

# NV10 OPERATIONS MANUAL

## INTELLIGENCE IN VALIDATION



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## 1 INTRODUCTION

This manual describes the operation of the NV10 Bank note Validator as fitted with Firmware Version 3.15 or greater.

### CAUTIONS:

- **THIS PRODUCT MUST BE FITTED WITH A 2 AMP FUSE BEFORE USE.**
- **THE NV10 VALIDATOR IS PIN FOR PIN COMPATIBLE WITH NV7/8/9, BUT NOT PIN FOR PIN COMPATIBLE WITH THE NV2/3/4/4X OR 5 SERIES PRODUCTS.**

We recommend that you study this manual as there are many new features permitting new uses and more secure applications.

If you do not understand any part of this manual please contact the factory, contact details are below, for assistance. In this way we may continue to improve our product.

This document is intended for those whose will:

- Design the NV10 into items of equipment.
- Build equipment using the NV10.
- Install equipment containing the NV10.
- Maintain equipment containing the NV10.

Although information is included which will allow a degree of fault diagnosis and repair, it is recommended that for all but simple mechanical repairs the unit be returned to an approved service centre for repair.

### CAUTIONS:

- **NEVER EXCEED THE RECOMMENDED ENVIRONMENTAL AND ELECTRICAL LIMITS.**
- **DO NOT ATTEMPT TO LUBRICATE THE MECHANISMS AS THIS MAY AFFECT THE NOTE TRANSPORT.**
- **DO NOT POLISH THE LENS AS THIS MAY ALTER THE OPTICAL CHARACTERISTICS.**
- **IF THE NV10 VALIDATOR IS DISASSEMBLED THE UNIT MUST BE RE-CALIBRATED/RE INITIALISED, FOLLOWING RE-ASSEMBLY.**

Innovative Technology Ltd has a policy of continual product improvement. As a result the products supplied may vary from the specification described here.

The NV10 Validator has been designed to minimise any performance variation over time. Much of this is achieved by careful Hardware and Software design. Innovative Technology Ltd has a policy of continual product improvement. As a result the products supplied may vary from the specification described here. This manual can be printed in A4 or letter sizes.

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## 2 ENVIRONMENT AND POWER REQUIREMENTS

### ENVIRONMENT

Environment	Minimum	Maximum
Temperature	+3°C	+50°C
Humidity	5%	95% Non condensing

Table 1 - Environmental Requirements

### CAUTIONS:

**IF THE INPUT VOLTAGE FALLS BELOW +11V, THE NV10 MAY NOT OPERATE CORRECTLY (THE VALIDATOR WILL REJECT NOTES). THE AMBER STATUS LED AND FRONT BEZEL LIGHTS WILL FLASH TO INDICATE INCORRECT CONDITIONS.**

**IT IS ESSENTIAL THAT THE POWER SUPPLY USED CAN SUPPLY AT LEAST 1.5 AMPS.**

### POWER REQUIREMENTS

Electrical Supply	Minimum	Maximum
Supply Voltage (V DC) Absolute Limits	+11 V	+15 V
MDB IF5 Version Supply Voltage	+18V	+42V
Supply Ripple Voltage	0 V	0.25 V @ 100 Hz
<b>Supply Currents:</b>		
Standby		0.35 A
Validating		1 A
Peak (Stacker Motor Stall)		1.5 A

Table 2 - Power Requirements

### 3 GENERAL DESCRIPTION

#### NV10 Validator - the next generation of Smiley® Bank Note validators

The NV10 Bank Note Validator is a compact note-validating machine (see figure 1), suitable for most money machines. It will accept up to 15 different denominations of notes in the serial control mode, pulse mode and binary mode, 4 notes in parallel mode and will cope with different designs of banknotes having the same value such as are found in the United Kingdom.

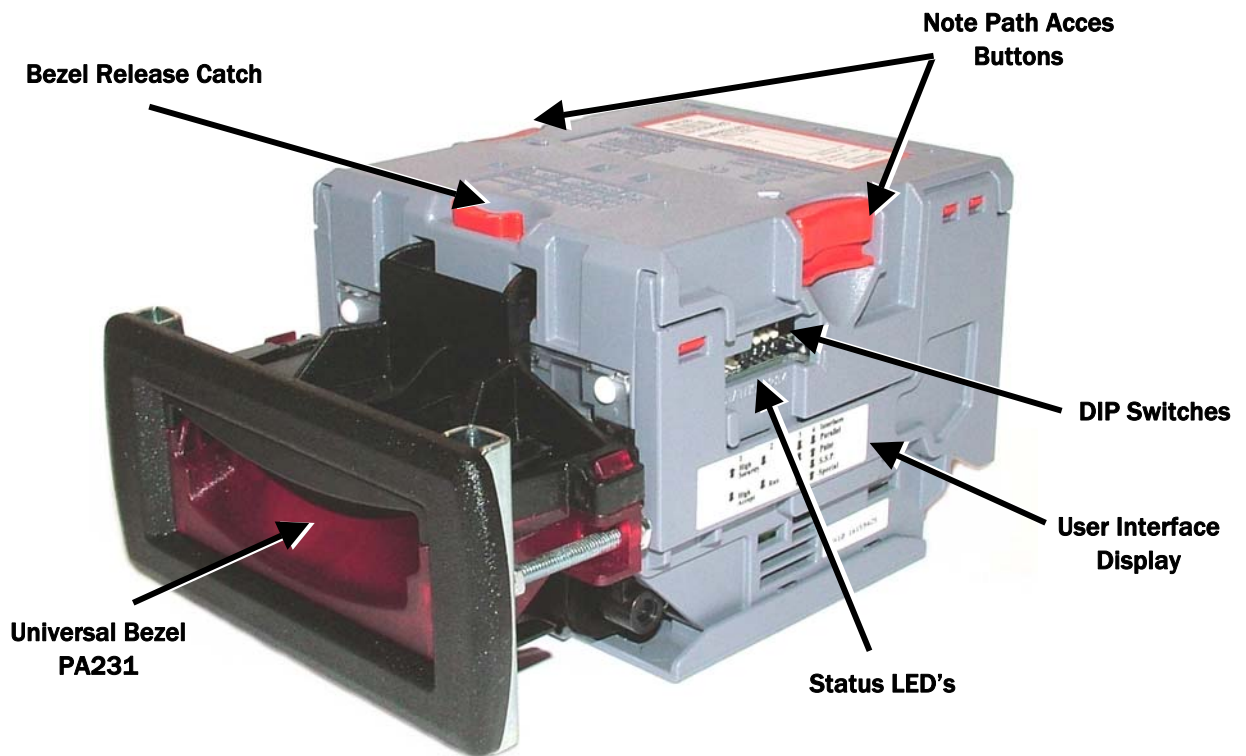


Figure 1 - The NV10 and Universal Bezel PA231

The NV10 Validator leaves the factory containing at least one currency data set so that it is ready for immediate installation. If it is desired to change the currency data set this may be done using either the NV10 to NV10 currency cloning system or the PC based Currency Management software.

New currencies and applications are being tested all the time, please refer to our web site or contact the factory for information concerning specific currencies if they are not already included on our approved list.

The NV10 has been designed for easy installation in most machines. The new stepped “smiling mouth” allows insertion of notes with one hand and simplifies the note handling mechanism. Interfacing the Validator is very simple, with the choice of the following protocols:

- Parallel open collector outputs.
- Pulse stream output.
- Binary
- Smiley® Secure Protocol (SSP) secure serial communications.
- Simple serial I/O communications.
- MDB interface protocol.
- ccTalk
- Extended Interface / USA Serial (NIS)

#### 4 NV10 USER INTERFACE

The user interface with the NV10 is shown below (see figure 2). It is simply a set of four DIPswitches and a RED LED, GREEN LED and an AMBER LED mounted on the top of the NV10. The DIPswitches set the basic operating mode of the unit, while the LED's indicate the operational status of the NV10.

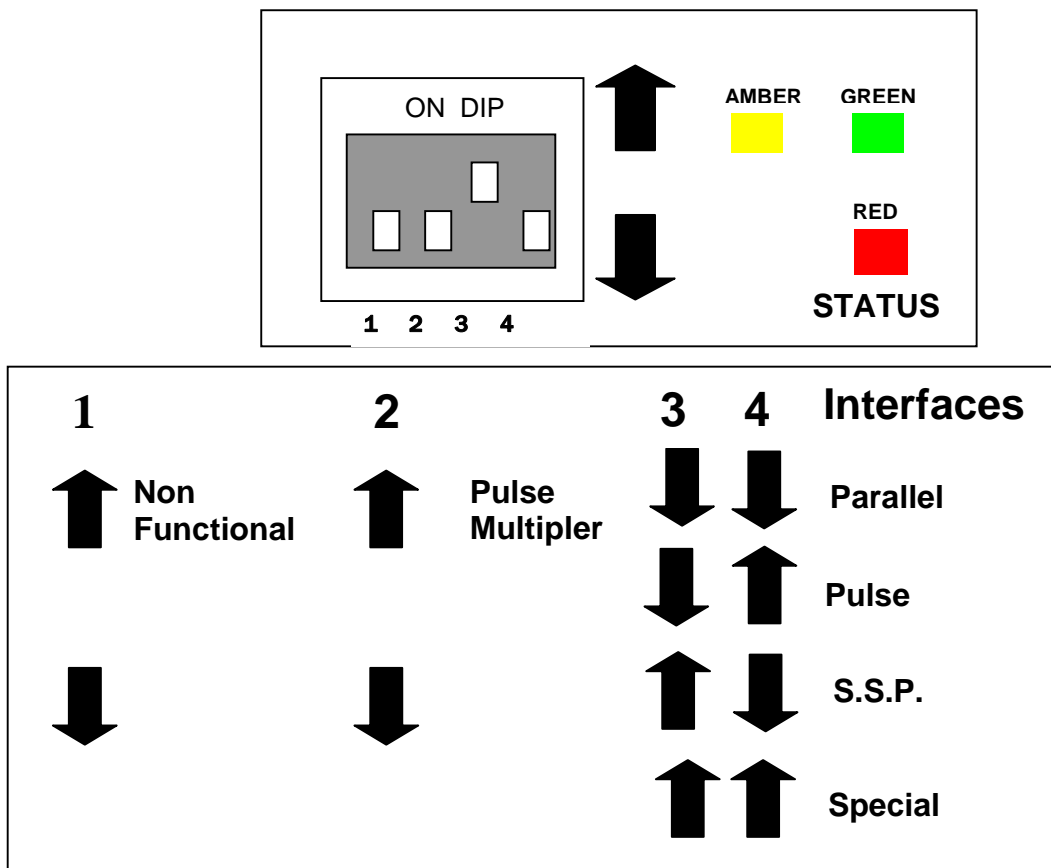




Figure 2 – NV10 User Display and DIPswitches

### 4.1 DIPSWITCH SETTINGS

The four DIPswitches can be set to a combination of either up  or down  depending on the configuration required for the particular NV10.

#### Switch 1 – Spare

Switch 1 currently has no function and is reserved for future use.

#### Switch 2 – Extended Options

This switch is used to modify the behaviour of the selected machine interface. Details of the function of this switch are covered in the interfaces' description in this manual.

#### Switches 3 and 4 – Machine Interface protocol selection

These switches are used to select the machine interface to be used. The NV10 supports numerous interfaces, as shown below, (see table 1).

Interface	Switch 3	Switch 4
Parallel	Down	Down
Pulse	Down	Up
SSP	Up	Down
Special	Up	Up

Table 3 - Switch 3 and 4 Machine Interface Selection

The details of the parallel, pulse, and SSP can be found in the machine interface protocols section of this manual.

#### Special Modes

The special interface depends on the firmware that is used in the NV10, the firmware shipped as standard is ccTalk (unless specified by order). The table below shows all the options that can be downloaded by the user:

BINARY
SIO
MDB
ccTalk
SI2
ccNet
NIS & Unencrypted ccTalk available on request only

Information on each of these interfaces can be found in the 'machine interfaces protocol section' of this manual.

### 4.2 LED STATUS CODES

The three status LED's are located to the right of the DIPswitches on the top of the unit and are used to indicate a variety of status signals.

The red status is used to indicate system problems, while the green status indicates system health; these are described below in table 2.

LED Status	Description
Slow flashing GREEN led Heartbeat (Slow = 1 second period)	In normal RUN operation, when the NV10 is ready to read a note, the green status led will flash slowly ("Heartbeat") to signal a "healthy" status.
On Start Up - Flashing RED one second period During operation - Flashing RED one second period.	Firmware fail  NV10 has a Transportation Error somewhere in the note path
On Start Up - Fast flashing RED (fast = half second period) During operation - Fast flashing RED (fast = half second period)	Dataset fail  NV10 cannot calibrate, sensor(s) may be blocked
Permanent RED	Memory has been corrupted
Flashing AMBER and bezel lights	Power supply is incorrect, check specification
Alternating RED and GREEN	Either a safe jam or Cash box full

Table 4 - LED Status Code

## 5 MACHINE INTERFACE: HARDWARE

The NV10 interface connector is located on the left side of the unit. It has 16 pins (see figure 3), two are used for the 0v and +12v power supply and there are five outputs and five inputs, the remaining four pins are reserved for future use. An example mating connector is Molex Part No: 39-51-2160

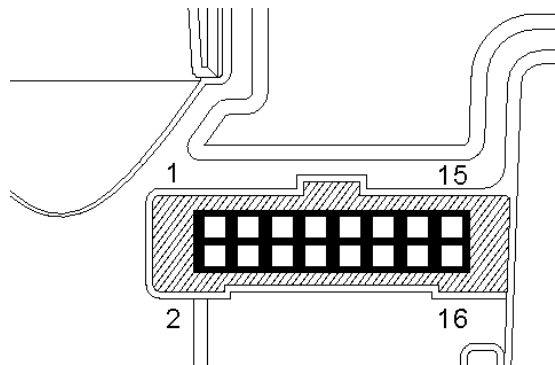


Figure 3 - Interface Connector

### 5.1 INTERFACE CONNECTOR PIN DETAILS

The connector pin details are described below (see table 5); they use an IDC 16-pin 0.1" pitch header with 2 rows of 8 pins.

Pin	Name	Description
1	Vend 1	Open Collector Output. Function changes depending on Machine Interface Protocol. (See individual interface descriptions for details) Also the Pulse Stream output. Also the serial Output pin in SSP Serial Mode, and other serial modes.
2	Vend 2	Open Collector Outputs. Function changes depending on Machine Interface Protocol. (See individual interface descriptions for details)
3	Vend 3	
4	Vend 4	
5	Inhibit 1	Inhibit channel 1 by holding this pin HIGH. To Enable a channel the inhibit must be held LOW Also the serial Input pin in SSP Serial Mode, and other serial modes
6	Inhibit 2	Inhibit channel 2 by holding this pin HIGH
7	Inhibit 3	Inhibit channel 3 by holding this pin HIGH
8	Inhibit 4	Inhibit channel 4 by holding this pin HIGH
9	Busy	NV10 is validating and stacking output. Active low while the NV10 is reading, transporting or stacking a note.
10	Escrow	Operate Escrow function by holding LOW (see Appendix B for full details)
11	Factory Use Only	Do not connect
12	Factory Use Only	Do not connect
13	Factory Use Only	Do not connect
14	Factory Use Only	Do not connect
15	+Vin	Nominal 12V DC supply
16	0V	0V supply

Table 5 - 16 Pin connector details

### 5.2 INPUT AND OUTPUT HARDWARE CIRCUITS

**CAUTION: THE OUTPUT LOW SIGNAL IS AFFECTED BY THE VALUE OF THE PULL UP RESISTOR ON THE HOST MACHINE INTERFACE. ENSURE YOUR SIGNAL LOW LEVELS COMPLY WITH THE 74HC CMOS SERIES SPECIFICATION FOR RELIABLE OPERATION (SEE FIGURE 4).**

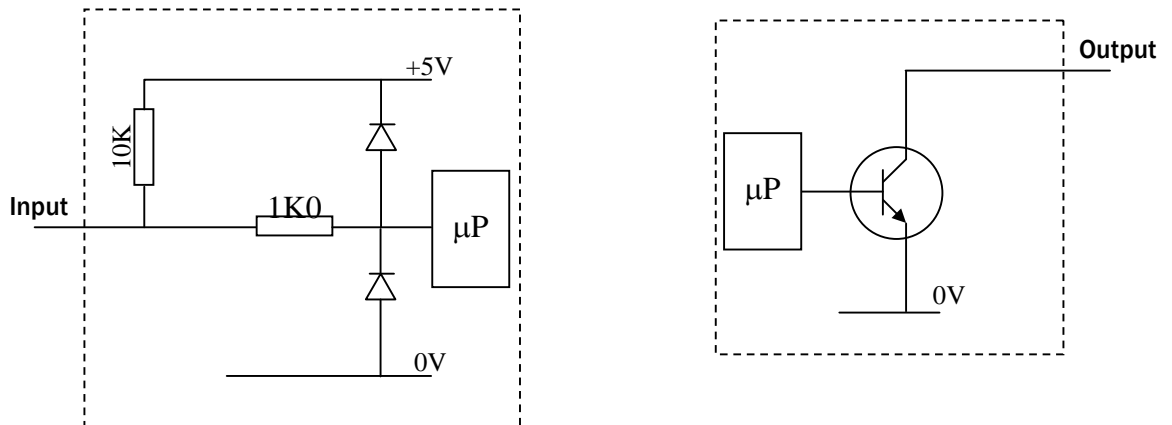


Figure 4 - Input and Output Circuits

**NOTES:**

- All outputs are open collector transistors.
- All Inputs are held high to internal +5V via 10KΩ. The input structure is a CMOS gate with anti-static protection fitted.

Interface logic levels	Logic low	Logic high
Inputs	0V <low<0.5V	3.7 V <high<12V
Outputs with 2K2Ω pull up	0.6V	Pull up voltage of host interface
Maximum Current Sink	50mA per output	

Table 6 - Interface Logic Levels

### 5.3 SERIAL INTERFACE INPUT AND OUTPUTS

**CAUTION: THE SERIAL INTERFACES WILL ONLY WORK IF THE RELEVANT INTERFACE SOFTWARE IS CORRECTLY INSTALLED.**

Name	Description
SSP TxD	Vend 1
SSP RxD	Inhibit 1

Table 7 - Serial Interface Inputs and Outputs

## 6 MACHINE INTERFACES: PROTOCOLS

The NV10 is set to the required Protocol/Interface, by setting the DIPswitches on top of the NV10 to the positions detailed below:

### 6.1 PARALLEL INPUT AND OUTPUT:

To use parallel output for 4 notes/channel acceptance, DIPswitches 3 and 4 must be set down. This mode is selectable regardless of which extended interface is programmed into the validator. (**Dipswitch 2 is not functional in this mode**)

**Vend Signals:** (Pins 1 to 4). The four channels have their own individual outputs. If a note is recognised then the relevant Vend line is set low for a period of  $100 \pm 3$ ms. Pulses outside these limits should be rejected as a precaution against false triggering.

**Busy Output:** (Pin 9). This is a general-purpose busy signal. It is active low while the NV10 is in operation.

**Escrow Control:** (Pin 10) Hold this pin Low to enable the single note escrow function. (See Appendix B).

If the host machine aborts the transaction by setting the corresponding inhibit input high, the note is returned immediately.

The host machine can force the return of the note to the customer by setting the inhibit line high, at any time before the end of the 30 second time-out. Setting high, all the inhibits, causes a note reject.

In the event of a note being forcibly removed from the mouth of the NV10 during the 30-second interval, the NV10 will go out of service for 45 seconds.

**Inhibit Operation:** (Pins 5 – 8) Channel 1 to 4 have their own inhibit input to allow the host machine to refuse specified notes. To inhibit a channel, the relevant inhibit input must be held high. To enable a channel, the corresponding inhibit must be latched low so that notes may be accepted.

If all four inhibits are high simultaneously then the NV10 will be disabled. In this state the bezel will not illuminate and if a note is inserted the motor will run in reverse preventing the insertion of the note.

All four inhibits may be connected together to create a 'global' inhibit. In this way the NV10 may be brought in and out of operation by the host machine.

### 6.2 PULSE STREAM OUTPUT

To use pulse stream output for acceptance of up to 16 channel / note acceptance, DIPswitch 3 must be down and DIPswitch 4 must be up. This mode is selectable regardless of which extended interface is programmed into the validator

**Vend Signal:** (Pins 1) When a note is recognised vend 1 will pulse a pre set number of times, the number of pulses and the timing is set in the ITL BNV validator manager program (and set to default values with supplied dataset).

**DIPswitch 2:** Used to select/de-select the X4 Pulse Multiplier.

**Down** – Number of pulses are as programmed in the dataset.

**Up** – Number of pulses is multiplied by 4 (Useful for USD Datasets)

**Busy Output:** (Pin 9). This is a general-purpose busy signal. It is active low while the NV10 is in operation.

**Escrow Control:** (Pin 10). Hold this pin Low to enable the single note escrow function. (See Appendix B).

If the host machine aborts the transaction by setting the corresponding inhibit input high, the note is returned immediately.

The host machine can force the return of the note to the customer by setting the inhibit line high, at any time before the end of the 30 second time-out. Setting all the inhibits high causes a note reject.

In the event of a note being forcibly removed from the mouth of the NV10 during the 30-second interval, the NV10 will go out of service for 45 seconds.

**Inhibit Operation:** (Pins 5 – 8) Channels 1 to 4 have their own inhibit input to allow the host machine to refuse specified values of notes. To inhibit a channel, the relevant inhibit input must be held high. To enable a channel, the corresponding inhibit must be latched low so that notes may be accepted.

If all four inhibits are high simultaneously then the NV10 will be disabled. In this state the bezel will not illuminate and if a note is inserted the motor will run in reverse preventing the insertion of the note.

**Note:** Channels higher than four cannot be individually inhibited, but will be globally inhibited if inhibits 1 to 4 are inhibited.

### 6.3 BINARY OUTPUT – BIN

To use Binary mode DIPswitches 3 and 4 must be in the Up position to select 'Special' mode on the validator and the BIN option of the interface firmware must be loaded into the NV10. (DIPswitch 2 is not functional in this mode)

In the event that the machine needs more than 4 notes to be recognised, but the host machine cannot take advantage of the serial communication methods then the NV10 can be set to give a binary pattern output on the four parallel output pins.

If the NV10 is set to binary mode it will issue the vend signals as a binary pattern on the parallel outputs for  $100 \pm 3\text{ms}$ . In this way a maximum of 15 different notes can be accepted and 4 notes individually inhibited.

**Vend Signals:** (Pins 1 to 4). The four channels have their own individual outputs. If a note is recognised the binary representation of the channel number will be pulled low for  $100 \pm 3\text{ms}$ . Pulses outside these limits will be rejected as a precaution against false triggering due to noise.

**Busy Output:** (Pin 9). This is a general-purpose busy signal. It is active low while the NV10 is in operation.

**Escrow Control:** (pin 10). Hold this pin Low to enable the single note escrow function. (See Appendix B).

If the host machine aborts the transaction by setting the corresponding inhibit input high on pin 10, the note is returned immediately.

The host machine can force the return of the note to the customer by setting the inhibit line high, at any time before the end of the 30 second time-out. Setting all the inhibits high causes a note reject.

In the event of a note being forcibly removed from the mouth of the NV10 during the 30-second interval, the NV10 will go out of service for 45 seconds.

**Inhibit Operation:** (Pins 5 – 8) Channels 1 to 4 have their own individual inhibit input to allow the host machine to refuse specified values of notes. To inhibit a channel, the relevant inhibit input must be held high. To enable a channel the corresponding inhibit must be latched low so that notes may be accepted.

If all four inhibits are high simultaneously then the NV10 will be disabled. In this state the bezel will not illuminate and if a note is inserted the motor will run in reverse preventing the insertion of the note.

**Note:** Channels higher than four cannot be individually inhibited, but will be globally inhibited if inhibits 1 to 4 are inhibited.

## 6.4 SERIAL INPUT/OUTPUT – SIO (BAUD RATE IS DEFAULTED TO 300)

Existing Smiley® NV4 users may already be using the serial input/output facility in conjunction with the parallel inputs. The NV10 Validator also supports this system. However this interface is not recommended for new designs, the Smiley® Secure Protocol SSP interface is recommended.

### CAUTION:

- **THE NV10 DOES NOT SUPPORT THE SIMPLE SERIAL DATA OUT ONLY MODE AS AVAILABLE ON NV4 AND EARLIER MODELS NV2 AND NV3. IT ONLY SUPPORTS THE SERIAL DATA INPUT/OUTPUT MODE.**
- **THE HOST MACHINE DOES NOT ECHO MESSAGES BACK TO THE VALIDATOR.**
- **THE NV10 DOES NOT OPERATE IN TRUE RS232 MODE. (ONLY TTL LEVEL).**
- **THE NV10 WILL NOT ENABLE IN SERIAL I/O MODE IF INHIBIT 3 LINE IS HELD LOW ON POWER UP**

To use simple serial mode DIPswitches 3 and 4 must be in the Up position to select 'Special' mode on the validator and the SIO option of the interface firmware must be loaded into the NV10. (Dipswitch 2 is not functional in this mode)

Commands are provided to fully control the operation of the NV10, the notes to be accepted and rejected can be set and a single note escrow mode can be enabled. In simple serial mode single byte commands are transmitted to the Validator, the Validator echoes each valid command it receives.

The Host machine needs to wait for an echo to a command it sends or for 1 second after sending a command before it sends its next command. If it does not receive an echo response and times out after 1 second then it should retry sending the previous command.

**NOTES:**

- The NV10 will operate at 9600 Baud rate if Inhibit 2 line is held low when powered up.
- The NV10 will not be enabled in serial I/O mode if Inhibit 3 line is held low when the unit is powered up. A software enable must be sent to enable the validator.

The data is formatted as follows:

**1-start bit, 8-data bits, 2-stop bits, 300 baud.**

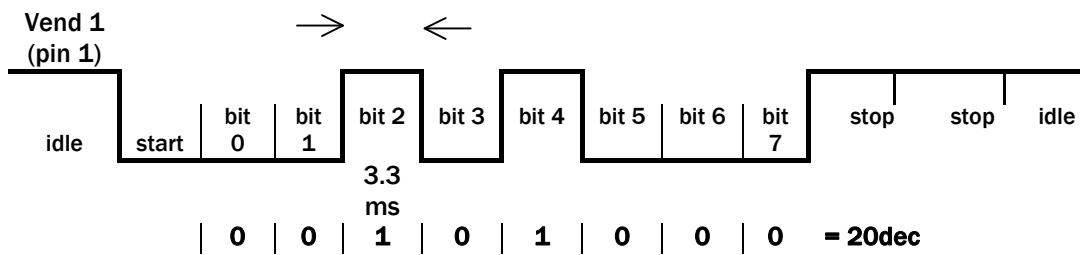


Figure- 5 Typical Serial Output: Transmission of the value 20 (decimal), Note not recognized

The NV10 will receive and transmit the following event codes.

Recognised Receive Codes to NV10		Transmitted codes from NV10	
MESSAGE	DECIMAL VALUE	MESSAGE	DECIMAL VALUE
Inhibit C1	131	Note Accept on C1	1
Inhibit C2	132	Note Accept on C2	2
Inhibit C3	133	Note Accept on C3	3
Inhibit C4	134	Note Accept on C4	4
Inhibit C5	135	Note Accept on C5	5
Inhibit C6	136	Note Accept on C6	6
Inhibit C7	137	Note Accept on C7	7
Inhibit C8	138	Note Accept on C8	8
Inhibit C9	139	Note Accept on C9	9
Inhibit C10	140	Note Accept on C10	10
Inhibit C11	141	Note Accept on C11	11
Inhibit C12	142	Note Accept on C12	12
Inhibit C13	143	Note Accept on C13	13
Inhibit C14	144	Note Accept on C14	14
Inhibit C15	145	Note Accept on C15	15
Inhibit C16	146	Note Accept on C16	16
Un-inhibit C1	151	Note Not Recognised	20
Un-inhibit C2	152	Mechanism running slow	30
Un-inhibit C3	153	Top of form Bottom of form	40
Un-inhibit C4	154	Channel 5 Note Rejected (fraud channel)	50
Un-inhibit C5	155	STACKER Full or Jammed	60
Un-inhibit C6	156	Abort During Escrow	70
Un-inhibit C7	157	Note may have been taken to clear jam	80
Un-inhibit C8	158	Validator Busy	120
Un-inhibit C9	159	Validator Not Busy	121
Un-inhibit C10	160	Command Error	255
Un-inhibit C11	161		
Un-inhibit C12	162		
Un-inhibit C13	163		
Un-inhibit C14	164		
Un-inhibit C15	165		
Un-inhibit C16	166		
Enable serial escrow mode	170		
Disable serial escrow mode	171		
Accept escrow	172		
Reject escrow	173		
Status	182		
Enable all	184		
Disable all	185		
Disable escrow timeout	190		
Enable escrow timeout	191		

Table 8 - Receive and Transmit Codes

Example transactions are shown below (see table 9):

Event	Validator	Decimal Value	Host
Note entered into validator	Validator Busy	120→	
Note accepted channel 2	Validator Ready	121→	
	Accept on channel 2	2→	
Note entered into validator	Validator Busy	120→	
Note not recognised	Validator Ready	121→	
	Note not recognised	20→	
Validator has returned note	Validator Ready	121→	
Software Inhibit Channel 4	Inhibit C4	←134	Inhibit C4
	Channel 4 inhibited	134→	
Software Enable Channel 4	Uninhibit C4	←154	Uninhibit C4
	Channel 4 inhibited	154→	
Status Report		←182	Status Request
	Status Requested	182→	
3 byte status message	Inhibit status Channels 1-8	Byte 1→	
	Inhibit status Channels 9-16	Byte 2→	
	Escrow On (=1) / Off (=0)	Byte 3→	
Turn on Escrow Mode		← 170	Enable Escrow Mode
	Escrow Mode Enabled	170→	
Note accept in Escrow Mode			
Note entered into validator	Validator Busy	120→	
Note Accepted Channel 2	Validator Ready	121→	
	Accept on Channel 2	2→	
		←172	Accept Note in Escrow
	Accept Escrow	172→	
	Accept on Channel 2	2→	

Table 9 – Example protocols

## 6.5 SERIAL INPUT/OUTPUT – SI2 (BAUD RATE IS DEFAULTED TO 9600)

This mode is identical to the SIO mode detailed in chapter 7.4 with the exception of the Baud rate used and the data format.

- Only 9600 baud rate is available.
- Inhibit 2 has no function.
- All Transmit and Receive codes and Example protocols are the same as in Chapter 6.4 (See tables 8 and 9 above)

The data is formatted as follows:

**1-start bit, 8-data bits, 1-stop bits, 9600 baud.**

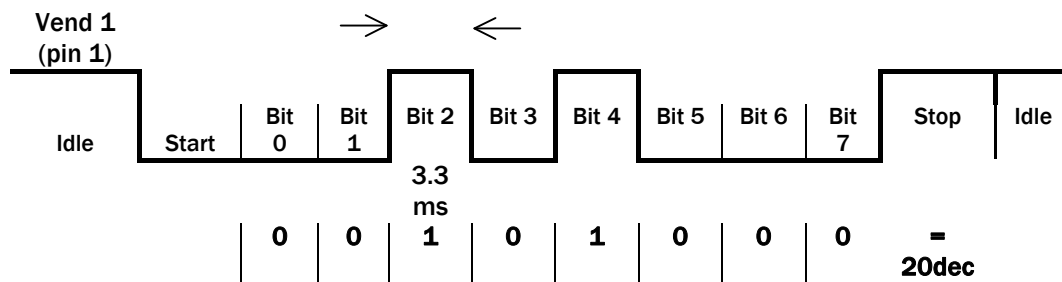


Figure 6 - Typical Serial Output: Transmission of the value 20 (decimal),  
Note not recognized

## 6.6 SMILEY® SECURE PROTOCOL - SSP

**NOTE:** Please refer to the Smiley® Secure Protocol (SSP) Specification (ITL Drawing GA138) on the web site for full details of the SSP protocol.

To use SSP mode DIPswitch 3 must be set up and DIPswitch 4 must be set down. This mode is selectable regardless of which extended interface is programmed into the validator. (DIPswitch 2 is non functional in this mode).

SSP is a secure serial interface specifically designed to address the problems experienced by cash handling systems in gaming machines. Problems such as acceptor swapping, reprogramming acceptors and line tapping are all addressed. This interface is recommended for all new designs.

The interface uses a master slave model, the host machine is the master and the peripherals (note acceptor, coin acceptor or coin hopper) are the slaves. Data transfer is over a multi-drop bus using clock asynchronous serial transmission with simple open collector drivers. The integrity of data transfers is ensured through the use of 16 bit CRC checksums on all packets.

Each SSP device of a particular type has a unique serial number; this number is used to validate each device in the direction of credit transfer before transactions can take place. Commands are currently provided for coin acceptors, note acceptors and coin hoppers. All current features of these devices are supported.

### Features:

- Serial control of Note / Coin Validators and Hoppers
- 4 wire (Tx, Rx, +V, Gnd) system
- RS232 (like) - open collector driver
- High Speed 9600 Baud Rate
- 16 bit CRC error checking
- Data Transfer Mode

**Benefits:**

- Proven in the field
- Simple and low cost interfacing of transaction peripherals.
- High security control of payout peripherals.
- Defence against surrogate validator fraud.
- Straightforward integration into host machines.
- Remote programming of transaction peripherals
- Open standard for universal use.

For detailed information and full protocol specification please refer to SSP Interface Specification ITL (Drawing GA 138), this is available from the ITL website [www.innovative-technology.co.uk](http://www.innovative-technology.co.uk).

To help in the software implementation of the SSP, ITL can provide DLL controls and Visual Basic applications on request. Please contact [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk)

**6.7 MULTI-DROP BUS/INTERNAL COMMUNICATIONS PROTOCOL (MDB/ICP)**

To use the MDB mode an IF5 interface box must be fitted to the NV10 Validator. DIPswitches 3 & 4 must be in the up position to select 'Special' mode on the validator and the MDB option of the interface firmware loaded into the NV10. (**DIPswitch 2 enables a fast reset on power up**).

The Fast Reset option should be set if the NV10 continuously resets the stacker after the machine is powered on. The Fast Reset option can be enabled via the Validator Manager Software, or by setting Dipswitch 2 to the ON position.

**Note:**

- Please refer to the Multi-Drop Bus specification for the suggested current drive circuits available.
- The NV10 supports the MDB protocol version 1, level 1
- For detailed information and full protocol specification please refer to [www.vending.org](http://www.vending.org)

MDB defines a serial bus interface used in electrically controlled vending machines (see figure 6). This is a 9600 Baud Master-Slave system where the NV10 banknote validator is a slave to a master controller. A master has the capability of communicating with 32 peripherals or slaves. The master is defined as the Vending Machine Controller (VMC).

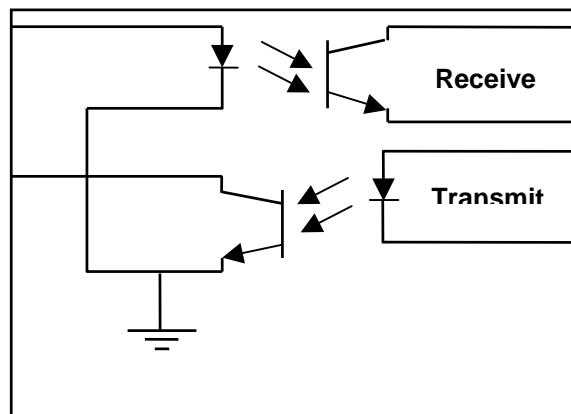


Figure 7 - MDB Opto Isolated Input / Output circuits NV10 MDB Slave

The NV10 banknote Validators have a unique address – 00110XXX binary (30H). The VMC polls the bus to detect presence of the NV10 Validators or get information on the current status of the Validators.

The Validators will respond when asked for activity with an acknowledgment, a negative acknowledgment or a specific reply, depending on its current status. Bus crashes are avoided as the Validators respond to being polled only by the VMC.

The international country code must be set for the country in which the Validators will be operating. This is either the international telephone code for that country, or the country code taken from ISO4217. The code is represented as two bytes. The initial digit signifies the source of the code. 0 signifies the telephone code is used, 1 signifies ISO4217 has been used.

For the USA the country code is 00 01, or 18 40

For Great Britain the code is 00 44, or 18 26.

The scaling factor must also be specified for each Validator. All accepted note values must be evenly divisible by this number.

- This number would be set to 100 (Hex 64) for the Euro or Great Britain.
- The number would be set to 1000 (Hex 03E8) for Romania.
- The number of decimal places must also be programmed for each Validators
- The number would be set to 2 for Euro or USA
- The number would be set to 3 for Romania

Adopting the numbers above:

- £5 would be displayed as 5.00
- £10 would be displayed as 10.00
- \$1 would be displayed as 1.00
- 1K Romania would be displayed as 1.000

## 6.8 ccTALK PROTOCOL – CCT

The NV10 supports the ccTalk serial protocol for easy interfacing with host machines that support this protocol.

To use ccTalk mode DIPswitches 3 and 4 must be in the Up position to select 'Special' mode on the validator and the CCT option of the interface firmware must be loaded into the NV10. **(DIPswitch 2 is non functional in this mode).**

Pin out connections on NV10 for ccTalk are shown below (see figure 7) looking at the connection pins on the NV10 interface connector. All communications with the note validator must be encrypted using the encryption key, the default encryption key will be printed on the label of the NV10.

**Note:** For detailed information and full protocol specification please refer to [www.cctalk.org](http://www.cctalk.org)

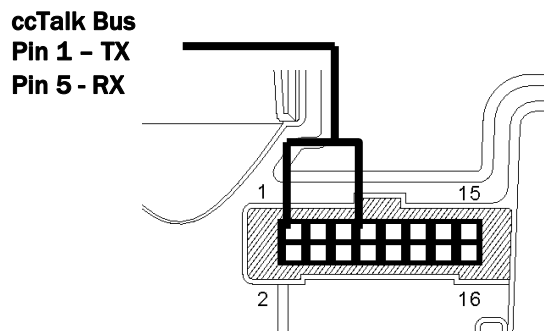


Figure 8 - ccTalk Connection Pins on the NV10

The default encryption key will be set to the key code printed on the label on the NV10. If the key is changed to a new stored key by the host machine, the key can be reset to the default by the following the steps below.

- Power off NV10.
- Set all 4 DIPswitches to the Up position.
- Apply power (no ccTalk comms).
- Red LED will now be flashing.
- Set DIP switches 1 and 2 down.
- 

The code is now reset.

### 6.9 CASH CODE SERIAL PROTOCOL - ccNET

The NV10 supports the ccNet serial protocol for easy interfacing with host machines that support this protocol.

To use ccNet mode DIPswitches 3 and 4 must be in the Up position to select 'Special' mode on the validator and the CCN option of the interface firmware must be loaded into the NV10.

**DIPswitch 2 is used to select default Baud rate - Down = 9600 UP = 19200**

Pin out connections on NV10 for ccNet are the same as for SSP.

**Note: For detailed information and full protocol specification, please refer to the CashCode specification**

## 6.10 NON-ISOLATED SERIAL PROTOCOL (NIS)

To use NIS mode DIPswitches 3 and 4 must be in the Up position to select 'Special' mode on the validator and the NIS option of the interface firmware must be loaded into the NV10. (DIPswitch 2 is not functional in this mode).

There is a single output DATA line from the NV10. There are three control lines, two from the controller "ACCEPT ENABLE" and "SEND" and one from the Validators IRQ (INTERRUPT) (see table 10).

### CAUTIONS:

- PLEASE NOTE THAT THE NV10 IS REQUIRED TO OPERATE ON A +12VOLT DC POWER SUPPLY.
- THE NV10 GROUND MUST BE CONNECTED TO THE GROUND OF THE CONTROL SYSTEM.
- 

For further details on this protocol please refer to the series 2000 interface manual (reference number 20105-002850046-PS), or contact [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk).

### Connection Details:

Signal	NV10
+12V	15
0V	16
ACCEPT ENABLE	6
SEND	7
IRQ (INTERRUPT)	2
DATA	1
OUT_OF_SERVICE	3

Table 10 - Extended Interface USA Serial

## 7 UPDATING CURRENCY AND FIRMWARE FILES

**Note:** Validators are supplied already programmed from the factory Please skip this section unless the validators need to be re-programmed with a new note or currency.

The NV10 Validator may only be programmed using the ITL Bank Note Validator Currency Manager 2.9.7 or greater or by cloning from a master unit:

### 7.1 ITL BANK NOTE VALIDATOR CURRENCY MANAGER

In order to use the ITL Bank Note Validator Currency Manager software, which is supplied with a range of currencies, it must be installed from the DA1/DA2 CD or by downloading from the web site. For the PC System Specification refer To Appendix F.

A list of currently supported currencies is maintained on our web site, where new releases can be downloaded. Further details are available from [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk)

## 7.2 NV10 – NV10 COPY (CLONING)

**Note:** Cloning is only available with Firmware 3.19 or lower.

### Overview

This facility exists for a NV10 Note Validator to copy a program and settings to another NV10. The “Master” Validator will transmit the currency data and upgrade the Slave’s Firmware. For cloning it is recommended to use the Cloning Kit 2 (CK2).

### Requirements

- Master to have firmware 3.15 or greater
- Cloning Kit 2
- 12V supply.

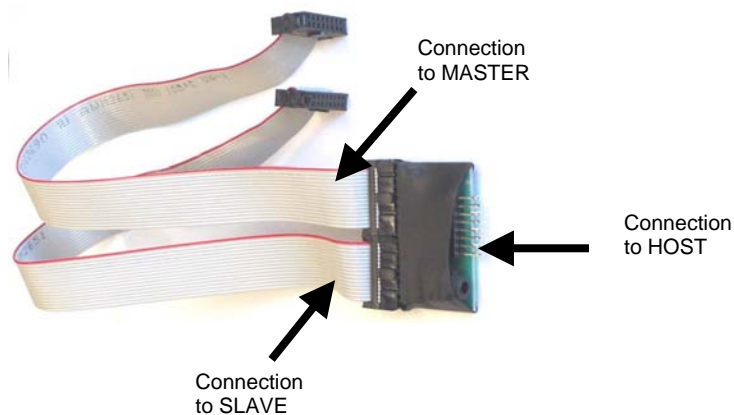


Figure 9 – Cloning Kit CK2

### Start-up configuration

**NOTE:** The Master will only update the Slave’s Firmware if the version of the Master is greater than that of the Slave. If the Master Firmware is less than the Slave, then the copy process is aborted.

If the Firmware on the Master and Slave are the same, only the currency will be transferred.

- Remove the power from the Master and Slave units.
- Set DIPswitches 3 UP and 4 DOWN to select SSP interface mode on both NV10s.
- Use the NV10 Cloning Kit 2 (CK2) and connect the two units together as per CK2 label.
- Turn on the +12V power supply.

**Cloning process.**

- Master unit will flash RED and GREEN LED if the connector is configured correctly.
- RED and GREEN on master flash together – attempting to communicate with slave.
- RED and GREEN on master flash alternately - communication established, master waiting for slave to reset.
- If communication has been established and slave has reset then the master will read slave firmware version and decide on next action.
- If the master is not compatible with the slave, Master RED and GREEN LED's will flash alternately at 1-second rate. No further copy action will take place.
- If slave firmware version is greater than master, Master RED and GREEN LED's will flash alternately at 1-second rate. No further copy action will take place.
- If slave firmware version is same as master then master will start to copy currency data to slave.
- If slave firmware version is less than master then master will start to copy firmware data to slave.

**Firmware copy:**

**CAUTION: IF MASTER RED LED CHANGES TO SLOW BLINK (1 PER SECOND) THEN COMMUNICATION HAS BEEN LOST AND COPYING SHOULD BE RESTARTED FROM BEGINNING.**

- Master RED LED will blink rapidly during firmware copy (the LED will pause from time to time).
- If master RED LED changed to slow blink (1 per second) then communication has been lost and copying should be restarted from beginning.
- When firmware copy is complete, slave will reset and Master unit will wait to re-establish communications. (LED flashes as at first stage power-up).
- When slave is ready, master will initiate currency data copy.

**Currency copy:**

**CAUTION: IF MASTER RED LED CHANGED TO SLOW BLINK (1 PER SECOND) THEN COMMUNICATION HAS BEEN LOST AND COPYING SHOULD BE RESTARTED FROM BEGINNING.**

- Master GREEN LED will blink rapidly during the currency copy process (the LED will pause from time to time).
- When currency copy is complete, Master will show GREEN and RED LED's continuously and slave will reset.
- NV10 – NV10 copy is now complete.

## 8 MECHANICAL INSTALLATION

The NV10 validator is supplied with the Universal Bezel-PA231 (see figure 10).

### 8.1 CHANGING OR REMOVING THE BEZELS

- Push the red Bezel Release Catch in the centre and top of the NV10.
- The bezel can then be unhooked from the 4 locating points on the NV10.
- To refit, hook the bezel onto the bottom 2 locating points and then lift to fit onto the top 2 locating points on the NV10.
- The bezel will click home into NV10 when fitted correctly.

### 8.2 FITTING THE BEZEL INTO A MACHINE

#### CAUTIONS:

- ENSURE THERE IS A CLEARANCE AROUND THE INITIAL EXIT (SEE DRG GA334 IN APPENDIX A) SO THERE IS NO OBSTRUCTION TO THE BANKNOTES AS THEY ARE BEING READ BY THE NV10.
- A SUITABLE CASH BOX IS NEEDED SO THAT THE NOTES SECURELY STORE AWAY FROM THE NOTE EXIT (SEE APPENDIX C), TO PREVENT NOTES ACCUMULATING AT THE NOTE EXIT.

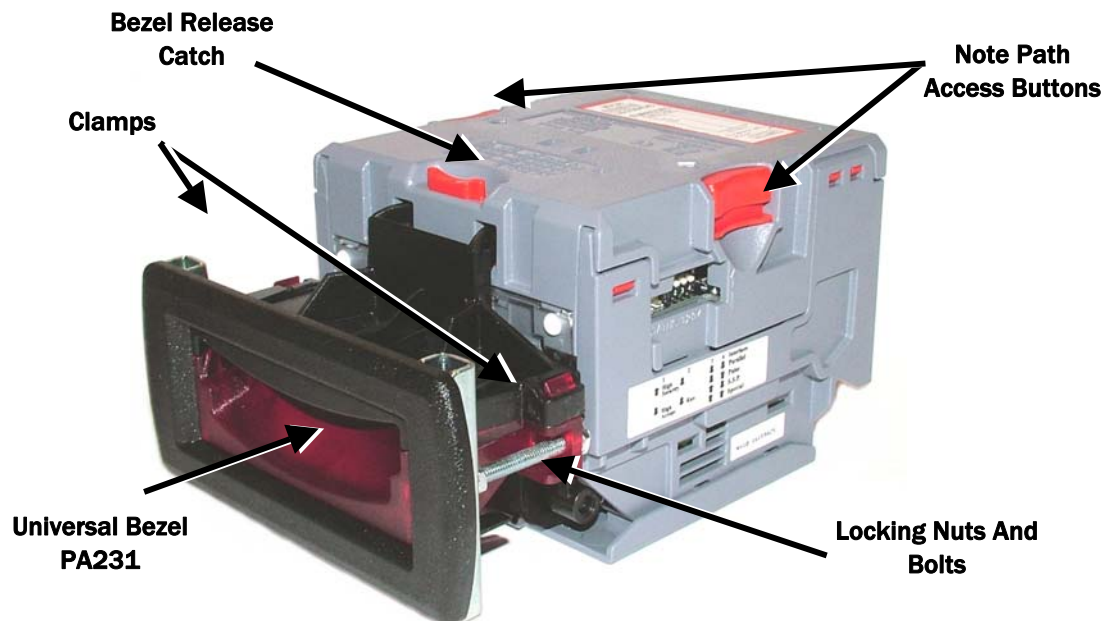


Figure 10 - Bezel and NV10 Installation

- Remove the 4 nuts, 2 metal clamps, star washers and 2 bolts from each side of the bezel as above (see figure 10).
- Place PA231 through the aperture in the door of the machine from the front.
- Fit the two metal clamps and star washers and tighten the nuts onto the bolts (recommended torque 25cN per metre).
- Fit the main bezel assembly onto the bolts with the black part to the top. Fit the star washers and tighten the nuts onto the bolts (recommended torque 25cN per metre).

### 8.3 CASH BOX INTERFACE

It is important that there is sufficient space for the "initial exit" and "final exit" of notes from the NV10 note path, before entry into the cash box/chute without any obstructions (see Appendix C).

For help on installing the NV10 into a new design please contact [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk).

## 9 ROUTINE MAINTENANCE

The NV10 Validator has been designed to minimise any performance variation over time. Much of this is achieved by careful hardware and software design. However, depending upon the environment the NV10 may at some time require cleaning, belt changing or note path clearing.

### 9.1 CLEANING

**CAUTION: DO NOT USE SOLVENT BASED CLEANERS SUCH AS ALCOHOL, PETROL, METHYLATED SPIRITS, WHITE SPIRIT or PCB CLEANER. THIS WILL RESULT IN PERMANENT DAMAGE TO THE VALIDATOR, ONLY USE A MILD DETERGENT.**

Remove the NV10 from its bezel. Push the 2 red Note Path Access Buttons on the sides of the NV10 downwards and then inwards towards the body of the NV10 (see figure 9) and lift to expose the note paths, place them on a clean dry surface. The note path will now be exposed for cleaning, (see figure 11).

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. Clean any metal debris that may be attached to the magnetic sensor.

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.

**CAUTION: WHEN CLEANING THE "RECESSED" FRONT SENSOR, USE A SMALL SOFT BRUSH OR COTTON WOOL BUD.**

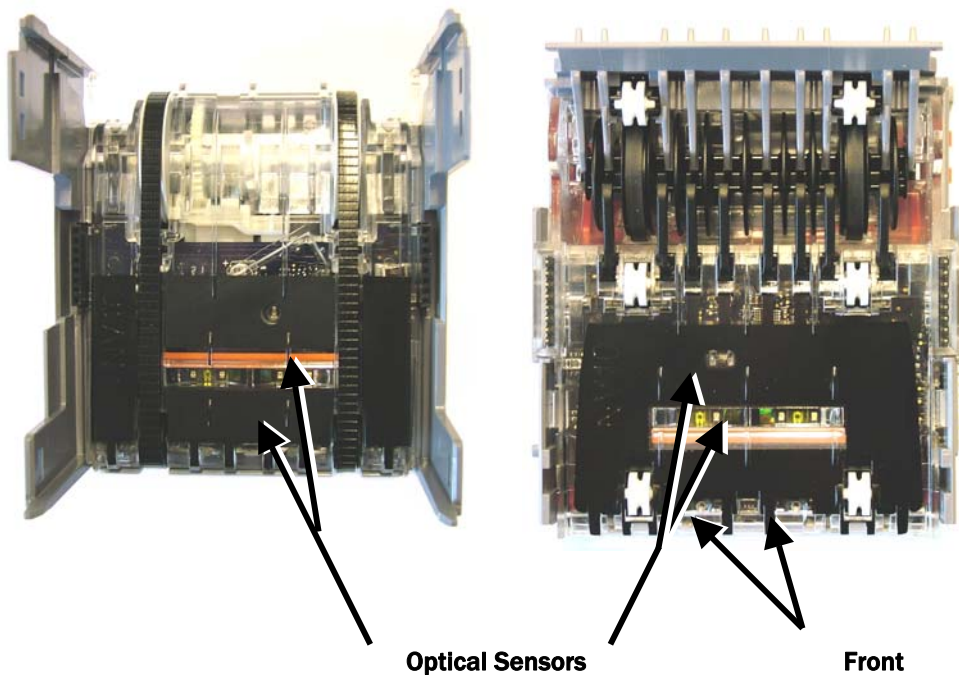
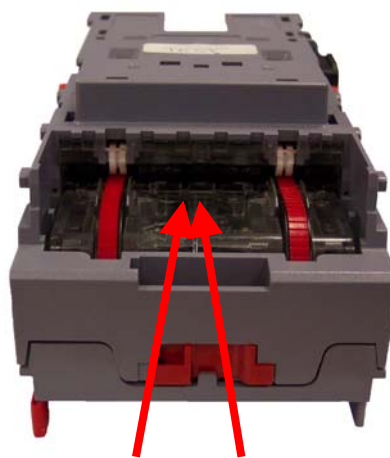


Figure 11 - NV10 Sensors

#### Belt Cleaning

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



Insert Paper

## 9.2 BELT CHANGING

- With the NV10 note paths exposed (see figure 11) place the unit on a clean dry surface.
- Remove the lower cover plate by lifting up the retention catch and carefully sliding it back (see figure 12).
- Push the 2 belt tension springs inwards then slide each belt off the drive unit body, smallest wheels first.
- Replace the belts by fitting them over the drive unit body legs, smallest wheels first.
- Place the lower cover plate into the locating slots (2 each side) pushing forward and down, the plate will "click" confirming correct insertion.
- Connect the upper and lower note path back together.

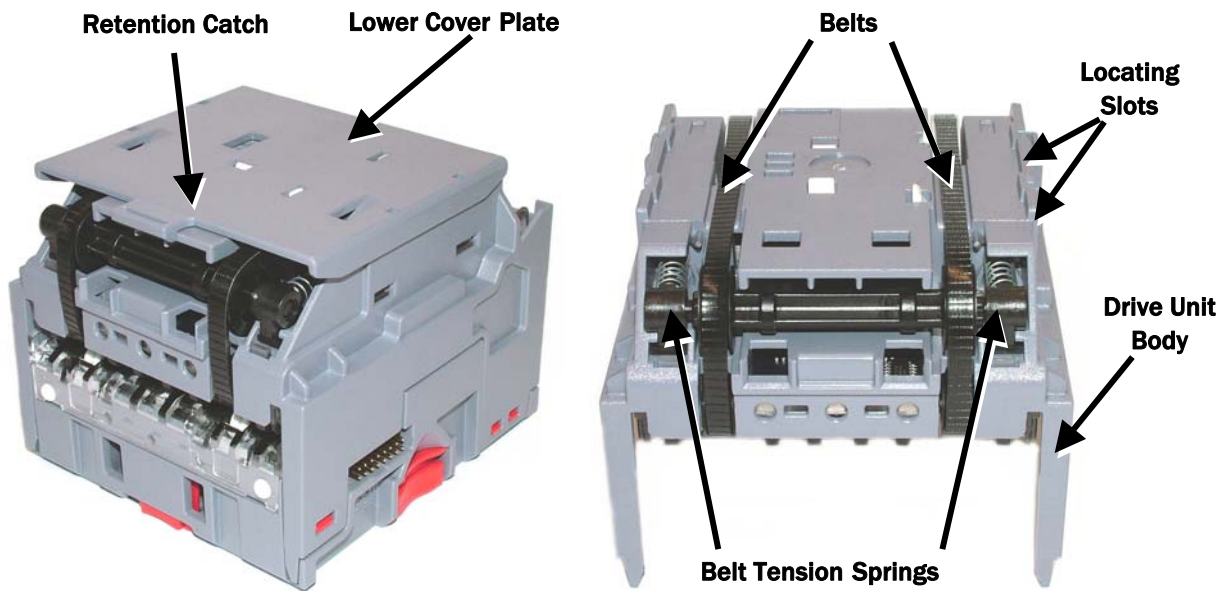


Figure 12 - NV10 Belt Access

### 10 FAULT FINDING ANALYSIS

PROBLEM	CHECK	SOLUTION
Validator will not accept notes	<p>Is the Bezel lit? Are any "STATUS" lights lit?</p> <p>Is the problem with all notes or just one denomination</p> <p>Is the Top to Bottom cable connected properly?</p>	<p>Check the Power Supply specification Check the LED Status codes (Chapter 4.2). Check correct interface is programmed in using VALIDATOR MANAGER software.</p> <p>Check the inhibit lines (pins 5 -8) from Host machine to Validator.</p> <p>Test cable for continuity and refit.</p>
Validator runs slowly and/or intermittently	<p>Check note paths for foreign objects Check note path for damage Check Voltage level of supply Check drive belts are fitted correctly Ensure that there is no grease on the drive belts</p>	<p>Clean the note path.</p> <p>Replace damaged parts</p> <p>Ensure PSU meets the required specification Refit belts</p> <p>Replace belts</p>
Notes are accepted but no credit received	<p>Is the PSU within specification? Has the correct interface been selected?</p>	<p>Check Power Supply specification</p>
Validator rejects genuine notes	<p>Is the correct currency file programmed?</p> <p>Is the required note contained in the Currency file? Are sensors ok</p>	<p>Check correct Currency is programmed in using Validator Manager software Contact Support with "Issue Date" and "Note Denomination" for details</p> <p>Run Diagnostics in Validator Manager</p>

## 11 SUPPORT TOOLS

The following support tools are available for use with the NV10 Bank Note Validator:

- ITL Bank Note Validator Currency Manager Software.
- Validator Programming System (DA3)
- Downloads from the Innovative Technology Ltd website: [www.innovative-technology.co.uk](http://www.innovative-technology.co.uk)
- E-mail Support via [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk)

**NOTE: The Validator must be in SSP mode when connected to a computer and then returned to the original Settings when complete**

### 11.1 PC PROGRAMMING SOFTWARE (ITL BANK NOTE VALIDATOR CURRENCY MANAGER)

The ITL BNV Currency Manager software offers the following functions:

- Program the Validator by downloading pre-prepared currency data via the DA1 or DA2 kit.
- Check the firmware version and currency set already loaded on an NV10 unit.
- Adjust the channel and pulse configuration on a pre-programmed NV10 to your own requirements.
- Download a new version of firmware onto the NV10.
- Use diagnostic functions to check Validators operation (firmware version 3.15 and greater only).

The software will run on an IBM compatible Personal Computer with Pentium™ processor or equivalent (see Appendix F for operating system requirements) and requires a DA1 kit fitted to the serial port or DA2 kit fitted to the USB port (see Appendix E).

### 11.2 VALIDATOR PROGRAMMING SYSTEM (DA3)

The DA3 is a programming system designed to enable the programming of ITL Bank Note Validators in the field without the use of a PC.

Once the DA3 has been programmed the user can:

- Update the existing software within a validator to the latest versions using the BNV Match Download function.
- Overwrite the existing software within a validator with pre-selected (Tagged) files using the BNV Override Download function.
- Test the functionality of the validator away from the Host machine.

For full DA3 operation and functionality details please refer to the DA3 User Manual (Document number GA339)

### 11.3 INTERNET WEBSITE SUPPORT

The Innovative Technology Ltd website provides the means to download new and updated currency sets and new versions of firmware for the NV10. You can obtain these along with technical bulletins by visiting [www.innovative-technology.co.uk](http://www.innovative-technology.co.uk).

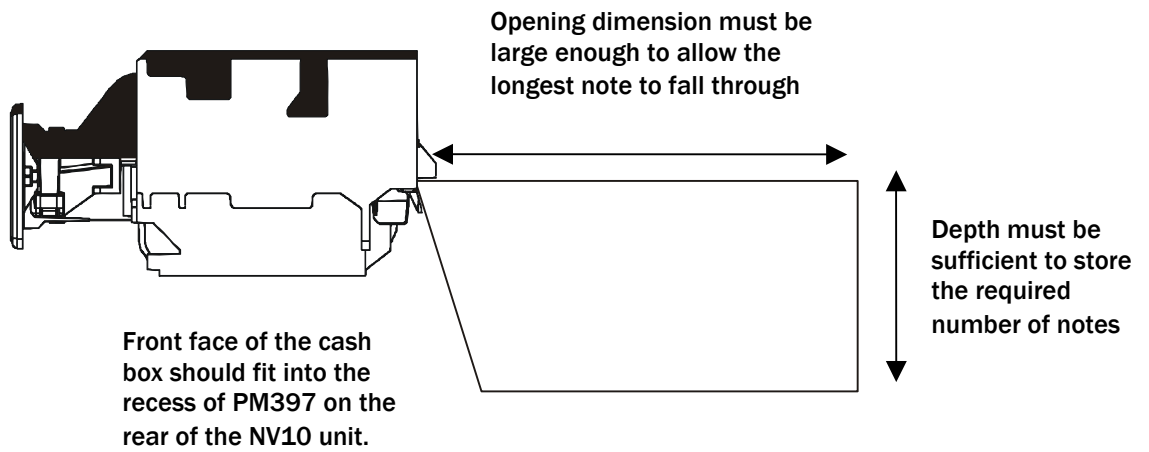
### 11.4 E-MAIL SUPPORT

If the data you require is not available over the Internet Innovative Technology supports an e-mail system to help customers with unusual requirements. The address is: [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk)

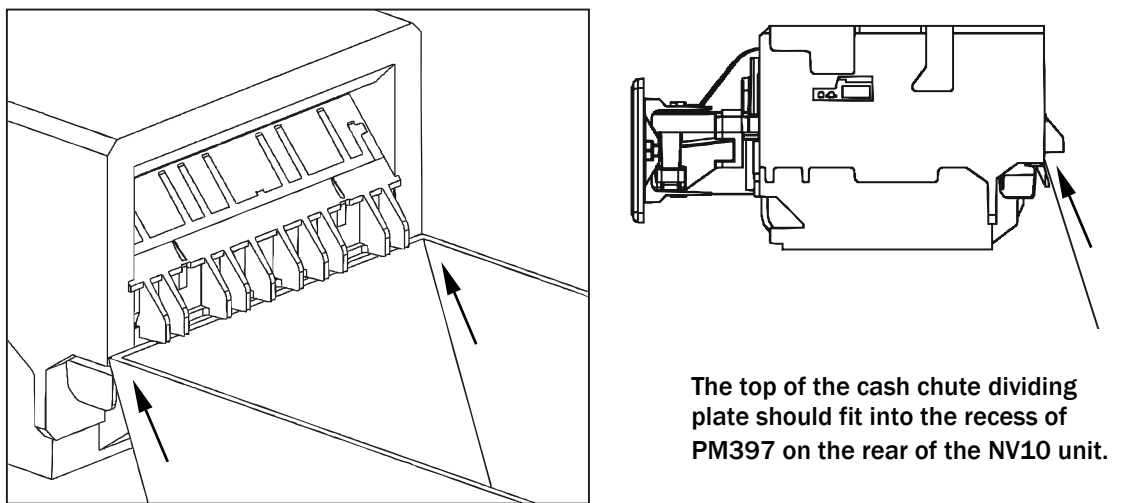




**APPENDIX C – CASH BOX ADVICE**



*Figure 13 – Cash box mounting location*



*Figure 14 - Dividing plate location for cash chute*



## APPENDIX D – ESCROW FUNCTION

The NV10 has a single note escrow facility (pin 10). This allows the Validator to hold onto the note once accepted, and then only stack the note in the cash box when the host machine confirms that the Vend operation has been completed. If no confirmation of the Vend is received then the note will be returned to the customer after 30 seconds, (see figure 14).

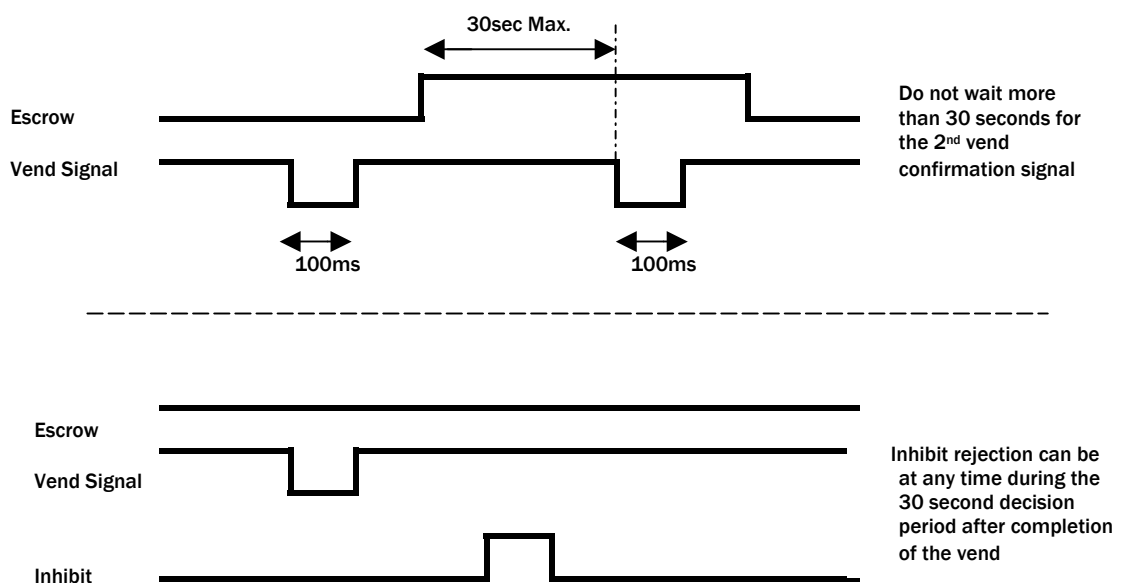


Figure 15 - Escrow Timing Diagram For Parallel Vends

If the host machine itself aborts the transaction by setting the corresponding inhibit input high, the note is returned immediately. The sequence of operations is as follows:

- Pin 10 held low awaiting note insertion.
- Note inserted. Validator issues a 100ms pulse on the appropriate channel.
- The host machine initiates vend process.
- The host machine sets pin 10 high to indicate that it wants the note. If this is not done within 30 seconds the Validator will return the note.
- The Validator issues a 100ms pulse on the appropriate channel after pin 10 going high to indicate final acceptance of the note. If the signal has not been received within 30 seconds it indicates the customer has forcibly retrieved the note and the vend will be aborted.
- The vend process is completed.
- The host machine sets pin 10 low in expectation of the next vend.
- 

The host machine can force the return of the note to the customer by setting the inhibit line high, at any time before the end of the 30 second time-out. For channels above 4, setting all the inhibits high will cause a note reject.

In the event of a note being forcibly removed from the mouth of the NV10 during the 30-second interval, the NV10 will go out of service for 45 seconds.

## APPENDIX E – INTERFACE TOOLS DA1 - DA2

The DA1/2 Kits are designed for the following:

- Connecting of ITL Note Validators to a PC for the upgrade and user option setting of Currency and Firmware files.
- Testing note acceptance of Note Validators independent of the host machine to confirm that the validator is working.

The DA1 and DA2 Kits comprise the following components:

DA1	DA2
DA1 adapter board	DA2 adapter board
DA1 to NV7, 8, 9 and 10 cable	USB type-A to Type-B cable
DA1 to NV4 Cable	DA2 to NV7, 8, 9 and 10 cable
Power Cable	Power Cable
ITL Support CD-ROM	ITL Support CD-ROM

### Connecting a DA1 to a validator and PC

For the PC system specification and set up refer to Appendix F.

Connect the DA1 to the validator as shown below (see figure 1), using the 16-way to 5-way connector. The supplied 3.5mm jack plug and 2 banana plugs are used to supply power to the DA1 when using a variable Bench power supply (Connect the +12 volts to the red banana plug and GND (0V) to the black plug). Alternatively a Portable DC Power Adapter supplying 12v and 1.5A minimum can be used.

Plug the 9-way D-type connector into the serial port of the PC and note of the number of the port, as this will be needed later for configuring the software. Once the connections have been made install the appropriate software for the validator you are using.

**NOTE: The Validator must be in SSP mode when connected to a computer and then returned to the Original Settings when the download is complete.**

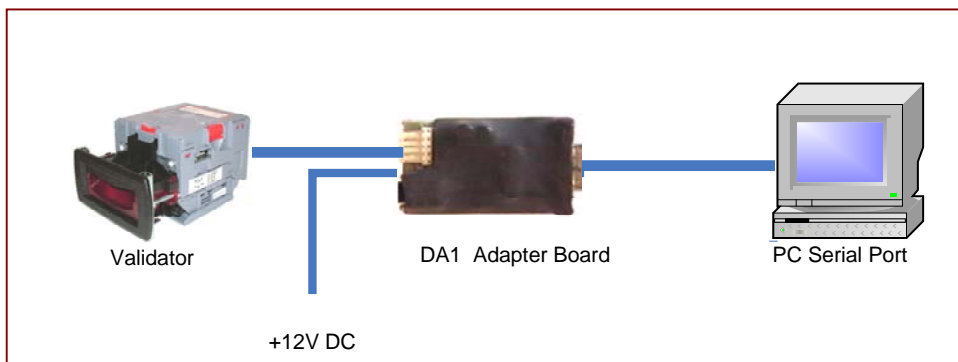


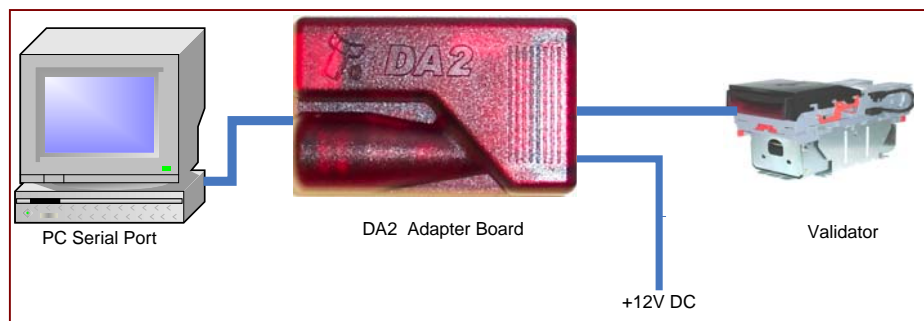
Figure 16 - Connecting DA1 to a NV10 and PC for upgrading



**Connecting a DA2 to a validator and PC**

For the PC system specification and set up refer to Appendix F. Details of how to install the DA2 are provided in the Support CD.

Plug the USB type Connector into the USB port of the PC. Once the connections have been made install the appropriate software for the validator you are using.



*Figure 17 - Connecting DA2 to a NV10 and PC for upgrading Software Installation*

**Software Installation**

**DA1** - To install the ITL BNV Download Manager Software insert the CDROM into the correct PC drive. The CD should automatically run and an installation menu will appear. Double click the ITL BNV Download Manager and follow the on-screen instructions. You can also install the Currency files, Firmware files and the Technical Manuals for each specific product as well as other generic documentation.

The Quick Start Guide for the DA1 is document number GA151.

**DA2** - To install the ITL BNV Download Manager Software insert the CDROM into the correct PC drive. The CD should automatically run and an installation menu will appear. Double click DA2 installation guide (GA338) and follow the instructions relating to your specific Operating System.

**NOTE:** All files contained on the CD are available from the ITL website:  
[www.innovative-technology.co.uk](http://www.innovative-technology.co.uk)

Please contact [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk), if you require further assistance.

## APPENDIX F – PC SYSTEM SPECIFICATION

The ITL Validator Software has been tested and verified using Windows 2000/XP™ on a Pentium™ based PC System (© Microsoft and Intel). Full functionality cannot be guaranteed on lower specification systems.

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**REVISION HISTORY**

<b>INNOVATIVE TECHNOLOGY LTD</b>			
<b>TITLE</b>	<b>NV10 OPERATIONS MANUAL</b>		
<b>DRAWING NO</b>	<b>AUTHOR</b>	<b>DATE</b>	<b>FORMAT</b>
GA333-5	TJC	20/07/05	MS Word 2000

<b>ISSUE</b>	<b>RELEASE DATE</b>	<b>MODIFIED BY</b>	<b>COMMENTS</b>
1	20/07/05	CC	First Draft
2	08/08/05	RJS	Second Draft
3	05/09/05	RJS	Initial Release
4	31/08/06	WB	Editorial Update
5	29/05/07	MLC	Addition of belt cleaning to 10.1

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