

***Innovative Technology Limited***  <sup>®</sup>

# **NV7 Bank Note Validating System**

**The Future of Smiley<sup>®</sup> Bank Note Handling**



## **Operations Manual**

**GA324-3**

**Revision History**

<b>Innovative Technology Ltd</b>			
<b>Title:</b>		<b>NV7 Engineers Manual</b>	
<b>Drawing No:</b>	GA324	<b>Project:</b>	
<b>Author:</b>	P. D. King	<b>Date:</b>	15/3/2004
<b>Format:</b>	MS Word	2000	
<b>Issue</b>	<b>Rel Date</b>	<b>Mod By</b>	<b>Comments</b>
Issue 1	10/6/2003		<i>First draft</i>
Issue 2	11/6/2003		<i>Document Restructured</i>
Issue 2	18/6/2003		<i>First release</i>
Issue 3	15/3/2004		<i>General Revision</i>

Contents

	Page
<b>1: INTRODUCTION</b> .....	<b>4</b>
<b>2: SCOPE OF DOCUMENT</b> .....	<b>5</b>
<b>3: ENVIRONMENT AND POWER REQUIREMENTS</b> .....	<b>6</b>
<b>4: GENERAL DESCRIPTION</b> .....	<b>7</b>
<b>5: NV7 USER INTERFACE</b> .....	<b>8</b>
5.1:DIPswitch Settings.....	8
5.2:LED Status Codes .....	9
<b>6: INTERFACES: HARDWARE DESCRIPTION</b> .....	<b>10</b>
6.1:Interface Connector Pin Details .....	10
6.2:Input and Output Hardware Circuits .....	11
6.3:Software Optional Serial Interface Input and Outputs .....	11
<b>7: MACHINE INTERFACES: PROTOCOLS</b> .....	<b>12</b>
7.1:Parallel input and output: .....	12
7.2:Pulse Stream Output.....	12
7.3:Binary Output.....	14
7.4:Simple Serial Input/Output: .....	14
7.5 Smiley® Secure Protocol - SSP .....	17
7.6:MDB – Multi-Drop Bus / Internal Communications Protocol (IF5).....	18
7.7: CCTalk Protocol.....	19
7.8: Extended Interface – USA Serial.....	20
<b>8: UPDATING CURRENCY AND FIRMWARE</b> .....	<b>21</b>
8.1:Currency Manager .....	21
8.2:NV7 – NV7 Copy (Cloning).....	21
8.3:NV7 – NV7 copy process. ....	22
<b>9: MECHANICAL INSTALLATION</b> .....	<b>23</b>
9.1:Changing or removing the bezels.....	23
9.2:Changing or removing cash boxes .....	23
<b>10: ROUTINE MAINTENANCE</b> .....	<b>24</b>
10.1:Cleaning .....	24
10.2>Note Path Debris Clearing / Belt Changing .....	25
10.3:Re-Calibration .....	25
<b>11: FAULT FINDING ANALYSIS</b> .....	<b>26</b>
<b>12: SUPPORT TOOLS</b> .....	<b>28</b>
12.1:PC Currency Programming Software.....	28
12.2:Internet Website support. ....	28
12.3:E-mail Support.....	28
<b>APPENDIX A - NV7 SPARES LIST</b> .....	<b>29</b>
<b>APPENDIX B - DRAWINGS</b> .....	<b>30</b>
<b>APPENDIX C - ESCROW CONTROL</b> .....	<b>35</b>
<b>APPENDIX D - INTERFACE TOOLS DA1 - DA2</b> .....	<b>36</b>

## 1: Introduction

This manual describes the operation of the NV7 Bank note Validator as fitted with Firmware Version 1.10 or greater.

### Caution

- This Product must be fitted with a 2 Amp fuse before use.
- The NV7 Validator is pin for pin compatible with NV8 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 for assistance. In this way we may continue to improve our product. Alternatively visit our web site at [www.innovative-technology.co.uk](http://www.innovative-technology.co.uk)

**Innovative Technology Ltd.**  
**Derker Street**  
**Oldham**  
**England**  
**OL1 4EQ**  
**Tel: +44 (0) 161 626 9999**  
**Fax: +44 (0) 161 620 2090**  
**Email: [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk)**  
**Web site [www.innovative-technology.co.uk](http://www.innovative-technology.co.uk)**

Smiley® and the ITL Logo are international registered trademarks and they are the property of Innovative Technology Limited.

Innovative Technology has a number of European and International Patents and Patents Pending protecting this product. If you require further details please contact the factory.

Innovative Technology is not responsible for any loss, harm, or damage caused by the installation and use of this product. This does not affect your local statutory rights. If in doubt please contact Innovative Technology for details of any changes

## 2: Scope of Document

This document is intended for those who will:

- Design the NV7 into items of equipment.
- Build equipment using the NV7.
- Install equipment containing the NV7.
- Maintain equipment containing the NV7.

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.

### **Caution:**

- 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 NV7 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.

### 3: Environment and Power Requirements

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

**Table 1 - Environmental Requirements**

**Caution:**

- If the input voltage falls below 11.5V the NV7 may not operate correctly (will reject notes).
- It is recommended that the power supply used can supply at least 1.5Amps.

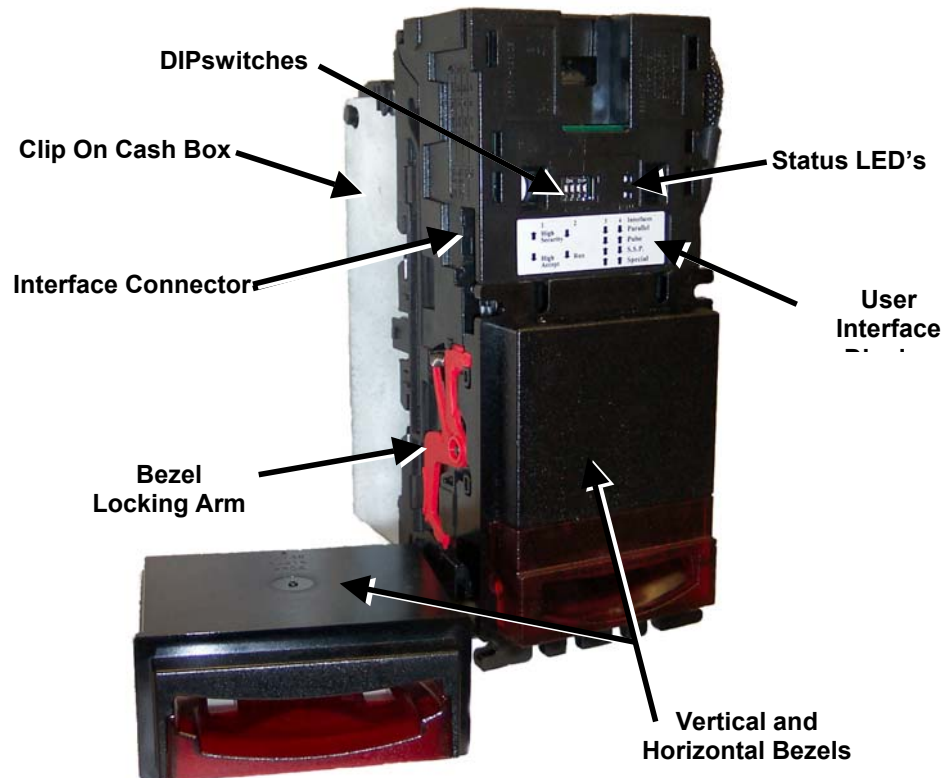
Electrical Supply	Minimum	Maximum
Supply Voltage (V dc) Absolute Limits	11.5V	13.5V
MDB IF5 Version Supply Voltage	18V	42V
Supply Ripple Voltage	0	0.25V @100 Hz
<b>Supply Currents:</b>		
Standby		0.35A
Validating		1A
Peak (Stacker Motor stall)		1.5A

**Table 2 - Power Requirements**

## 4: General Description

### NV7 Validator - the next generation of Smiley® Bank Note Validators

The NV7 Bank Note System 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 or 4 different notes in parallel mode, and will cope with different designs of banknote having the same value such as are found in the United Kingdom and Scotland.



**Figure 1 – The NV7 with Vertical and Universal Bezels**

The NV7 Validator leaves the factory preset to at least one currency so that it is ready for immediate installation. If it is required to change the currency data set this may be done using either the NV7 to NV7 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 NV7 is designed for easy installation in most machines. The 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 open collector output.
- Binary open collector output.
- Smiley® Secure Protocol (SSP) secure serial communications.
- Simple serial I/O communications.
- MDB interface protocol.
- CCTalk

## 5: NV7 User Interface

The user interface with the NV7 is shown below (see figure 2). It is simply a set of four DIPswitches and one red and one green LED, mounted on the top of the NV7. The DIPswitches set the basic operating mode of the unit, while the LED's indicate the operational status of the NV7.

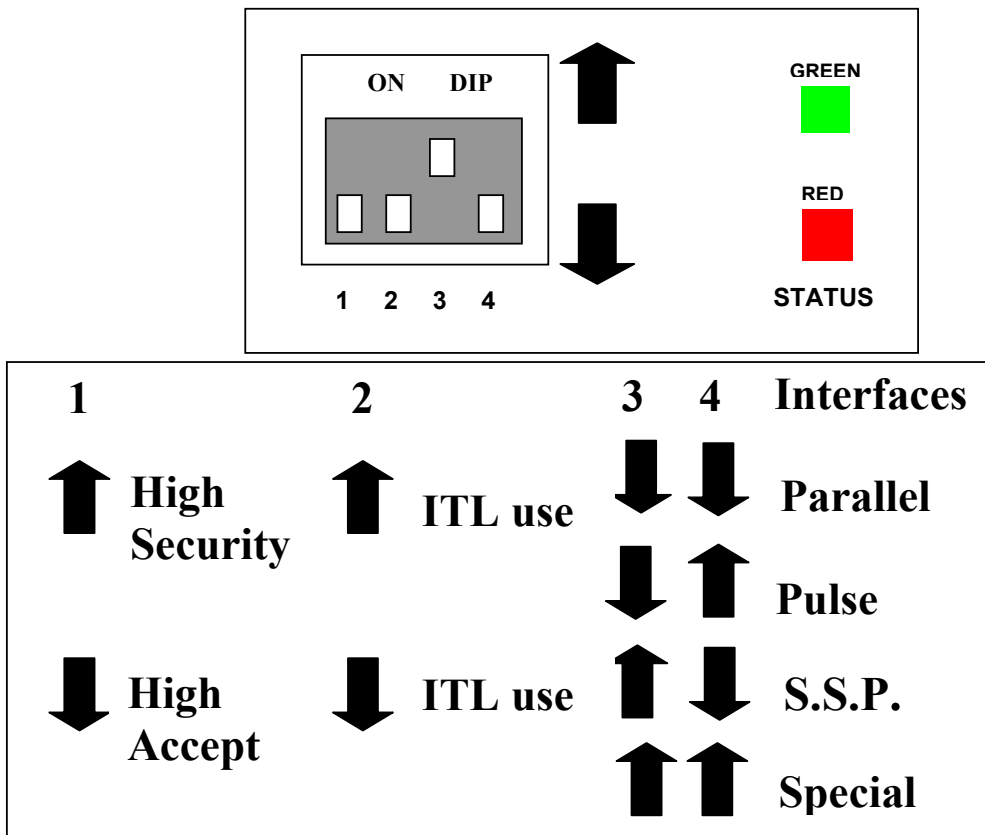




Figure 2 - User Display and DIPswitch Settings

### 5.1:DIPswitch Settings

The four DIPswitches can be set to a combination of either up  or down  depending on the configuration required for the particular NV7.

#### Switch 1 – security setting

Switch 1 allows the operator to alter the security sensitivity of the NV7. The NV7 can be configured for high acceptance (switch down), or for high security (switch up).

#### Switch 2 – pulse multiplier

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.

Currently the only interface to make use of this switch is the pulse mode. In this mode the switch can be used to multiply the number of pulses given by a factor of four. When the switch is down the multiplier is 1, when the switch is up and the NV7 is programmed with a US dataset the multiplier is 4.

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



## NV7 Operations Manual-GA324-3

These switches are used to select the machine interface to be used. The NV7 supports four 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 1 - 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.

The special interface depends on the firmware that is used in the NV7, the firmware shipped as standard is the binary interface (World Wide) and CCTalk (UK only). However, there are other options that can be downloaded by the user:

- Binary
- CCTalk
- ITL Simple serial I/O
- MDB

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

### 5.2:LED Status Codes

The two 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 NV7 is ready to read a note, the green status led will flash slowly ("Heartbeat") to signal a "healthy" status.
Flashing red one second period	NV7 is jammed, somewhere in the note path
Fast flashing red (fast = half second period)	NV7 cannot calibrate, sensor(s) may be blocked
Permanent Red	Memory has been corrupted
Alternately flashing green then red	Stacker is full

**Table 2 - LED Status Codes**

## 6: Interfaces: Hardware Description

The NV7 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 type Part No: 39-51-2160

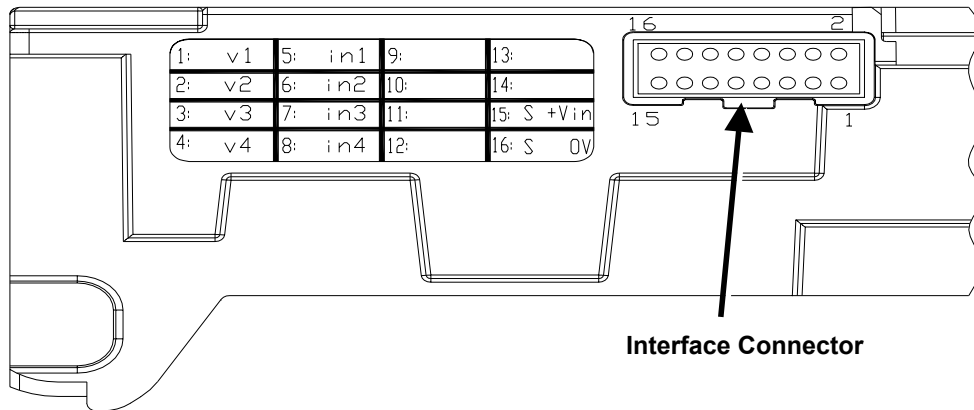


Figure 3 - Interface Connector

### 6.1:Interface Connector Pin Details

The connector pin details are described below (see table 3); they use a 0.1" pitch header with 2 rows of 8 pins.

Pin	Name	Description
1	Vend 1 (binary bit 1)	Note accepted on Channel 1 Also the Pulse Stream output Also the serial output pin in SSP Serial Mode
2	Vend 2 (binary bit 2)	Note accepted on Channel 2 pulse output.
3	Vend 3 (binary bit 4)	Note accepted on Channel 3 pulse output
4	Vend 4 (binary bit 8)	Note accepted on Channel 4 pulse output
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 RS232 serial mode
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	NV7 is validating and stacking output. Active low while the NV7 is reading, transporting or stacking a note.
10	Escrow	Operate Escrow function by holding LOW, refer to Escrow section in parallel and binary modes and Escrow <a href="#">Appendix C</a> for full details)
11	Spare	Spare
12	Spare	Spare
13	Spare	Spare
14	Spare	Spare
15	+Vin	Nominal 12V DC supply
16	0V	0v Supply

Table 3 - 16 Pin Connector Details

## 6.2: 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).

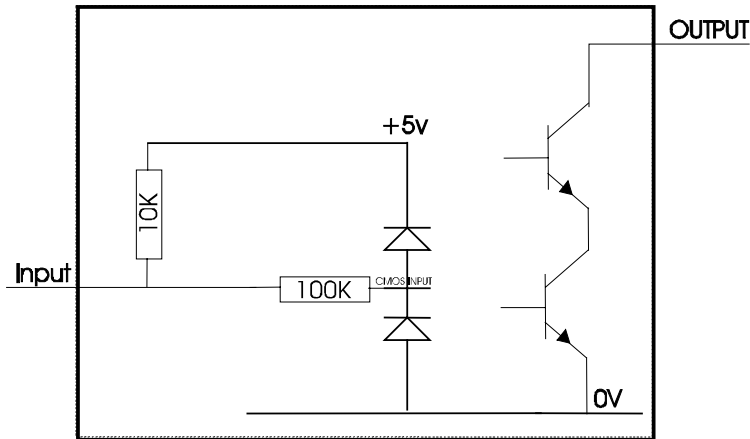


Figure 4 - Input and Output Circuit

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

Interface Logic levels	Logic Low	Logic High
Inputs	0V < Low < 0.5	+3.7V < High < 12V
Outputs with 2K2 $\Omega$ pull up	0.6V	Pull up voltage of host interface
Maximum Current Sink	50mA per output	

Table 4 - Interface Logic Levels

## 6.3: Software Optional 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 5 - Software Optional Serial Interface Inputs and Outputs

## 7: Machine Interfaces: Protocols

To select the required interface, the DIPswitches on top of the NV7 need to be set accordingly:

### 7.1: Parallel input and output:

To use parallel output for 4 notes / channel acceptance, DIPswitches 3 and 4 must be set down

**Vend Signals:** (Pins 1 to 4). The four channels have their own individual outputs. If a note is recognised then the relevant channel line is set low for a period of 100µs 3ms. Pulses outside these limits should 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 NV7 is in operation.

**Escrow Control:** (pin 10). -Parallel mode: The NV7 uses a single note escrow facility in this mode (see [Appendix C](#)). 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 confirmation of the Vend is not received the note will be returned to the customer after 30 seconds.

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 will cause a note reject.

In the event of a note being forcibly removed from the mouth of the NV7 during the 30 second interval, the NV7 will go out of service for 45 seconds.

**Inhibit Operation:** 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 NV7 will not read in any notes. In this mode, if a note is inserted the motor will run in reverse preventing the insertion of a note and the bezel will not illuminate.

All four inhibits may be connected together to create a 'global' inhibit. In this way the NV7 may be brought in and out of operation by the host machine.

### 7.2: Pulse Stream Output

To use pulse stream output for acceptance of up to 15 channel / note acceptance, DIPswitch 3 must be down and DIPswitch 4 must be up.

**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 NV7 currency manager program (and set to default values with supplied dataset).

The number of pulses is multiplied by a factor of four for USA dollar datasets, depending on the position of switch 2. If the switch is down then the number of pulses is as programmed in the dataset output. If the switch is up then four times this number of pulses is output.

**Busy Output:** (Pin 9). This is a general-purpose busy signal. It is active low while the NV7 is in operation.

**Escrow Control:** (Pin 10). The NV7 uses a single note escrow facility in this mode (see [Appendix C](#)). 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 confirmation of the Vend is not received the note will be returned to the customer after 30 seconds.

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 will cause a note reject.

In the event of a note being forcibly removed from the mouth of the NV7 during the 30 second interval, the NV7 will go out of service for 45 seconds.

## NV7 Operations Manual-GA324-3

---

**Inhibit Operation:** Each channel (1 to 4) has its 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.

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

If all four inhibits are high simultaneously then the NV7 will not read in any notes. All four inhibits may be connected together to create a 'global' inhibit. In this way the NV7 may be brought in and out of operation by the host machine.

## 7.3: Binary Output

To use binary output DIPswitches 3 & 4 must both be up and the BIN option of the interface firmware must be loaded into the NV7.

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 NV7 can be set to give a binary pattern output on the four parallel output pins.

If the NV7 is set to binary mode it will issue the vend signals as a binary pattern on the parallel outputs for 100 ± 3ms. 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 ± 3ms. 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 NV7 is in operation.

**Escrow Control:** (pin 10). The NV7 uses a single note escrow facility in this mode (see [Appendix C](#)). 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 is completed. If confirmation of the Vend is not received then the note will be returned to the customer after 30 seconds.

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 will cause a note reject.

In the event of a note being forcibly removed from the mouth of the NV7 during the 30 second interval, the NV7 will go out of service for 45 seconds.

**Inhibit Operation:** Each channels (1 to 4) have their 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.

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

If all four inhibits are high simultaneously then the NV7 will not read in any notes. All four inhibits may be connected together to create a 'global' inhibit. In this way the NV7 may be brought in and out of operation by the host machine.

## 7.4: Simple Serial Input/Output:

Existing Smiley® NV4 users may already be using the serial input/output facility in conjunction with the parallel inputs. The NV7 Validator also supports this system. However this interface is not recommended for new designs, the Smiley® Secure Protocol SSP interface is recommended.

### Caution:

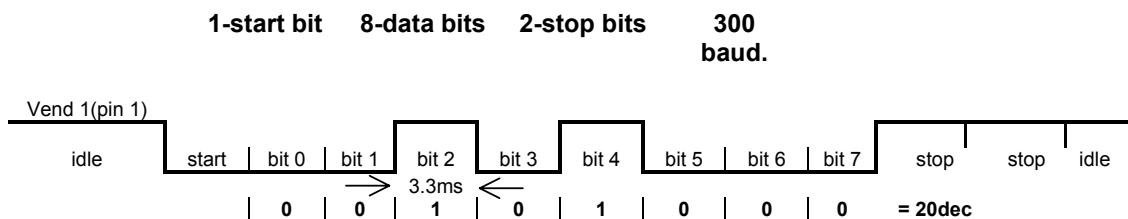
- The NV7 **does not** support the Simple serial data out only mode as available on NV4. It only supports the serial data Input/Output mode.
- The host machine does not echo messages back to the Validator.
- The NV7 **does not** operate in true RS232 mode.
- The NV7 will not be enabled in serial I/O mode if Inhibit 3 line is held low when the unit is powered up

To use simple serial mode, DIPswitches 3 & 4 must both be up and the Simple Serial mode SIO option of the interface firmware must be loaded into the NV7.

Commands are provided to fully control the operation of the NV7, the notes to be accepted and rejected can be set and a single 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.

## NV7 Operations Manual-GA324-3

The serial I/O mode will work at 9600 Baud rate if Inhibit 2 line is held low when the NV7 is powered up. The NV7 will not be enabled in serial I/O mode if Inhibit 3 line is held low when the unit is powered up. The data is formatted as follows:



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

The NV7 will receive and transmit the following event codes:

VV7 Recognised Receive Codes		NV7 Transmitted codes	
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	Strimming attempted	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		

**Table 6 - Receive and Transmit Codes**

## NV7 Operations Manual-GA324-3

Example transactions are shown below (see table 7):

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

**Table 7 - Example Protocols**



### 7.5 Smiley® Secure Protocol - SSP

**Note:** Please refer to the Smiley® Secure Protocol (SSP) Specification ITL Drawing GA 138 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.

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.

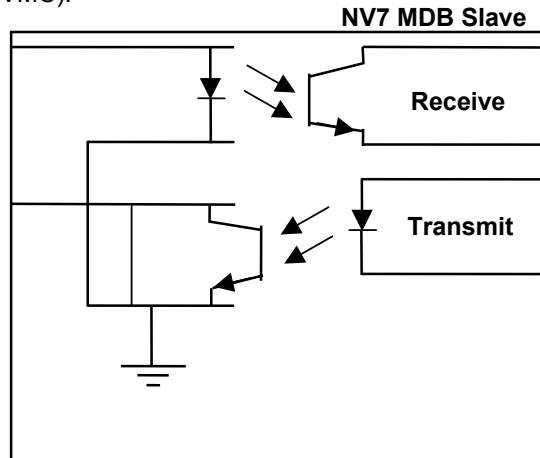
For detailed information and full protocol specification please refer to SSP Specification ITL Drawing GA 138, this is available from the ITL website [www.innovative-technology.co.uk](http://www.innovative-technology.co.uk). To help in the software implementation of the SSP, ITL can provide sample C Code, DLL controls and Visual Basic applications on request. Please contact [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk).

## 7.6:MDB – Multi-Drop Bus / Internal Communications Protocol (IF5)

To use the MDB mode an IF5 interface box must be fitted to the NV7 Validator and DIPswitches 3 & 4 must both be set up, with the MDB option of the interface firmware loaded into the NV7.

**Note:** Please refer to the Multi-Drop Bus specification for the suggested current drive circuits available.

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 NV7 MDB 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 6 – MDB Opto Isolated Input / Output circuits**

The NV7 MDB banknote Validators have a unique address – 00110XXX binary (30H). The VMC polls the bus to detect presence of the NV7 MDB 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 the international telephone code for that country. The code is represented as two bytes

For the USA the country code is 00 01

For Great Britain the code is 00 44

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 Validator
- 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

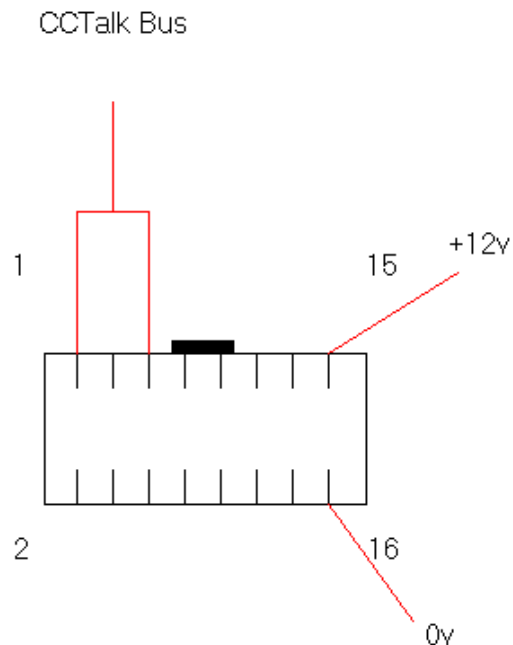
## 7.7: CCTalk Protocol.

The NV7 supports the CCTalk serial protocol for easy interfacing with host machines that support this protocol.

To use CCTalk mode (as in Binary mode etc) set DIPswitches 3 and 4 in the Up position to select 'Special' mode on the validator.

The NV7 must have the CCTalk software loaded using the "advanced" option on the Currency manager program.

Pin out connections on NV7 for CCTalk are shown below (see figure 7) looking at the connection pins on the NV7 interface connector.



**Figure 7 - CCTalk Connection Pins on the NV7**

The default encryption key will be set to the key code printed on the label on the NV7. 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 steps below.

1. Power off NV7.
2. Set all 4 DIPswitches to the Up position.
3. Apply power (no CCTalk comms).
4. Red LED will now be flashing.
5. Set DIPswitches 1 and 2 down.

The code is now reset.

## 7.8: Extended Interface – USA Serial

The USA Serial interface is a non-isolated interface serial communications protocol.

There is a single output DATA line from the NV7. There are three control lines, two from the controller "ACCEPT ENABLE" and "SEND" and one from the Validators IRQ (INTERRUPT) (see table 8).

**Caution:**

- Please note that the NV7 is required to operate on a +12volt DC power supply.
- The NV7 ground must be connected to the ground of the control system.

**Connection Details:**

Signal	NV7
0v	16
ACCEPT ENABLE	6
SEND	7
IRQ (INTERRUPT)	2
DATA	1
OUT_OF_SERVICE	3

**Table 8 - Extended Interface USA Serial**

For further details on this protocol please refer to the Series 2000 Interface manual (reference number 20105-002850046-PS).

## 8: Updating Currency and Firmware

**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 NV7 Validator can only be re-programmed using the NV7 currency download manager or by cloning from a master unit.

### 8.1: Currency Manager

To use the NV7 Currency Manager Software, which is supplied with a range of currencies. The system will require you to be running a PC Windows 95/98/NT™2000 or XP Professional, Pentium™ (© Microsoft and Intel). 100MHz or faster with a serial port (DA1 KIT) or USB port (DA2 kit) and a 12volt dc power supply, to power the Validators (see [Appendix D](#)).

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

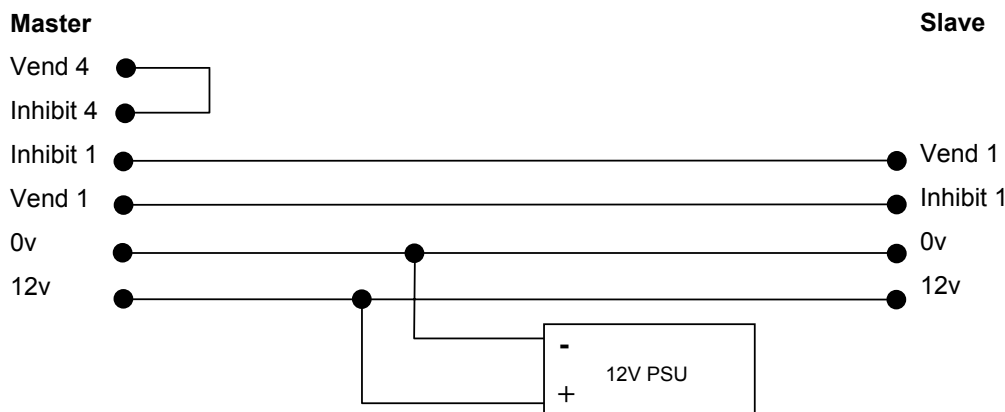
### 8.2: NV7 – NV7 Copy (Cloning)

#### Overview

This facility exists for a NV7 Bank Note Validator to copy its program and settings to another NV7. The 'Master' Validator will transmit the currency data and upgrade the slave's firmware if necessary using the NV7 configured copy cable assembly (see figure 8).

#### Requirements

- Master to have firmware 1.10 or greater
- NV7 configured copy cable assembly.
- 12V power supply.



**Figure 8 - NV7 Copy Cable Diagram**

#### Start-up configuration

- Remove power from slave and master units.
- Set DIPswitches 3 up and 4 down to select SSP interface mode on both NV7's.
- Using the NV7 cloning kit (CK2) connect the two units together as above.
- Turn on the 12V supply.
- The Master unit will update the slave firmware if the version of the Master is greater than 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.

### 8.3:NV7 – NV7 copy process.

- Connect the NV7 to the master slave using copy cable adaptor and 12V power supply
- The Master unit will flash the RED and GREEN LED's if the connector is configured correctly.
- RED and GREEN LED's on the master flash together – attempting to communicate with Slave.
- RED and GREEN LED's on master flash alternately - communication established, master waiting for Slave to reset.
- If communication has been established and the Slave has reset then the Master will read the Slave firmware version and decide on next action.
- If the Slave firmware version is not compatible with 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 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).
- When the firmware copy is complete, the 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 and 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.
- NV7 – NV7 copy is now complete.

## 9: Mechanical Installation

The NV7 validators can be supplied with either of the following bezels, (see figure 9):

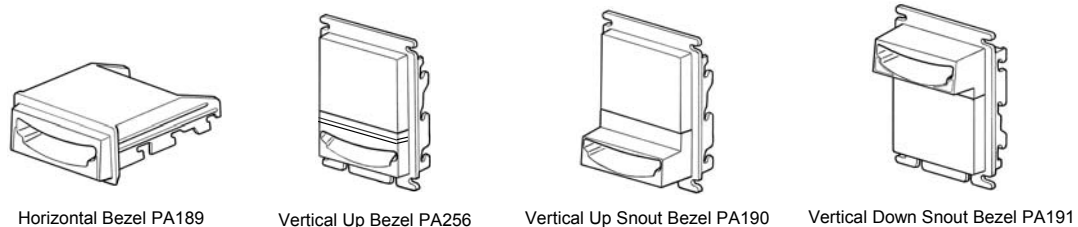


Figure 9 - NV7 Bezels

### 9.1: Changing or removing the bezels

**Caution:** Always make sure that **both** the locking arms have fully located in to prevent damage.

Push both of the red locking arms so that they disengage from the bezel sides. The bezel may then be unhooked from the 6 locating points, (see figure 10). To refit push the bezel onto the six locating points (3 each side). The red locking arms will spring back to secure the bezel

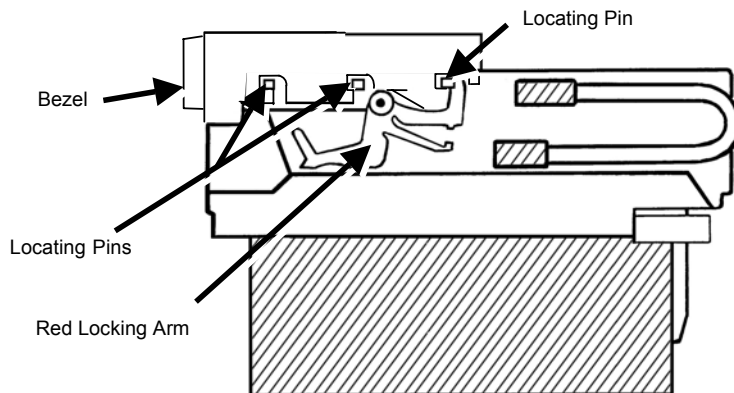


Figure 10 - Bezel and Validator Removal

### 9.2: Changing or removing cash boxes

The NV7 validators can also be supplied with the various cash box options, (see figure 11).



Figure 11 - Clip On and Slide in Cash Boxes

- 300 Note Clip (part no PA185) on for the vertical bezel options only.
- 300 Note Slide in (part no PA192) for both the horizontal and vertical bezel options.
- 600 Note Clip on (part no PA193) for the vertical bezel options only.
- 600 Note Slide in (part no PA194) both the horizontal and vertical bezel options.
- 300 Note Lockable for the horizontal bezel option only (part no PA186). (Lock is not supplied – use with Baton Lock type 6086-00KAL06 with supplied cam)

## 10: Routine Maintenance

The NV7 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 NV7 may at some time require cleaning, belt changing, note path clearing or even re-calibration.

### 10.1: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, ALWAYS USE A MILD DETERGENT.**

To clean, slide the red release catch on the end of the NV7 Validator to open the note path. The note path and lozenge are now exposed for cleaning.

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 12), ensuring they are clean and dry. Clean any metal debris that may be attached to the magnetic sensor.

#### Caution

When cleaning the "recessed" Front Sensor, use a small soft brush or cotton wool bud.

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.

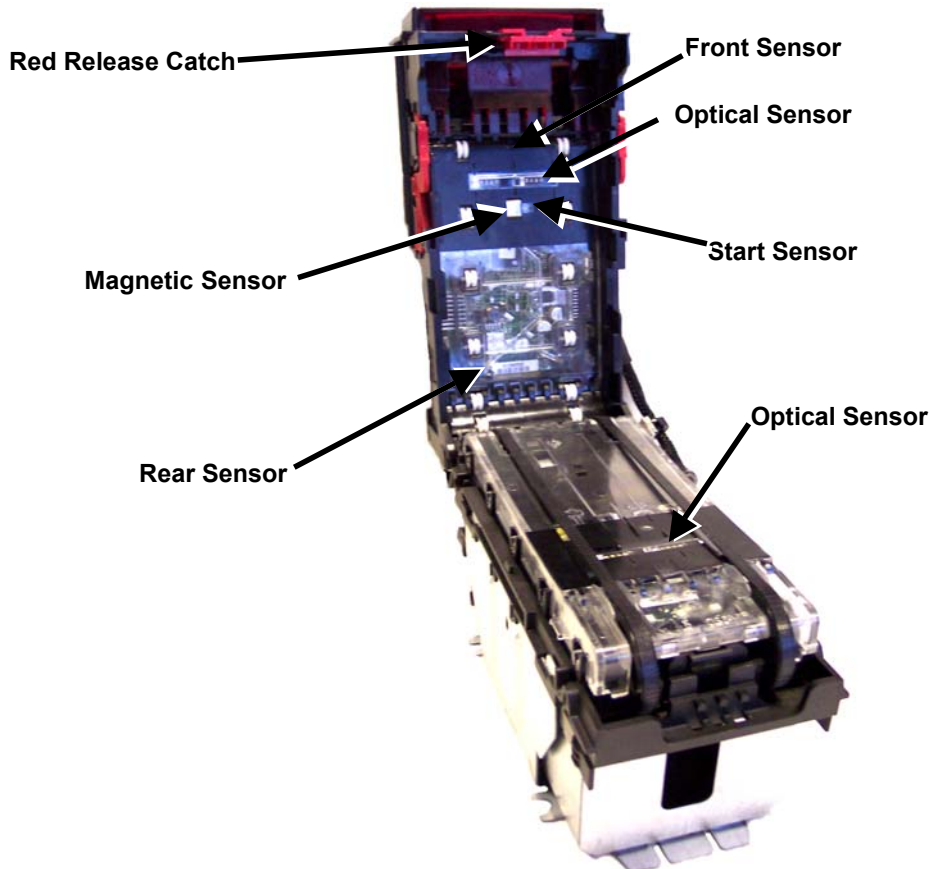


Figure 12 - NV7 Sensors



## 10.2: Note Path Debris Clearing / Belt Changing

To access the note path and lozenge, slide the red release catch on the end of the NV7 Validator and lift to open. Push the lozenge release catch and lift; the note path and lozenge are now exposed for maintenance (see figure 13).

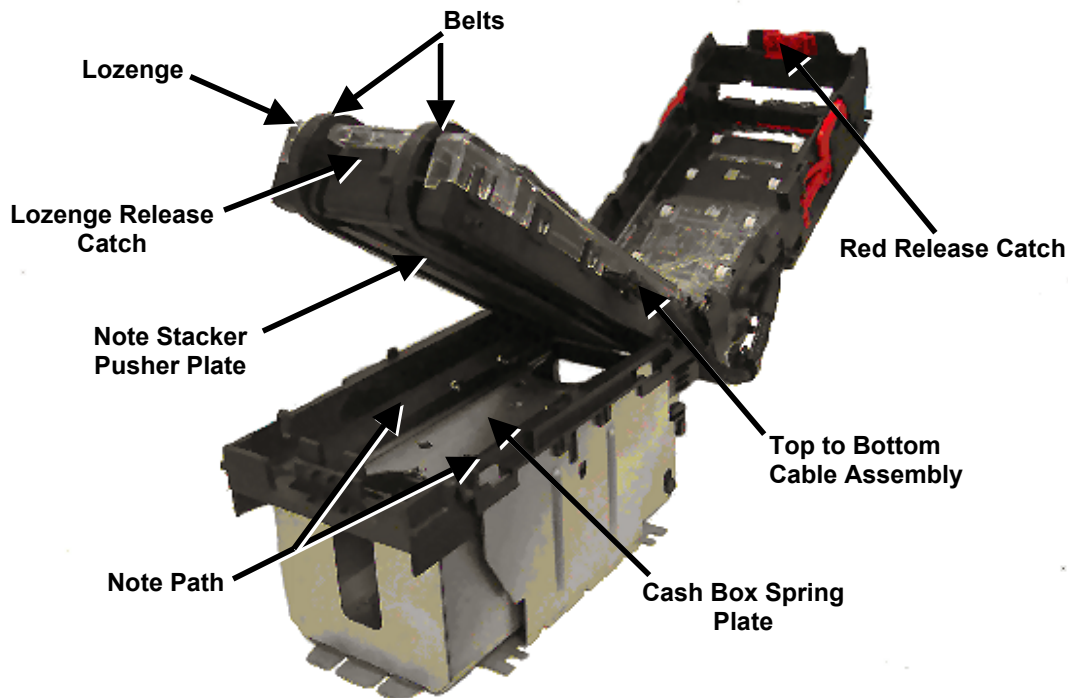


Figure 13 - NV7 Note Path and Lozenge Access

### Debris Clearing

Examine the note paths, lozenge and note stacker for any dirt or debris.

Carefully clear and wipe the surfaces of the note paths and lozenge 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 12), ensuring they are clean and dry.

Check that the note stacker and cash box spring plate are not jammed.

### Belt Changing

With the NV7 lozenge exposed (see figure 13) carefully unplug the bottom connector of the "top to bottom cable assembly" from the lozenge.

Remove and place the lozenge on a clean dry surface and remove the belts, sliding them off the smallest wheels first. Replace the belts using the reverse procedure from the above.

## 10.3: Re-Calibration

The NV7 has an in-built self-calibration system that maintains the optical sensors at their best operating point. However if the NV7 is disassembled for any reason it will need to be re-calibrated. Re-calibration may only be performed under license from ITL, contact [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk) for further details.

This can be performed in conjunction with the diagnostics software option in the NV7 currency manager program and help menus supplied with this program.

11: Fault Finding Analysis

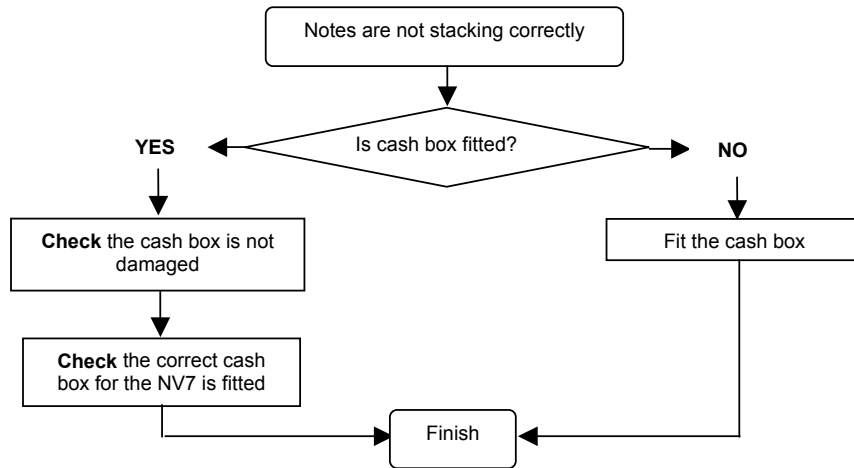


Figure 14 - Notes are not stacking Correctly

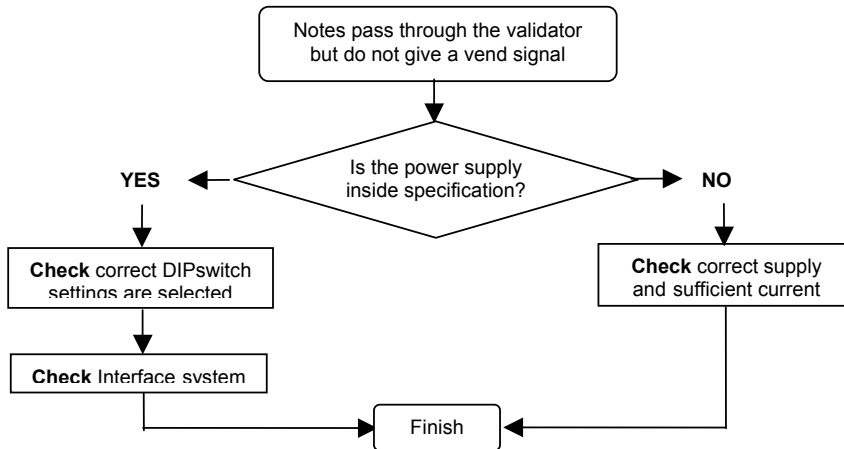


Figure 15 - Notes pass validators with no vend signal

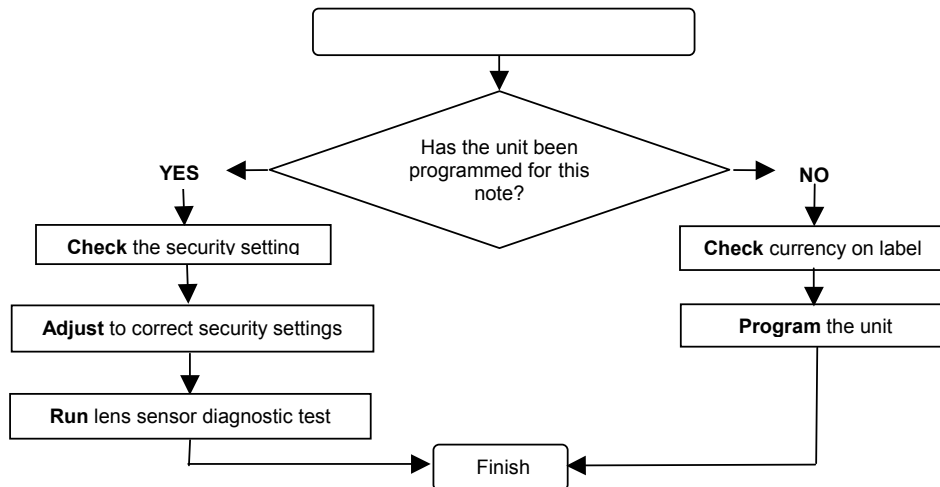


Figure16 - Unit rejects genuine notes

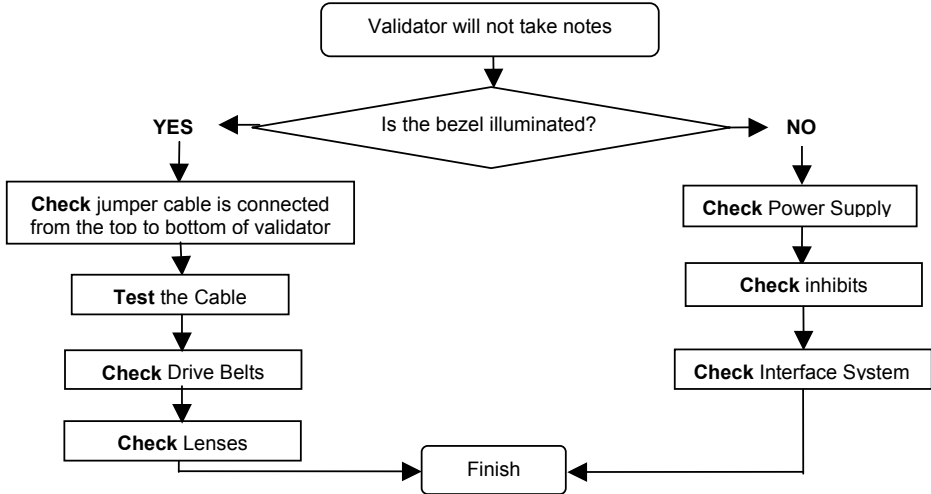


Figure 17 - Validator will not take notes

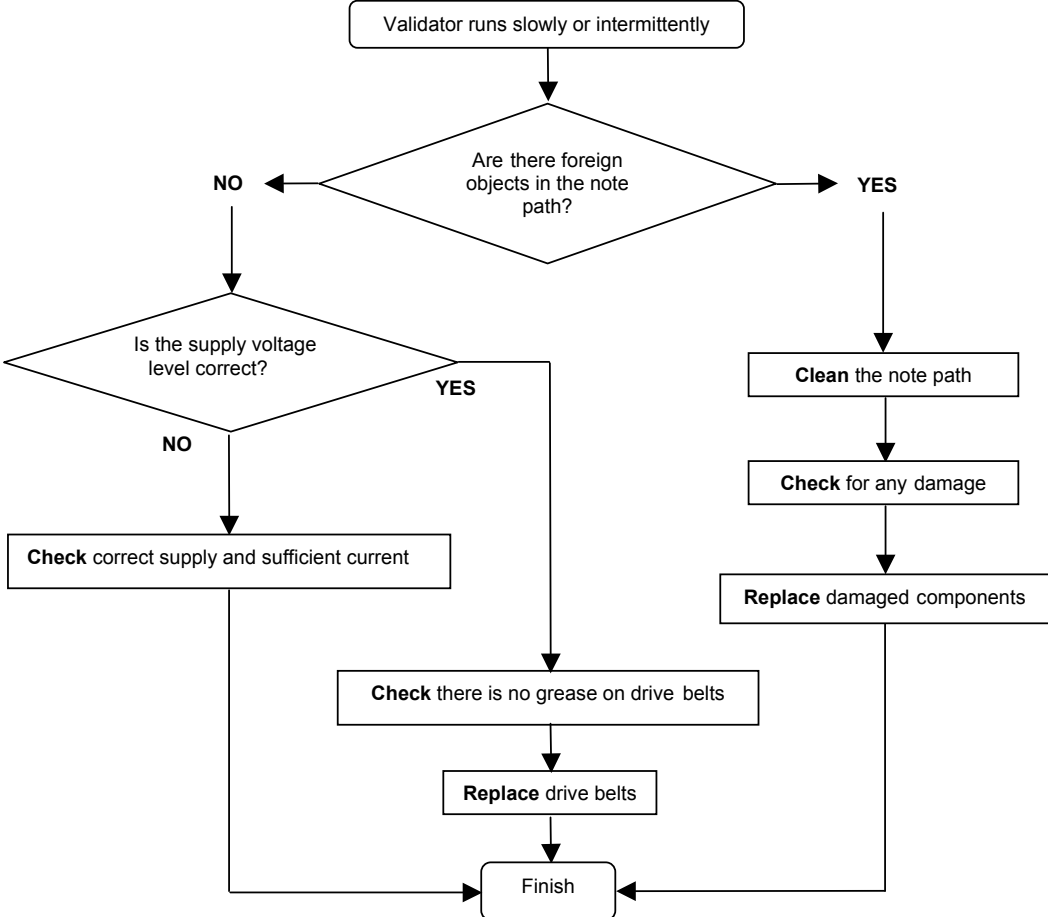


Figure 18 - Validator runs slowly or intermittently

## 12: Support Tools

The following support tools are available for use with the NV7 Bank Note Validator:

1. PC Currency Manager Software.
2. Downloads from the Innovative Technology Ltd website: [www.innovative-technology.co.uk](http://www.innovative-technology.co.uk)
3. E-mail Support [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk).

### 12.1:PC Currency Programming Software.

The NV7 Currency Manager software offers the following functions:

- Program the Validator by downloading pre-prepared currency data via the serial communications link using the DA1 kit or DA2 kit using the USB link.
- Check the firmware version and currency set already loaded on an NV7 unit.
- Adjust the channel and pulse configuration on a pre-programmed NV7 to your own requirements.
- Download a new version of firmware onto the NV7.
- Use diagnostic functions to check Validators operation (firmware version 1.10 and greater only).

The software will run on an IBM compatible Personal Computer with Pentium™ processor or equivalent and requires a DA1 kit fitted to the serial port or DA2 kit fitted to the USB port depending on the operating system that you are using (see [Appendix D](#)).

### 12.2: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 NV7. Visit [www.innovative-technology.co.uk](http://www.innovative-technology.co.uk) to register your user name and to access the password for further details, updates and technical bulletins, which are also made available.

**Note:** The files are password protected to prevent abuse. Periodically the passwords are changed. Please contact support at Innovative Technology for password updates.

### 12.3:E-mail Support.

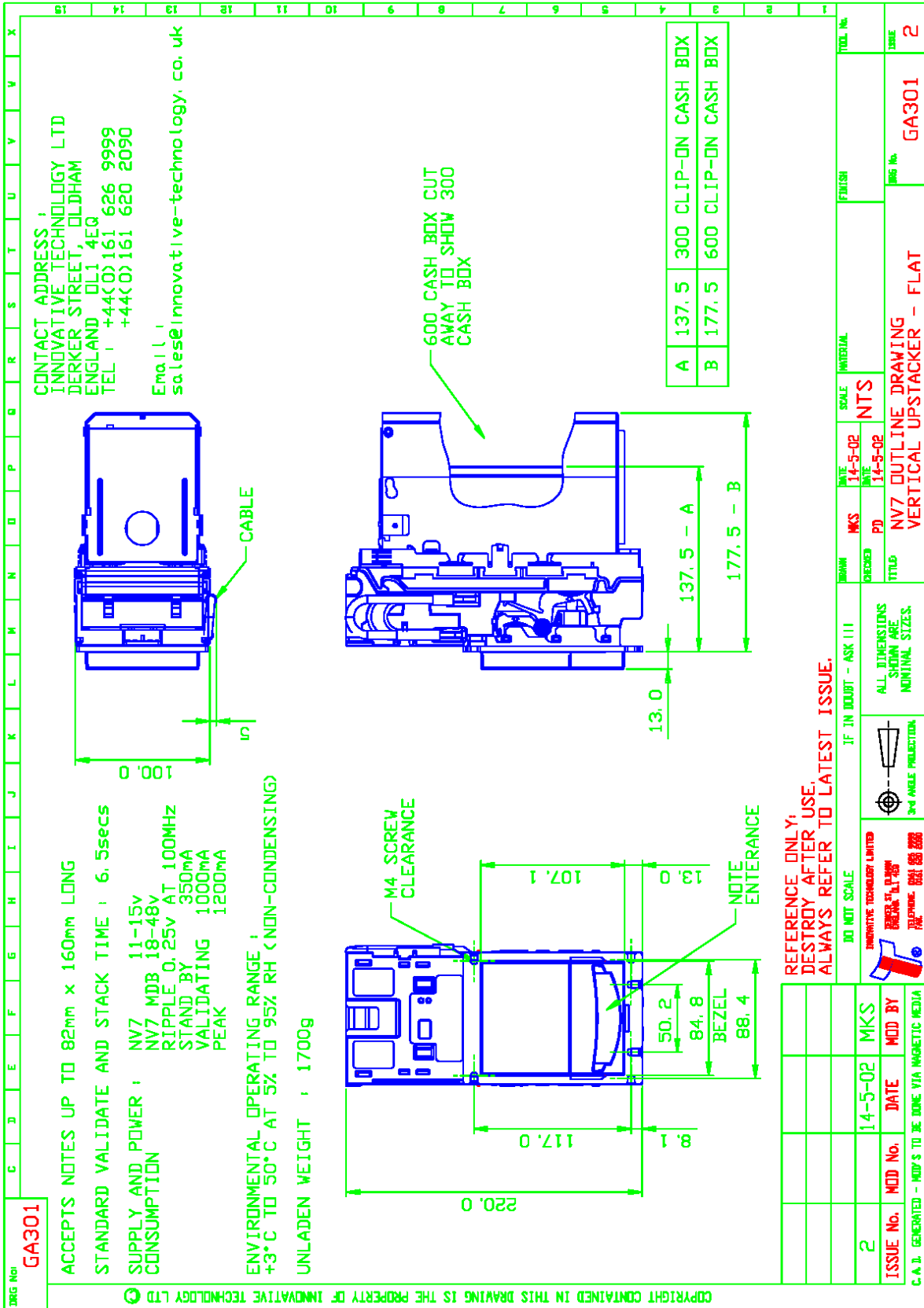
If the data you require is not available over the Internet Innovative Technology supports an e-mail system to help customers with unusual requirements. The address is [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk)

## Appendix A - NV7 Spares List

\*NOT AVAILABLE AS A SPARE

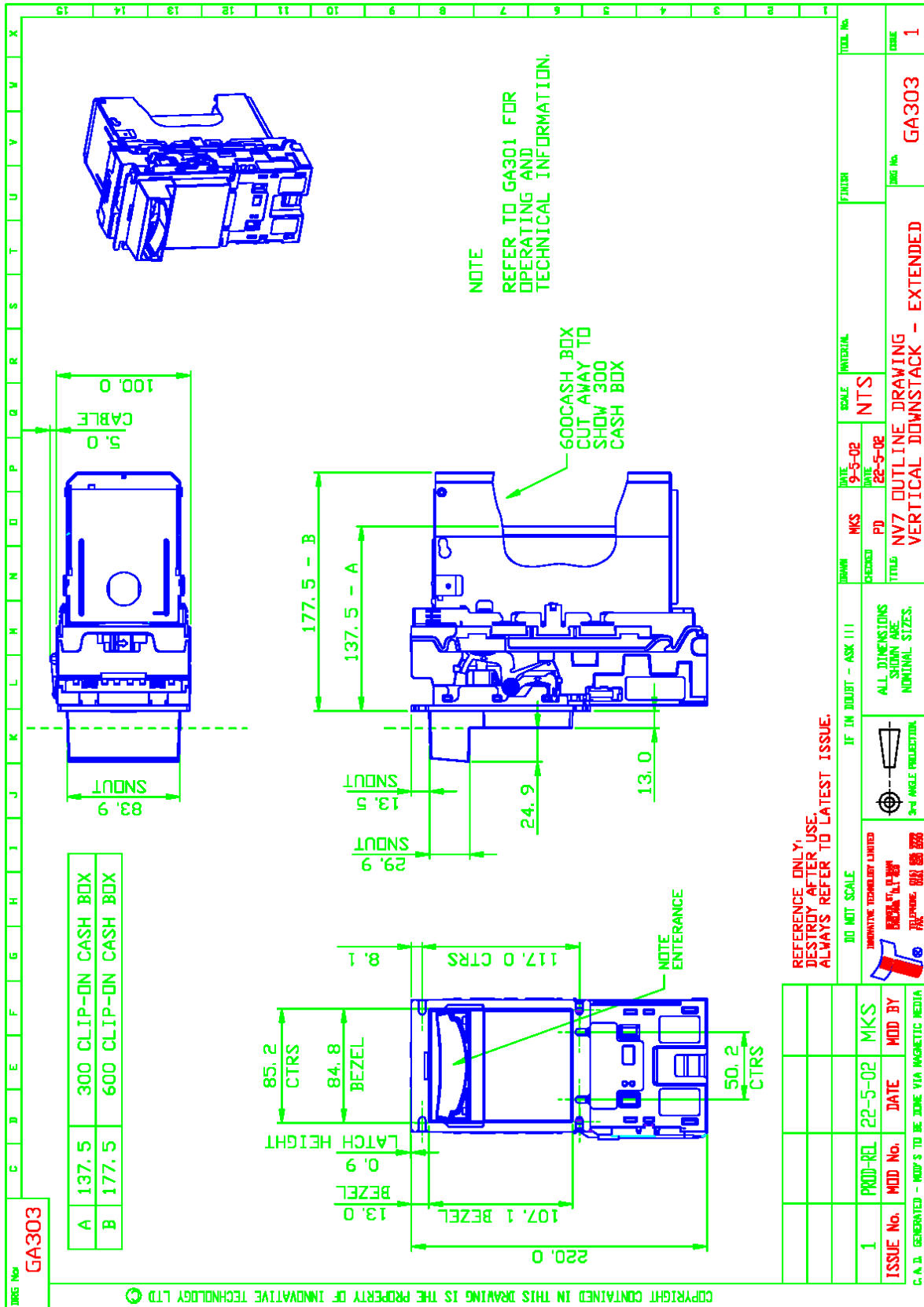
Item	Part No	Description	Comments
1	CN158	Top to Bottom Cable Assembly	
2	PM300	Main Housing	
3	*PM301	Note Path	See printed version
4	PM302	Lock Arm	
5	PM307	Upper Note Path	Full assembly is PA177
6	PM308	Note Path Cover	Full assembly is PA177
7	PM316	Cash box handle	
8	PM322	Scissor Inner	Full assembly is PA178
9	PM323	Scissor Outer	Full assembly is PA178
10	*PM324	Push Plate	Order PM256 for spare
11	PM325	Push Drive Shaft	Full assembly is PA178
12	PM326	Push Drive Cover	
13	PM327	Captive Nut	Full assembly is PA178
14	PM337	Note Pressure Wheel	
15	SP108	NV4 Spring	
16	PB139	NV7 Mother board	
17	WR130	PINK WIRE	
18	WR131	GREEN WIRE	
19	WR132	BLUE WIRE	
20	WR133	ORANGE WIRE	
21	CL105	Lockable cable clamp	
22	*PM363	Printed non mag lens	See PA243
23	PM364	Printed PM320	
24	*PM365	Printed mag lens	See PA242
25	PA242	Printed mag lens with light shield	
26	PA243	Printed non mag lens with light shield	
27	PA229	Motor drive assembly with wires	
28	PA230	Stacker motor assembly with wires	
<b>BEZEL ASSEMBLIES</b>			
29	PA256	Fixed width vertical bezel assy	
30	PA256BK	Fixed width vertical bezel assy (sunlight)	
31	PA257	Fixed width horizontal bezel assy	
32	PA257BK	Fixed width horizontal bezel (sunlight) assy	
33	PA189	Horizontal bezel assy	
34	PA189BK	Horizontal bezel black assy	
35	PA190	Vertical UP Extended snout assy	
36	PA190BK	Vertical UP Extended black snout assy	
37	PA191	Vertical DOWN Extended Bezel assy	
38	PA191BK	Vertical DOWN Extended black Bezel assy	
<b>CASHBOXES</b>			
39	PA185	300 Clip On	
40	PA186	300 Lock	
41	PA192	300 Slide On	
42	PA193	600 Clip On	
43	PA194	600 Slide On	

Appendix B - Drawings





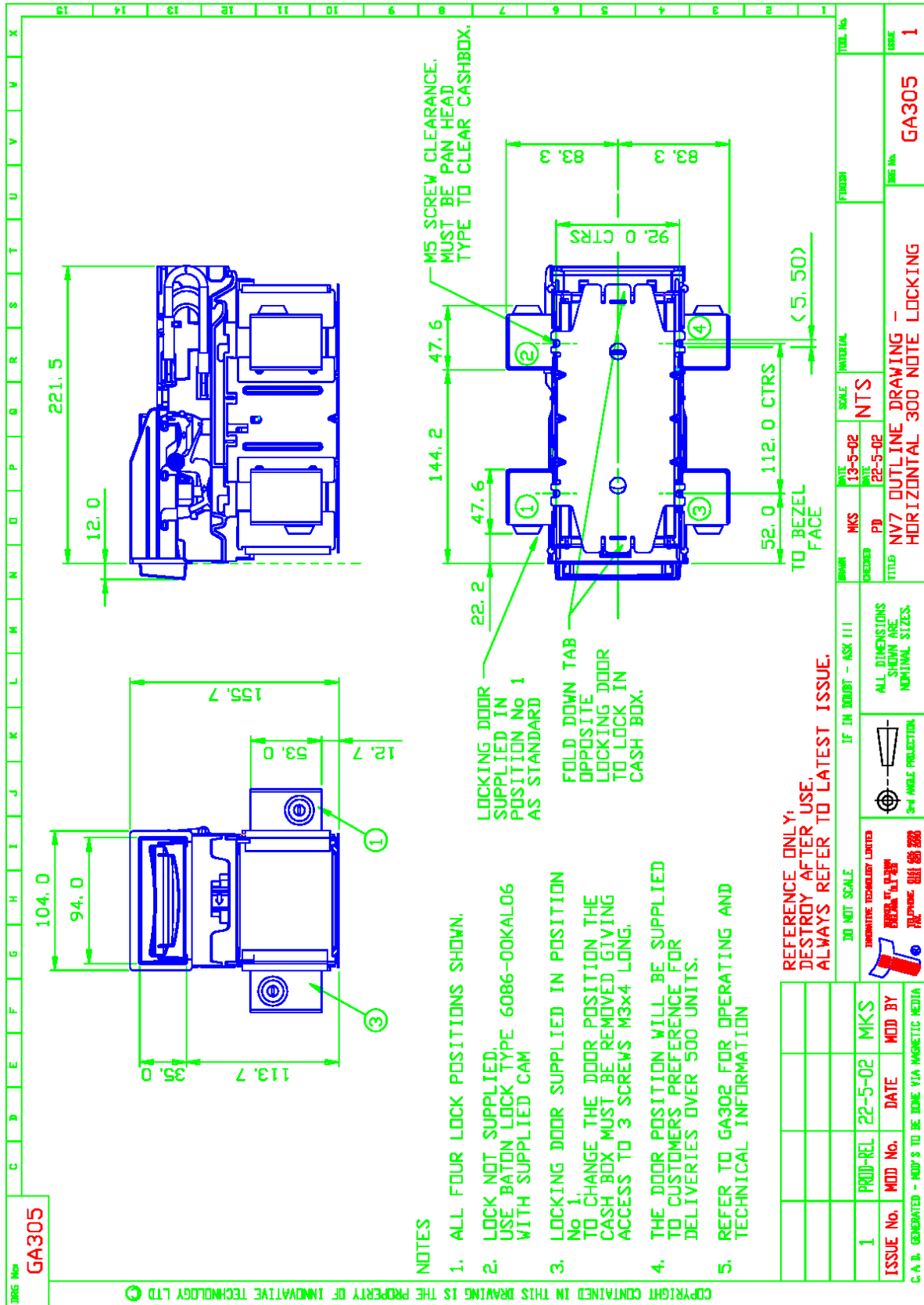
Drawings







Drawings



### Appendix C - ESCROW Control

The NV7 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 19).

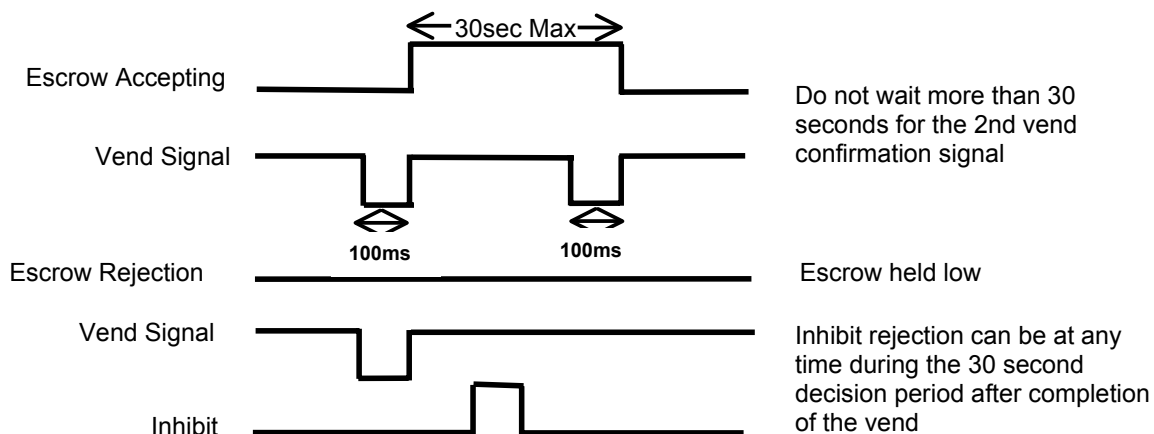


Figure 19 - Escrow Timing Diagram for Parallel Vends

If the host machine itself aborts the transaction by setting the corresponding inhibit input high on pin 10, the note is returned immediately. The sequence of operations is as follows:

1. Pin 10 held low awaiting note insertion.
2. Note inserted. Validator issues a 100ms pulse on the appropriate channel.
3. The host machine initiates vend process.
4. 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.
5. 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.
6. The vend process is completed.
7. 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 NV7 during the 30 second interval, the NV7 will go out of service for 45 seconds.

**Note: Escrow Control (SSP mode):** Escrow is also possible using the SSP serial Interface. Please refer to SSP Specification GA138 available on the website [www.innovative-technology.co.uk](http://www.innovative-technology.co.uk).

## Appendix D - interface Tools DA1 - DA2

The DA1/2 Kits are designed for the following:

- Connecting of ITL note validators to a PC to upgrade note data and firmware.
- Testing of NV7 note validators independently of the host machine to confirm the validator is working but the host machine may be inhibiting some of the channels.

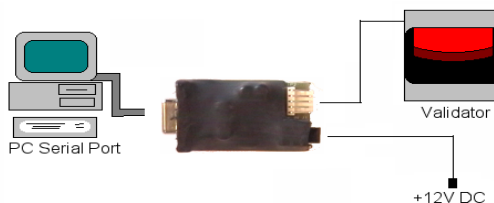
The DA1 and DA2 Kit comprise of the following components:

DA1	DA2
DA1 adapter board	DA2 adapter board
NV7Adapter to Validator cable	USB type-A to Type-B cable
Power Cable	DA2 to NV7 cable
ITL Support CD-ROM for DA1	ITL Support CD-ROM for DA2
Installation Guide	Installation Guide

### Connecting a DA1 to a validator and PC

If you are using Windows 95/98/NT™, Pentium™ (© Microsoft and Intel) operating systems connect the DA1 to the validator as shown below (see figure 1), using the 16-way to 5-way connector. The 3.5mm jack plug and 2 banana plugs are used to supply power to the DA1. Connect +12 volts to the red banana plug and GND (0V) to the black plug.

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.

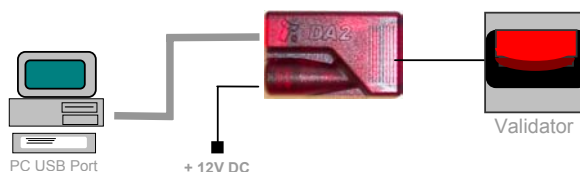


**Figure 1 - Connecting DA1 to a NV7 and PC for upgrading**

### Connecting a DA2 to a validator and PC

If you are using Windows Pentium™ (© Microsoft and Intel) 98, 98SE, 2000, XP Home or XP Professional operating systems, connect the DA2 to the validator as shown below (see figure 2), using NV7 TO DA2 connector. The 3.5mm jack plug and 2 banana plugs are used to supply power to the DA2. Connect +12 volts to the red banana plug and GND (0V) to the black plug.

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 2 - Connecting DA2 to a NV7 and PC for upgrading**

### Software Installation

To install the software to upgrade datasets and firmware, insert the CDROM into the PC drive. An installation menu will appear, select the product that you wish to download, and select the software you wish to use. Follow the onscreen instruction to complete the installation. Instructions for configuring and using the software you have installed can be found in the online help for that software.

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