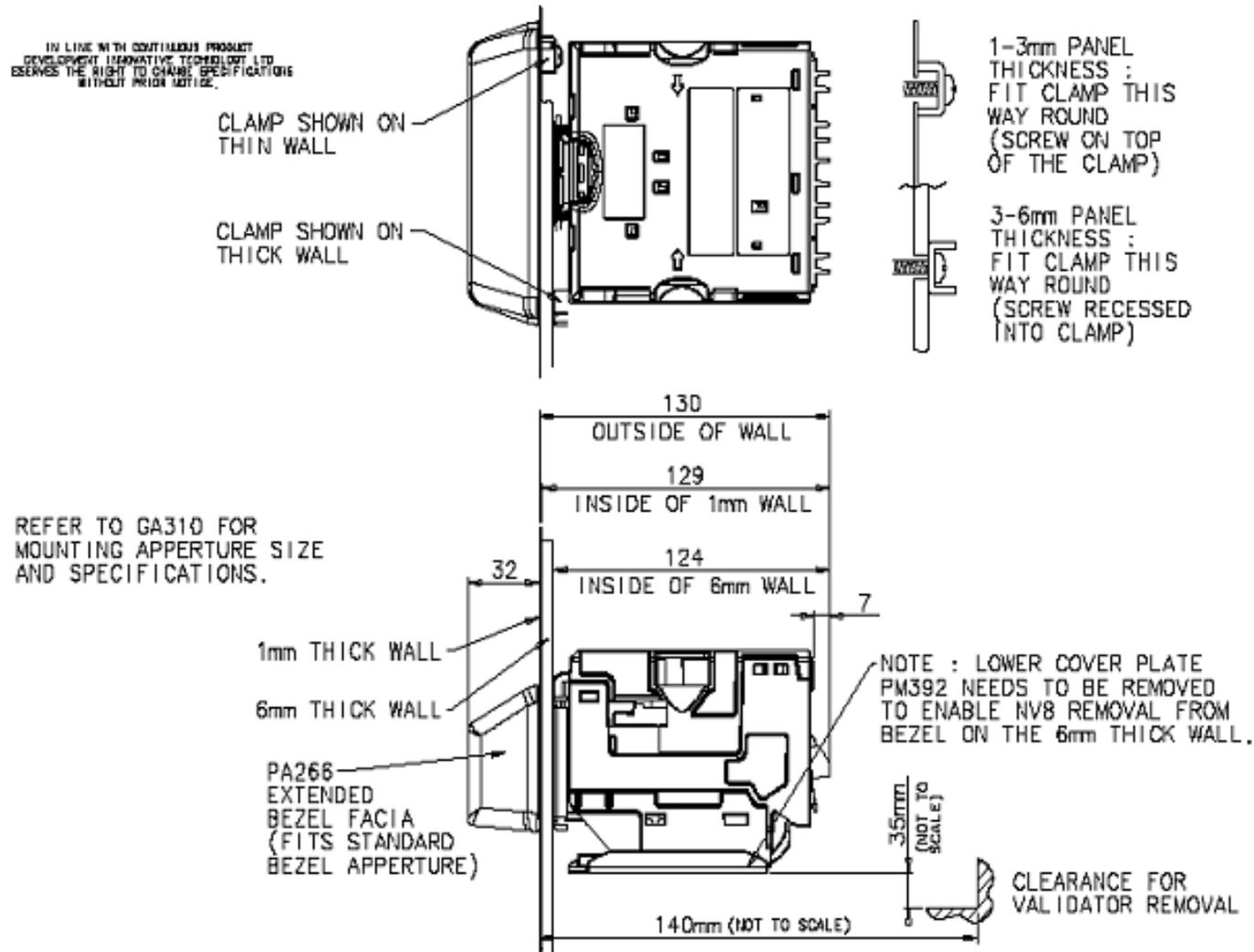
4.11 Drawings and Schematics

NOTE: If required, IGES 3D models are available on request from ITL technical support.

NV10 USB with standard bezel



NV10 USB with extended bezel



MAIN HEADQUARTERS

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