

# NV9 OPERATIONS MANUAL

## INTELLIGENCE IN VALIDATION



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## 1 INTRODUCTION

This manual describes the operation of the NV9 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 NV9 VALIDATOR IS PIN FOR PIN COMPATIBLE WITH NV7/8/10 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.

This document is intended for those who will:

- Design the NV9 into items of equipment.
- Build equipment using the NV9.
- Install equipment containing the NV9.
- Maintain equipment containing the NV9.

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 NV9 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 NV9 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 NV9 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)<br>Absolute Limits | +11 V   | +15 V            |
| MDB IF5 Version Supply<br>Voltage        | +18V    | +48V DC or 34VAC |
| 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

The NV9 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, Pulse mode and Binary mode, 4 different notes in parallel mode, and will cope with different designs of banknotes having the same value such as are found in the United Kingdom and Scotland.

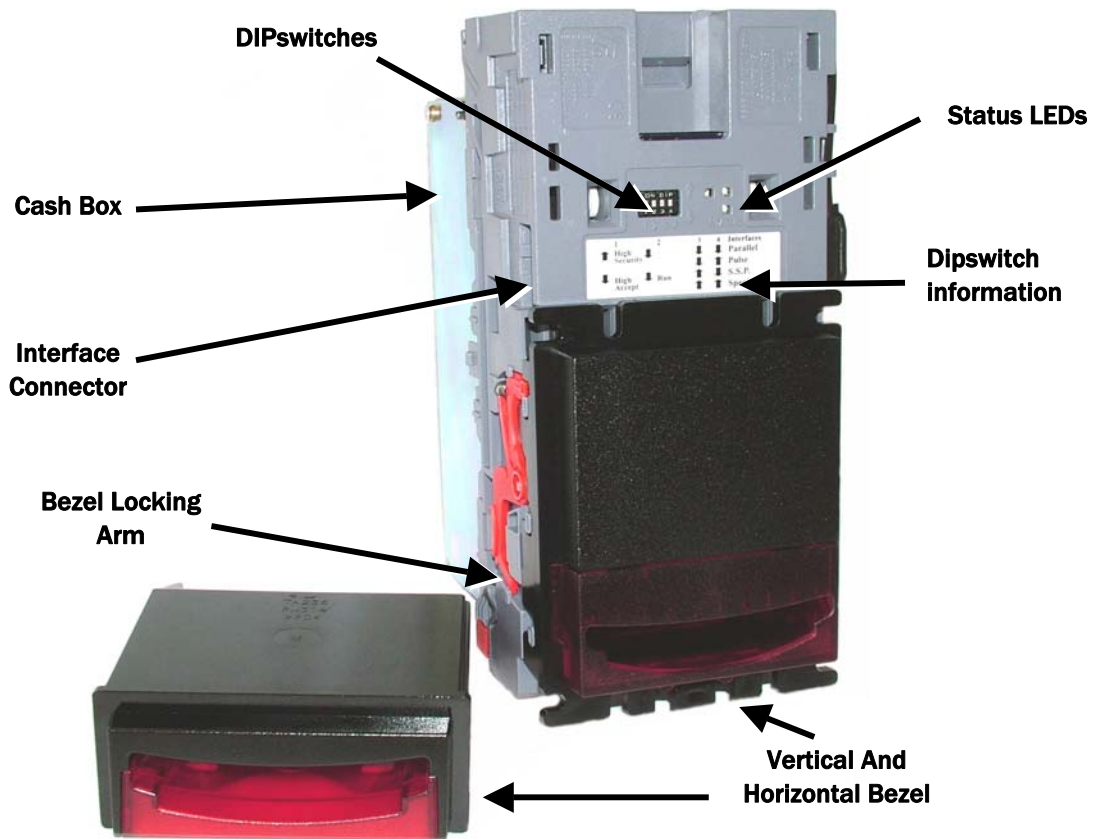


Figure 1 - The NV9 validator

The NV9 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 PC based Currency Management software or the DA3 Validator Programming System.

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 NV9 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
- Extended Interface / USA Serial (NIS)

#### 4 NV9 USER INTERFACE

The user interface with the NV9 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 NV9. The DIPswitches set the basic operating mode of the unit, while the LED's indicate the operational status of the NV9.

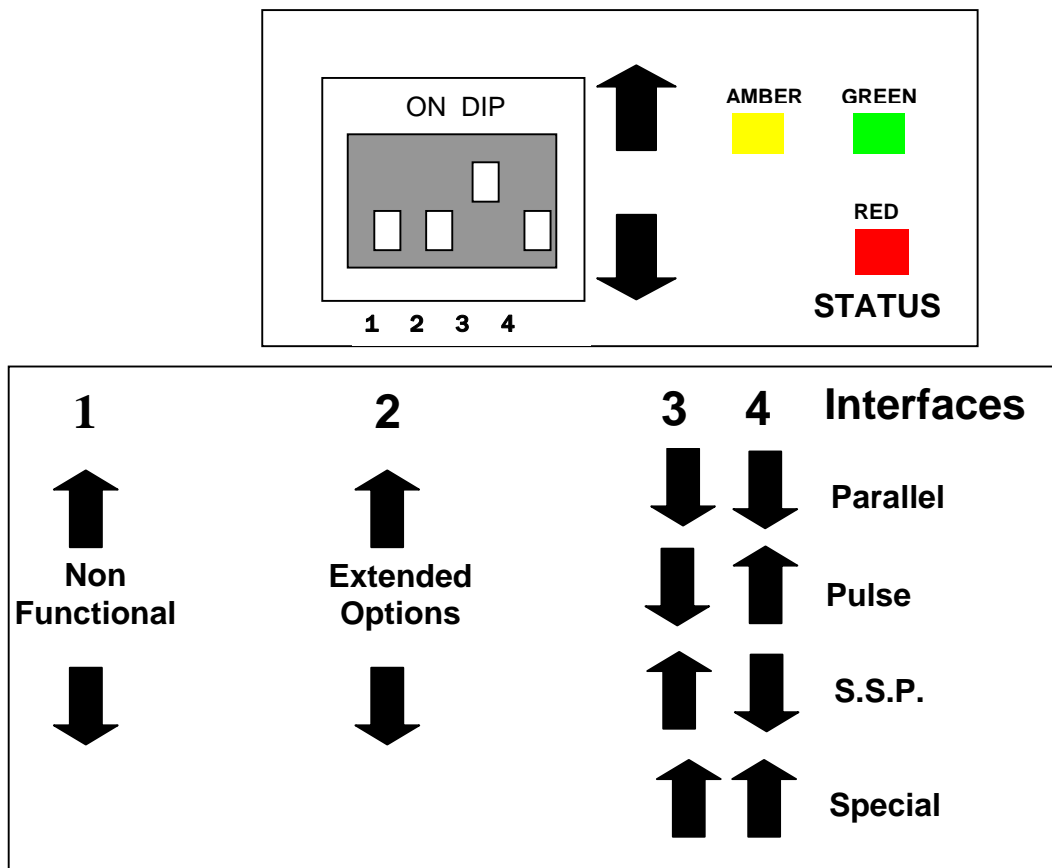




Figure 2 - User Display and DIPswitch Settings

#### 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 NV9.

##### 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 NV9 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 NV9, 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<br>(Slow = 1 second period)   | In normal RUN operation, when the NV9 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<br>During operation - Flashing RED one second period.                              | Firmware fail<br><br>NV9 has a Transportation Error somewhere in the note path  |
| On Start Up - Fast flashing RED (fast = half second period)<br>During operation - Fast flashing RED (fast = half second period) | Dataset fail<br><br>NV9 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 INTERFACES: HARDWARE DESCRIPTION

The NV9 interface connector is located on the left side of the unit; it has 16 pins (see figure 3) refer to Table 3 for the pin allocation. 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 factory use and should not be connected. An example mating connector is Molex type Part No: 39-51-2160 (Note: When assembling own cables ensure the Moulding pin-out below is followed)

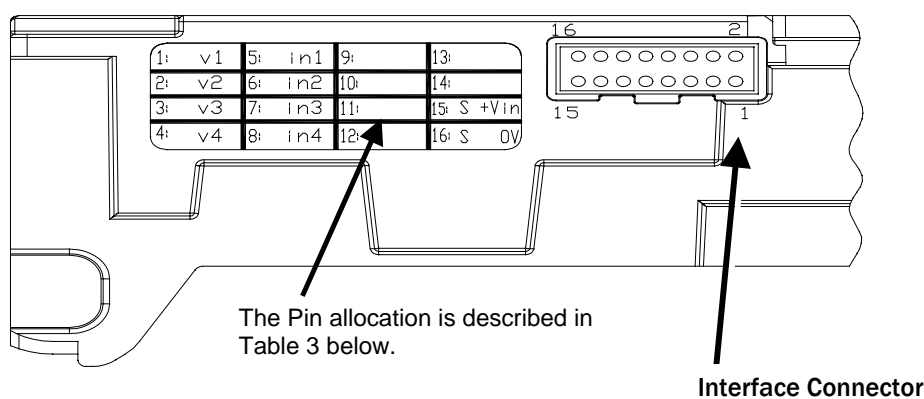


Figure 3 - Interface Connector

### 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.<br>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             | NV9 is validating and stacking output. Active low while the NV9 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).**

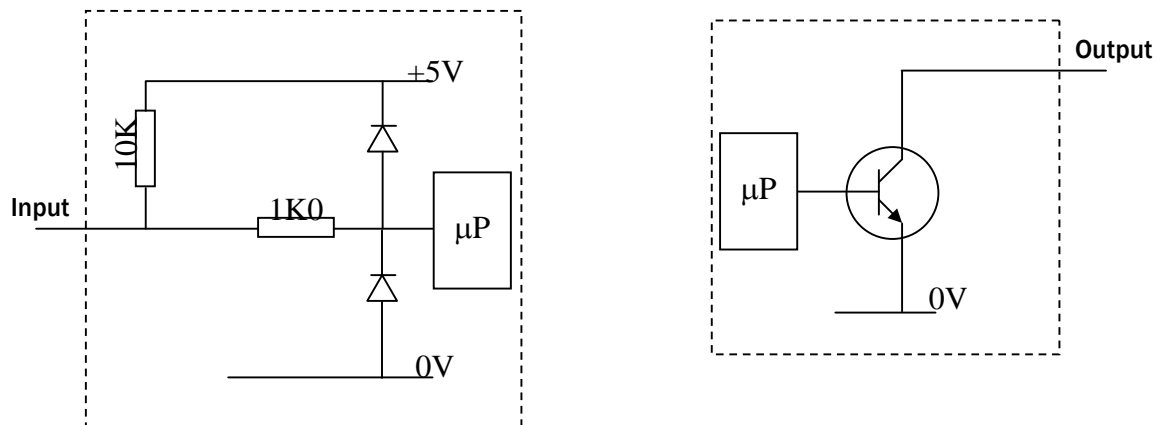


Figure 4 - Input and Output Circuits



**NOTES:**

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

| Interface logic levels            | Logic low       | Logic high                        |
|-----------------------------------|-----------------|-----------------------------------|
| Inputs                            | 0V to +0.5V     | +3.7 V +12V                       |
| Outputs with 2K2 $\Omega$ 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 |
|---------------|-------------|
| Validator TxD | Vend 1      |
| Validator RxD | Inhibit 1   |

*Table 7 - Serial Interface Inputs and Outputs*

## 6 MACHINE INTERFACES: PROTOCOLS

The NV9 is set to the required Protocol/Interface, by setting the DIPswitches on top of the NV9 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  $100 \pm 3\text{ms}$ . 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 NV9 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 NV9 during the 30-second interval, the NV9 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 NV9 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 NV9 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 NV9 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 NV9 during the 30-second interval, the NV9 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 NV9 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 NV9. (**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 NV9 can be set to give a binary pattern output on the four parallel output pins.

If the NV9 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 NV9 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 NV9 during the 30-second interval, the NV9 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 NV9 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 NV9 Validator also supports this system. However this interface is not recommended for new designs, the Smiley® Secure Protocol SSP interface is recommended.

### CAUTION:

- **THE NV9 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 NV9 DOES NOT OPERATE IN TRUE RS232 MODE. (ONLY TTL LEVEL).**
- **THE NV9 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 NV9. (**Dipswitch 2 is not functional in this mode**)

Commands are provided to fully control the operation of the NV9, 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.

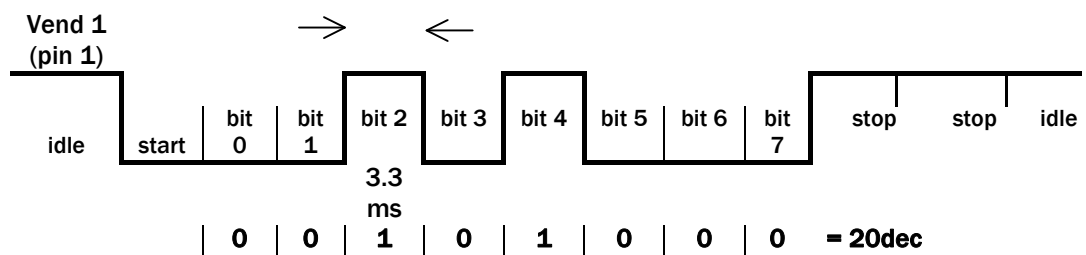


**NOTES:**

- The NV9 will operate at 9600 Baud rate if Inhibit 2 line is held low when powered up.
- The NV9 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 NV9 will receive and transmit the following event codes.

| Recognised Receive Codes to NV9 |               | Transmitted codes from NV9              |               |
|---------------------------------|---------------|---|---------------|
| 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           |   |               |
| Disable escrow timeout          | 190           |   |               |
| Enable escrow timeout           | 191           |   |               |
| Request firmware                | 192           |   |               |
| Request dataset                 | 193           |   |               |

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→                              |                       |
| Request firmware version    | Firmware requested<br>4 byte ascii string | ←192<br>192→<br>0321(ascii)     | Request               |
| Request dataset code        | Firmware requested<br>8 byte ascii string | ←193<br>193→<br>EUR02901(ascii) | Request dataset       |

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.**

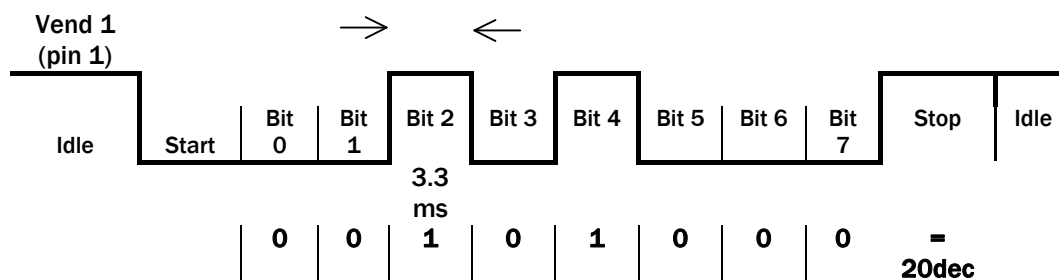


Figure 6 - Typical Serial Output: Transmission of the value 20 (decimal),  
Note not recognized

## 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 (TTL) - 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 NV9 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 NV9. (**DIPswitch 2 enables a fast reset on power up**).

The Fast Reset option should be set if the NV9 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 NV9 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 NV9 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).

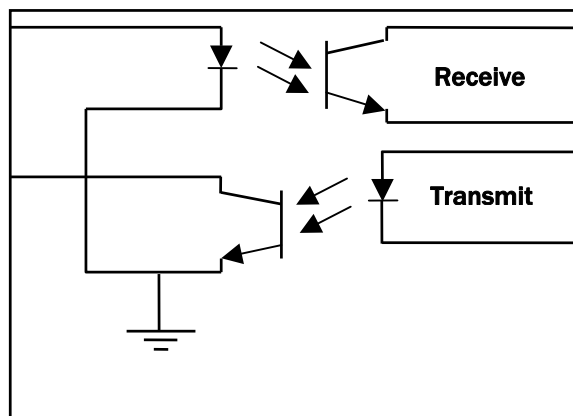


Figure 7 - MDB Opto Isolated Input / Output circuits NV9 MDB Slave

The NV9 banknote Validators have a unique address – 00110XXX binary (30H). The VMC polls the bus to detect presence of the NV9 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 Columbia.
- 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 Columbia

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 Columbia would be displayed as 1.000

## 6.8 ccTALK PROTOCOL – CCT

The NV9 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 NV9. (DIPswitch 2 is non functional in this mode).

Pin out connections on NV9 for ccTalk are shown below (see figure 7) looking at the connection pins on the NV9 interface connector as defined in the ccTalk specification. 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 NV9.

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

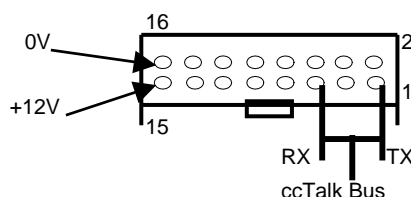


Figure 8 - ccTalk Connection Pins on the NV9

## 6.9 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 NV9. (DIPswitch 2 is not functional in this mode).

There is a single output DATA line from the NV9. 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 NV9 IS REQUIRED TO OPERATE ON A +12VOLT DC POWER SUPPLY.
- THE NV9 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.

### Connection Details:

| Signal          | NV9 |
|-----------------|-----|
| +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 an updated Currency Firmware file.

The NV9 Validator can only be re-programmed using the ITL Bank Note Validator Currency Manager 3.2.0 or greater or via a DA3.

**Note:** Cloning is not available for the NV9 with firmware 3.20 and later (March 2007)

### 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



## 7.2 VALIDATOR PROGRAMMING SYSTEM (DA3)

Refer to chapter 11.2 for more details.

## 8 MECHANICAL INSTALLATION

The NV9 validators can be supplied with various bezels options as shown in Appendix D.

### 8.1 CHANGING OR REMOVING THE BEZELS

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

**CAUTION: ALWAYS MAKE SURE THAT BOTH THE LOCKING ARMS HAVE FULLY LOCATED IN TO PREVENT DAMAGE.**

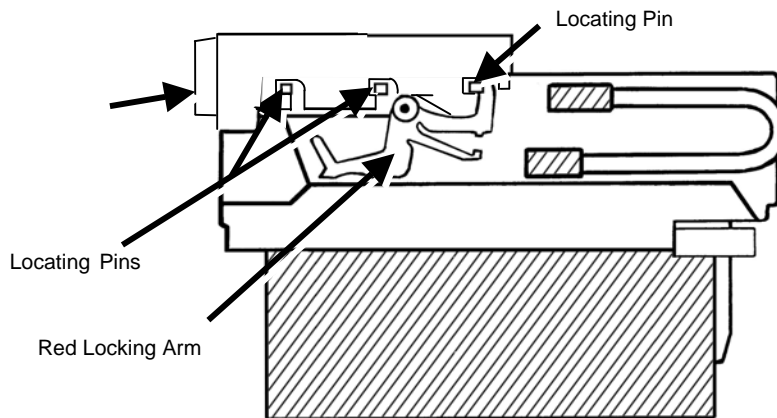


Figure 9 - Bezel and Validator Removal

### 8.2 CASH BOX OPTIONS

The NV9 validators can be supplied with various cash box options, shown in Appendix E.

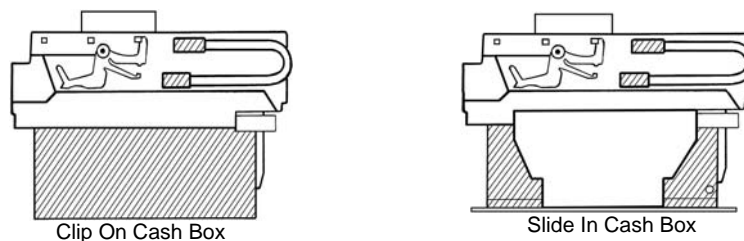


Figure 10 - Clip On and Slide in Cash Boxes

- 300 Note Clip on (part no PA185) 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).

## 9 ROUTINE MAINTENANCE

The NV9 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 NV9 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.**

To clean, slide the red release catch on the end of the NV9 Validator to the left, 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.

**CAUTION: WHEN CLEANING THE RECESSED FRONT SENSORS, 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

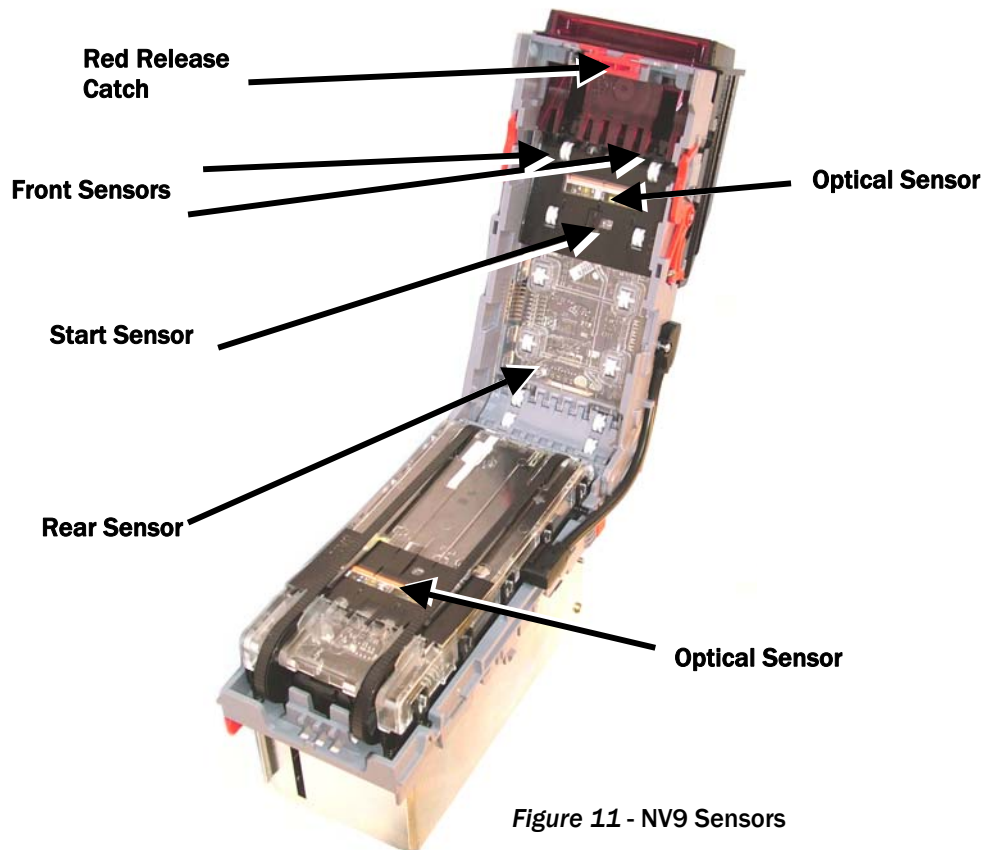
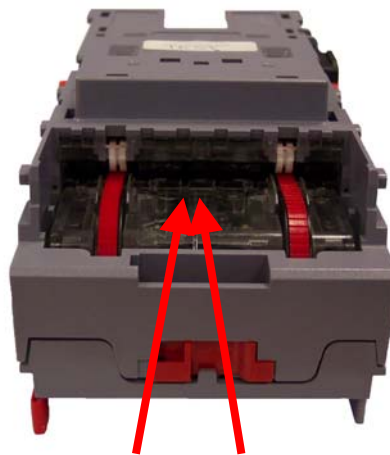


Figure 11 - NV9 Sensors

#### 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 NOTE PATH DEBRIS CLEARING / BELT CHANGING

To access the note path and lozenge, slide the red release catch on the end of the NV9 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).

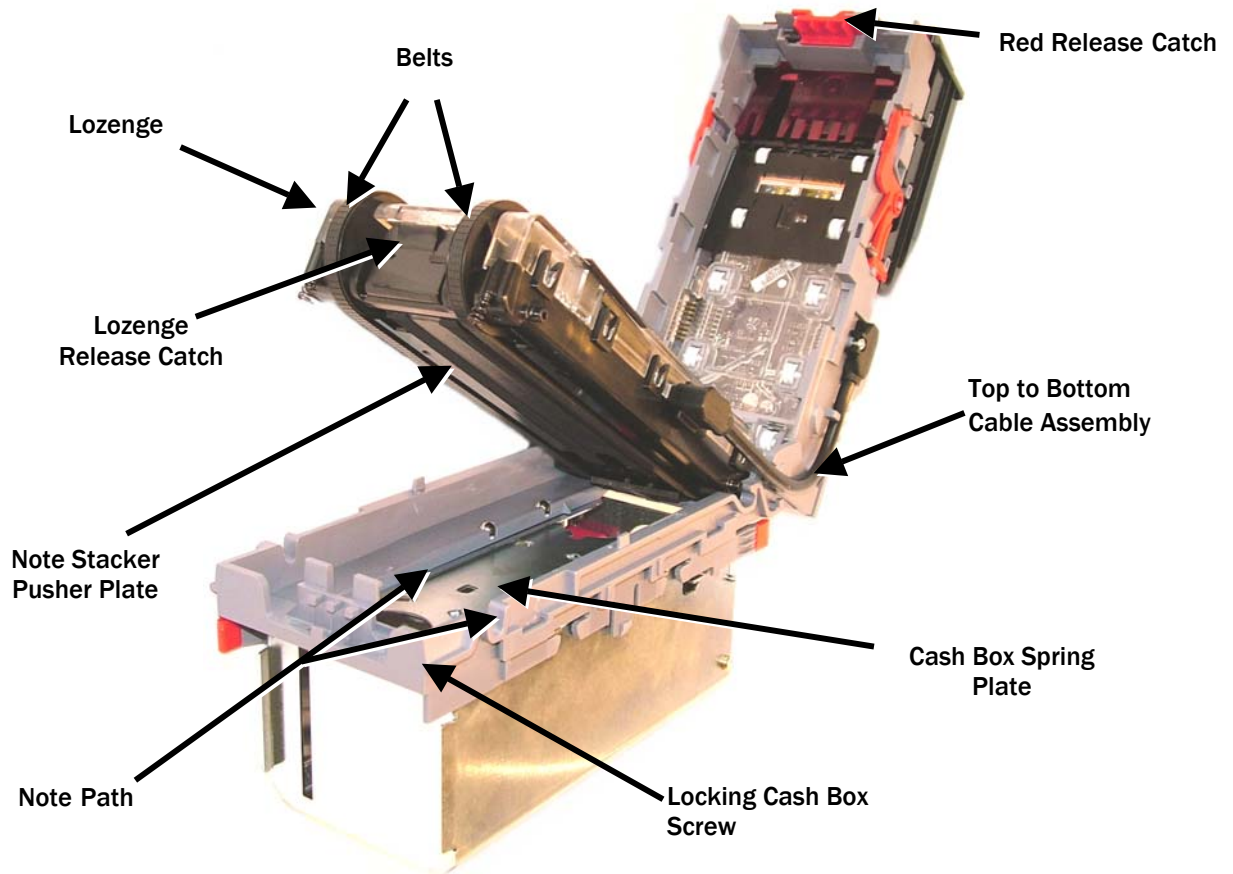


Figure 12 - NV9 Note Path and Lozenge Access

### 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 NV9 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.

**NOTE:** With the Locking Cash Box, the Locking screw must be removed first.

## 10 FAULT FINDING ANALYSIS

| PROBLEM                                     | CHECK   | SOLUTION  |
|---|---|---|
| Validator will not accept notes             | <p>Is the Bezel lit?<br/>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<br/>Check the LED Status codes (Chapter 4.2).<br/>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<br/>Check note path for damage<br/>Check Voltage level of supply<br/>Check drive belts are fitted correctly<br/>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<br/>Refit belts</p> <p>Replace belts</p>  |
| Notes are accepted but no credit received   | <p>Is the PSU within specification?<br/>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?<br/>Are sensors ok</p>  | <p>Check correct Currency is programmed in using Validator Manager software<br/>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 NV9 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 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 NV9 unit.
- Adjust the channel and pulse configuration on a pre-programmed NV9 to your own requirements.
- Download a new version of firmware onto the NV9.
- 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 C)

### 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 NV9. You can obtain these along with technical bulletins by visiting [www.innovative-technology.co.uk](http://www.innovative-technology.co.uk)

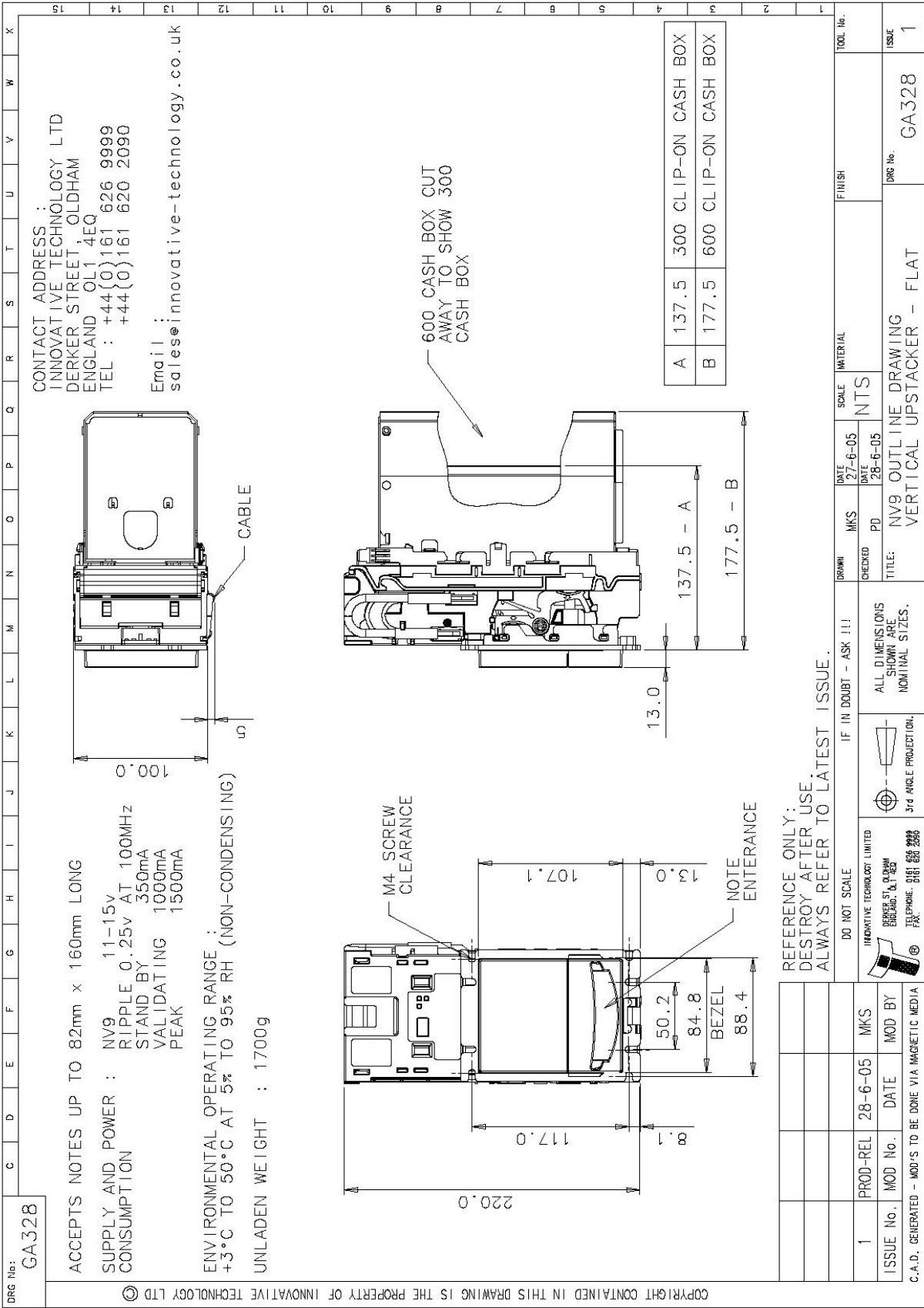
### 11.4 E-MAIL SUPPORT

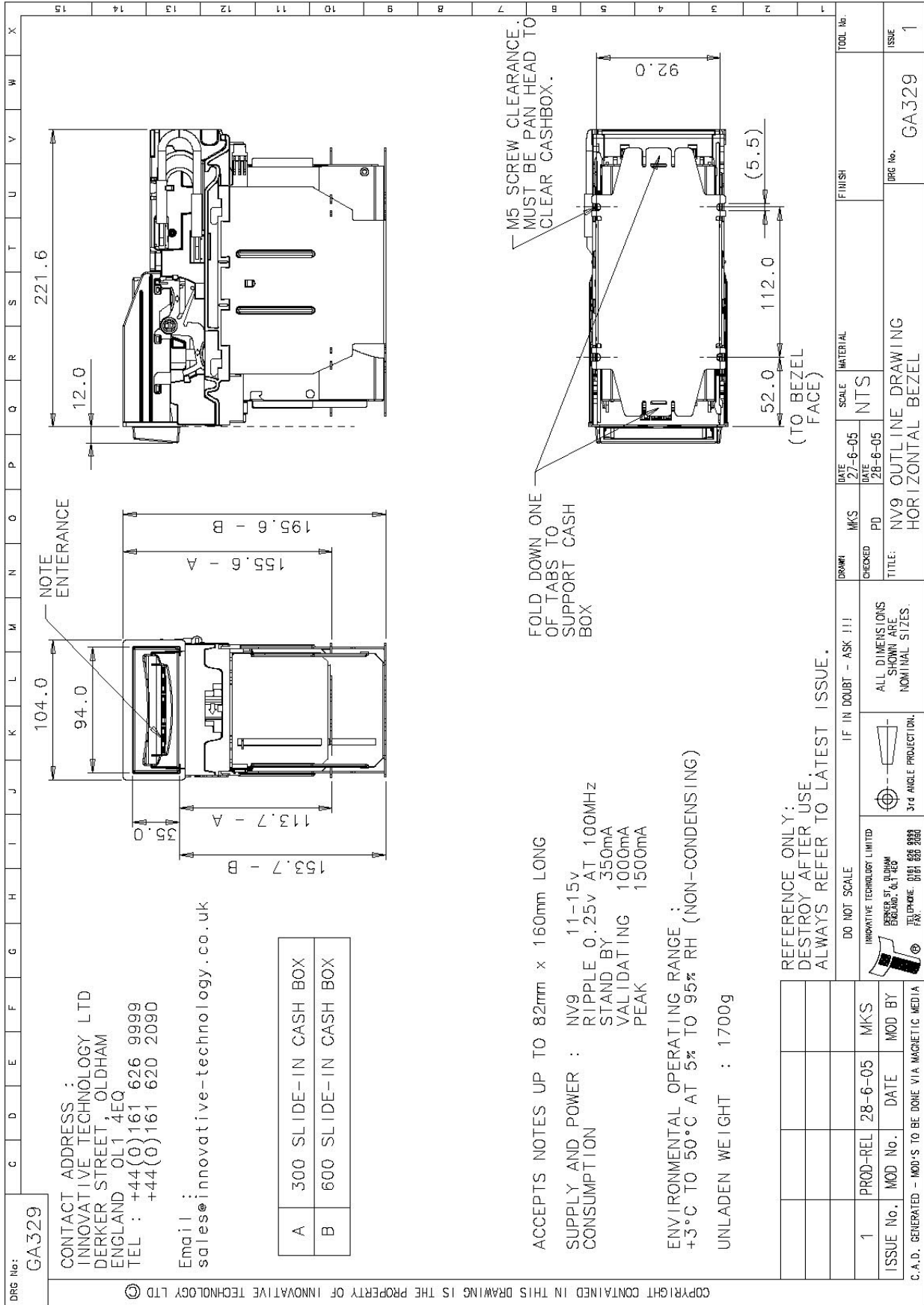
If the data you require is not available over the Internet Innovative Technology supports an e-mail system to help customers with unusual requirements. The address is: [support@innovative-technology.co.uk](mailto:support@innovative-technology.co.uk)

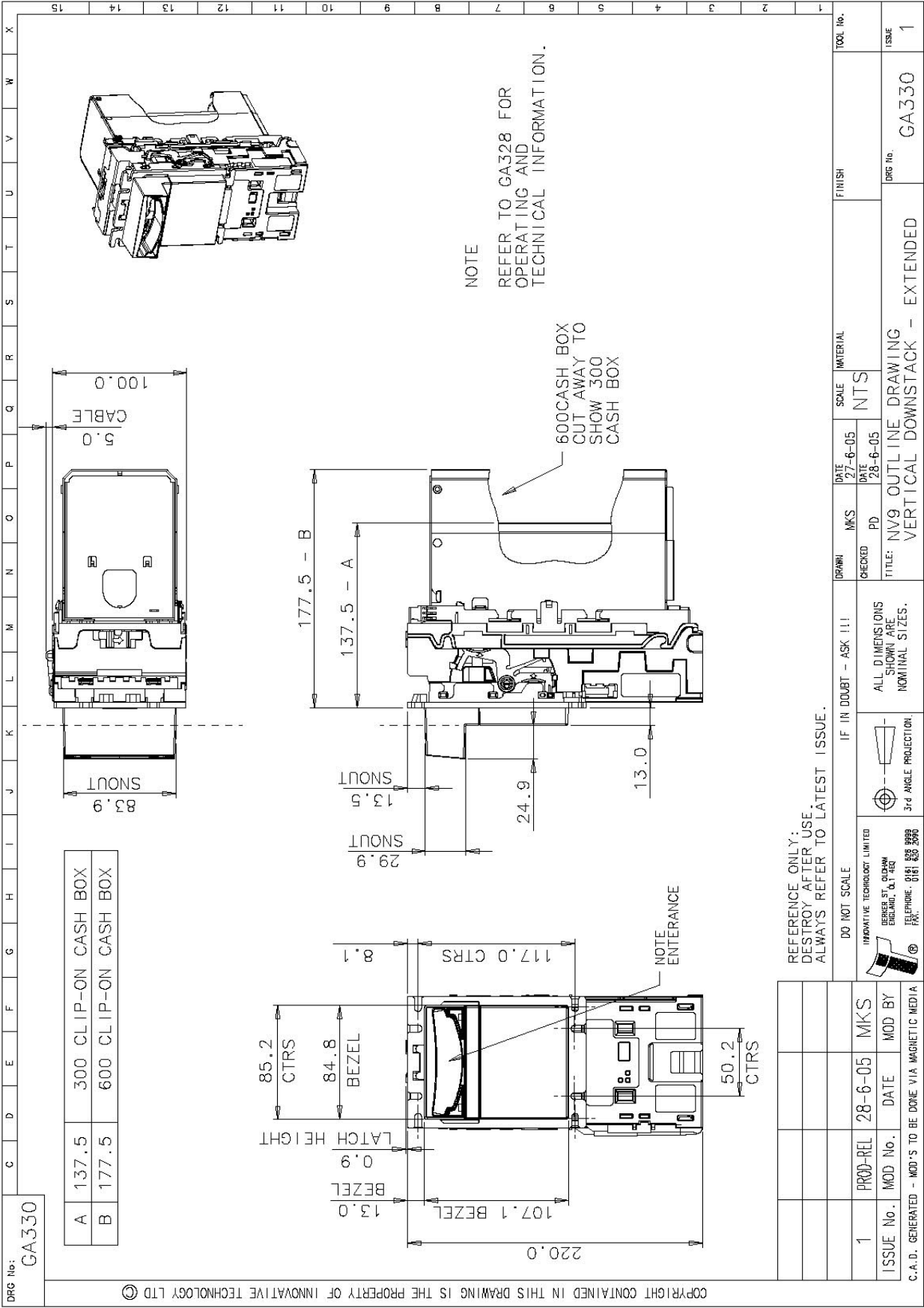


## **APPENDIX**

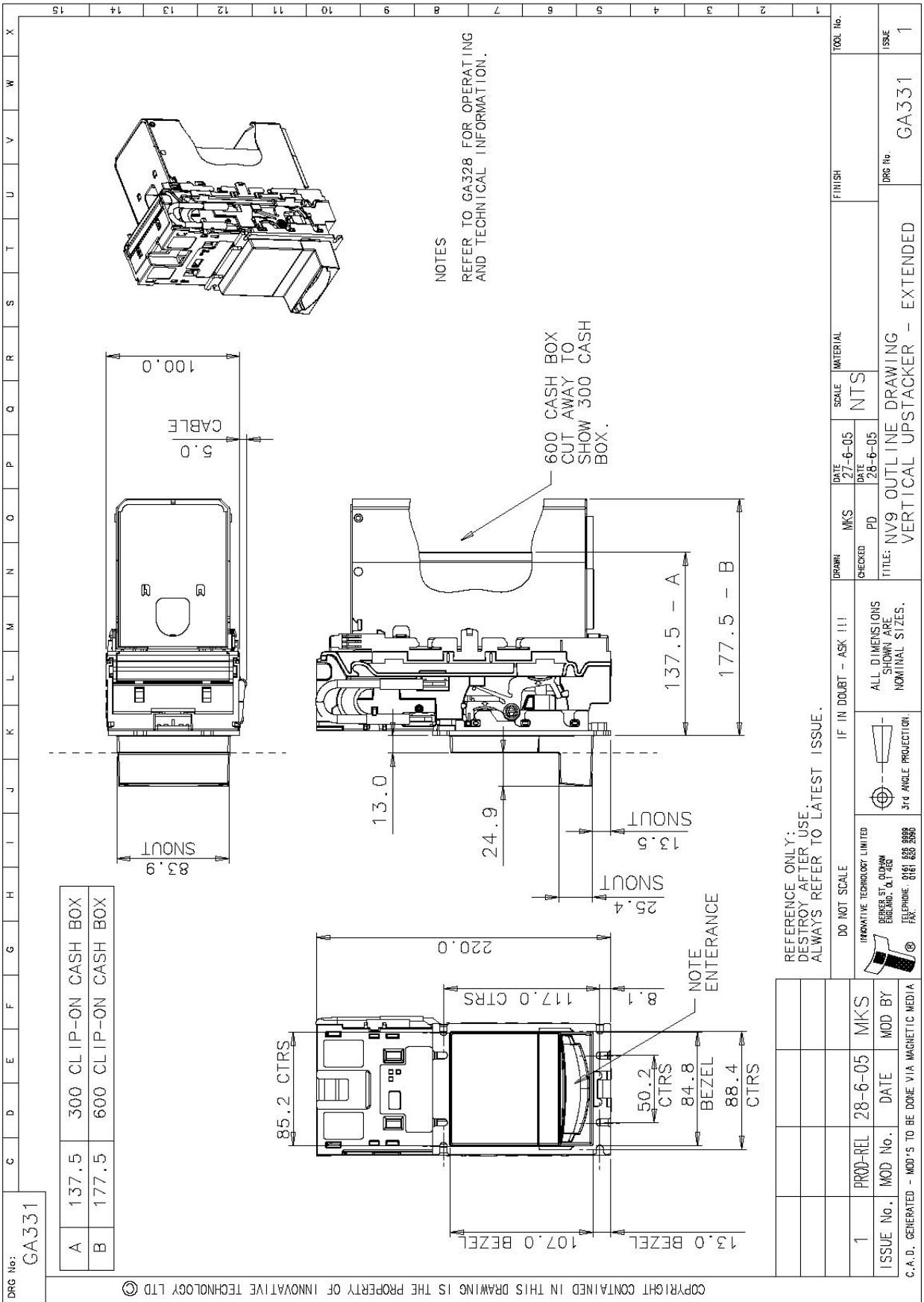
### **APPENDIX A - DRAWINGS**



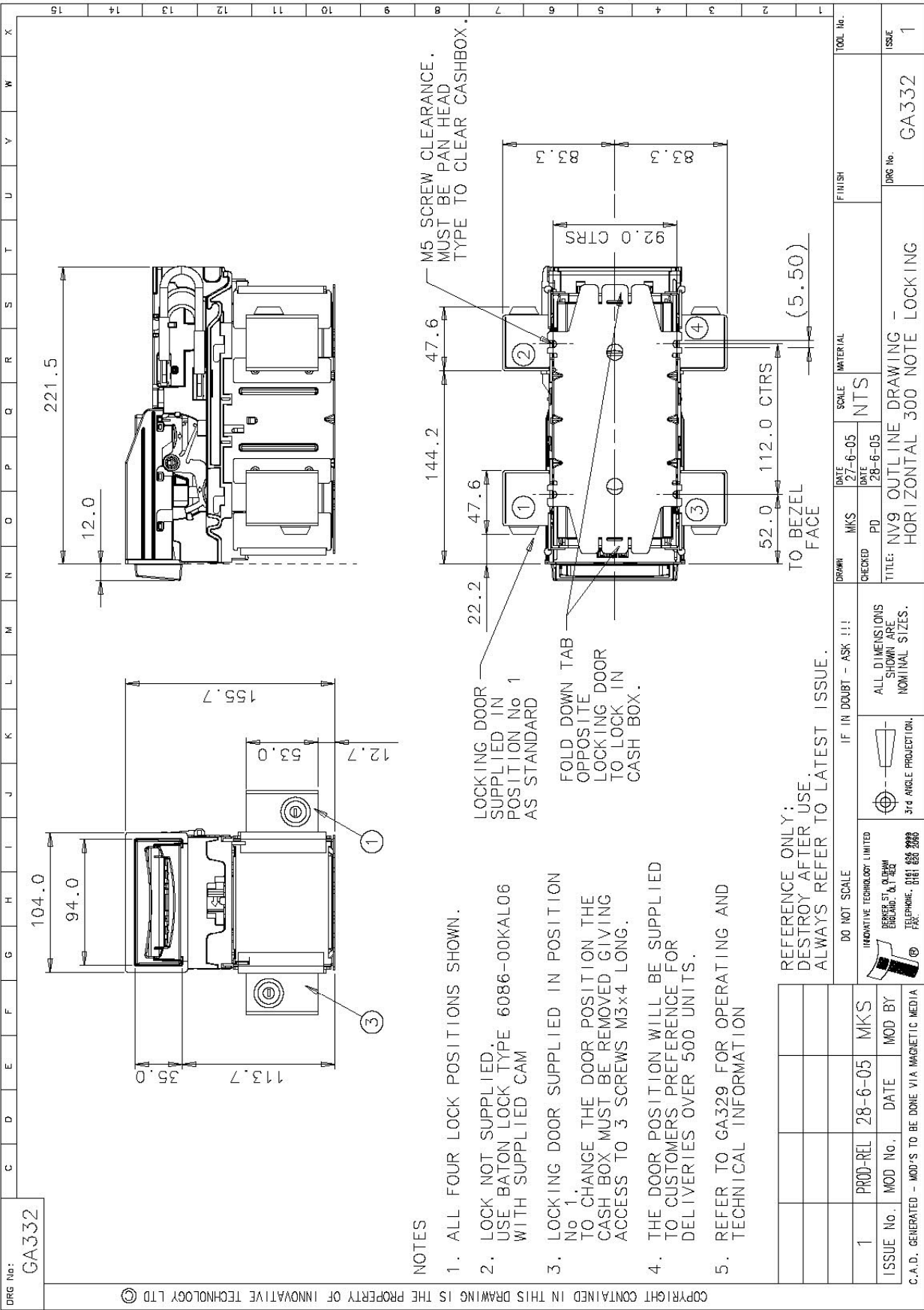












## APPENDIX B – ESCROW FUNCTION

The NV9 has a single note escrow facility (pin 10) used in Parallel, Pulse and Binary modes. 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).

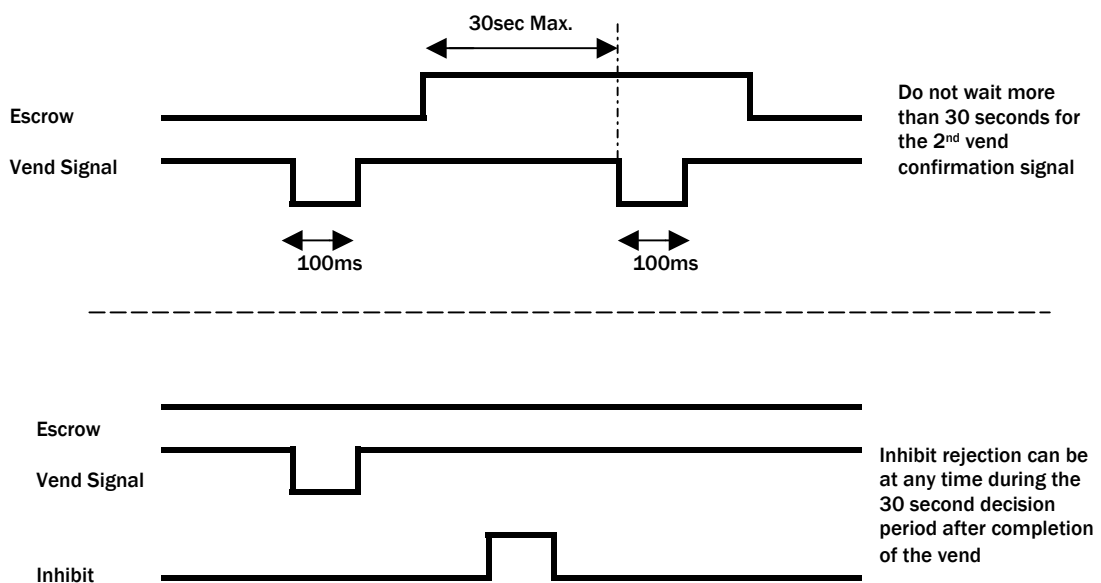


Figure 13 - Escrow Timing Diagram

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 C – 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.**

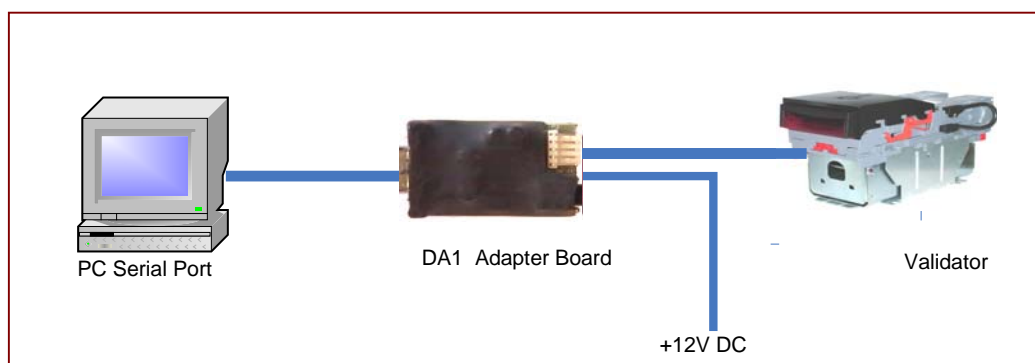
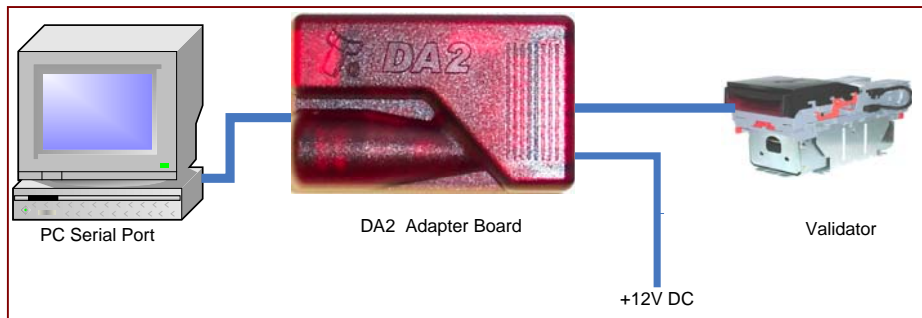


Figure 14 - Connecting DA1 to a NV9 and PC for upgrading

**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 15 - Connecting DA2 to a NV9 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.



**PA189**  
Horizontal Bezel Assembly



**PA191**  
Vertical Down Stack Extended  
Snout Bezel Assembly



**PA268**  
69mm Fixed Width Horizontal Bezel



**PA324**  
Vertical Up/Down Extended 66mm



**PA323**  
Vertical Up/Down Flat 69mm



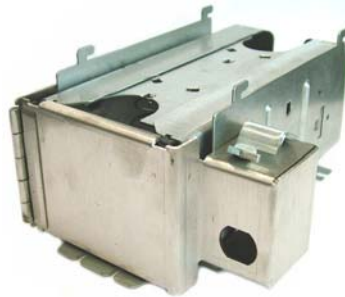
**PA256**  
66mm Vertical Up Bezel



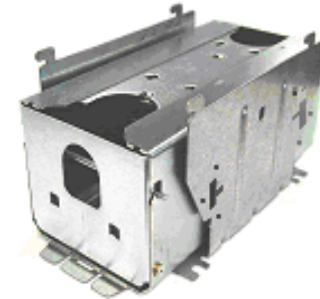
**PA190**  
Vertical Up Stack Extended  
Snout Bezel Assembly



**PA185**  
Clip on Cash Box Assembly (300C)



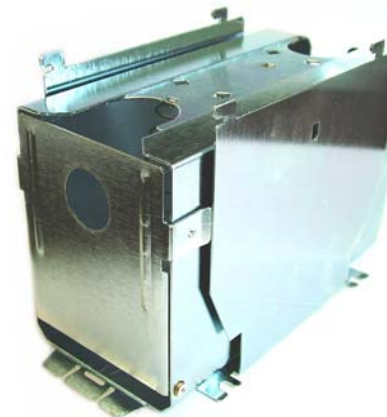
**PA186**  
Locking Cash Box Assembly (300L)



**PA192**  
Slide on Cash Box Assembly (300S)



**PA193**  
Clip on Cash Box Assembly (600C)



**PA194**  
Slide on Cash Box Assembly (600S)

## 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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| DRAWING NO                | AUTHOR                | DATE     | FORMAT       |
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