Innovative Technology

INTELLIGENCE IN VALIDATION

NV200 Spectral Range

GA02204

SSP Implementation Script

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Version: 1.1

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1 DOCUMENT INTRODUCTION

1.1 Contact Information

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1.2 Related Documents

This document should be read together with the following:

For SSP/eSSP:

GA00863 – SSP Protocol Manual

GA00973 – SSP Full Implementation Guide

GA02119 – User Manual NV200 Spectral Range

1.3 Manual Amendments

Rev.	Date	Amendment Details	Issued by
1.0	02/07/2021	First Issue	BO
1.1	15/10/2021	- Wording amendments - Layout amendments - Data Logging added - SSP Update added - Power Off handling added - Error Events packet examples added - Generic responses added - Poll routine amendments	BO

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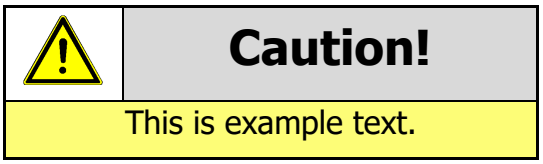

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Safety Notice! Read before using this product!

Safety Notice - Warning. Ensure power is removed before allowing access to the inside of this product. Ensure any static build up is discharged before allowing access to any part of this product or media contained. Always earth this product/base plate in accordance with the manual.

For use only in or with complete equipment where the acceptability of the combination is determined by UL LLC. When installed in an end-product, consideration must be given to the following:

- The power supply terminals and/or connectors are: Not investigated for field wiring
- The investigated Pollution Degree is: 2
- The following end-product enclosures are required: Mechanical, Fire

Sicherheitshinweis – Warnung: Es muss sichergestellt werden, dass das Gerät von der Versorgungsspannung getrennt wird, bevor ein Eingriff in das Innere des Gerätes erfolgt. Es muss sichergestellt werden, dass jegliche statische Aufladung des Gerätes entladen wird, bevor auf das Gerät oder auf innerhalb des Gerätes befindliche Objekte zugegriffen wird. Die Erdung des Gerätes muss immer gemäß Handbuch erfolgen.

Nur für die Verwendung in oder mit kompletter Ausstattung, dessen Eignung und Kombination von der UL LLC ermittelt wurde. Bei der Installation in einem Endproduckt, muss folgendes berücksichtigt werden:

- Die Spannungsversorgungsklemmen und/oder Verbinder sind: Feldverkabelung wurde nicht untersucht
- Der untersuchte Verschmutzungsgrad ist: 2
- Folgende Anforderungen an die Gehäuse des Endproduktes sind gefordert: Mechanisch, Feuer

Aviso de seguridad: Asegúrese de que la alimentación está desconectada y de que toda la energía estática es descargada antes de manipular este producto. Conecte a tierra la chapa base de la manera que se indica en el manual.

Solo para uso con dispositivos con los cuales la compatibilidad ha sido certificada por UL LLC. Tras su instalación en producto acabado, tener en cuenta lo siguiente:

- Los conectores y terminales de alimentación son: No se ha investigado/especificado cableado externo.
- El grado de contaminación determinado es: 2
- Los siguientes manuales/certificados de producto final son requeridos: Mecánico, Fuego

Avis de sécurité : Assurez-vous que l'alimentation est coupée et que toute l'énergie statique est déchargé avant de manipuler ce produit. Connecter à la terre, la plaque de base à la manière indiquée dans le manuel.

A utiliser Seulement avec les dispositifs dont la compatibilité a été certifiée par UL LLC. Après son installation dans le produit fini, prendre en considération ce qui suit:-

- Les connecteurs et les bornes d'alimentation sont : cela n'a pas été étudié/spécifié câblage externe.
- Le degré de contamination déterminé est: 2
- Les manuels suivants / les certificats du produit final sont nécessaires : mécanique, incendie

Bezpečnostní upozornění. Před manipulací uvnitř tohoto produktu se ujistěte, že je produkt odpojen od zdroje elektrického napětí. Ujistěte se, že jakýkoliv elektrostatický náboj byl vybit před manipulací s jakoukoliv částí tohoto produktu nebo obsaženým médiem. Vždy uzemněte tento produkt/základovou desku v souladu s návodem.

Pouze pro použití v nebo s kompletním vybavením, kde je přijatelnost kombinace určena UL LLC. Při instalaci v konečném produktu je třeba zvážit nasledující:

- Napájecí svorky a/nebo konektory: Nejsou sledované pro externí kabeláž
- Sledovaný stupeň znečištění je: 2
- Následující krytí konečného produktu jsou požadované: Mechanické, Protipožární

Caution!

Accessibility to children not evaluated. To be evaluated in end product application.

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2 GENERAL INTRODUCTION

2.1 Purpose of this Document

This document is intended to show the basic requisites for SSP Software integration for the NV200 Spectral Range. This manual cover basic SSP integration and generic error handling.

It is recommended to use this document before Host software release. This document should assist an Original Equipment Manufacturer (OEM) to reduce the development efforts and to minimise potential issues.

This document is intended as a guide only as the NV200S Spectral Range can be used in a variety of applications with different complexity. Any user of this document may need to edit and amend the SSP implementation procedure described in this document for their own purposes and full product release.

2.2 How to Use this Document

This NV200 Spectral Range SSP implementation script is divided into different categories as listed below:

- General instructions
- Pre-requisites
- Basic Software Integration
- Error Handling

	**Caution!**
This document is only valid for the NV200 Spectral Range and SSP interface	

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3 PRE-REQUISITES

3.1 Power Requirements

3.1.1 Supply Voltages

Supply Voltage	Minimum	Nominal	Maximum
Supply Voltage (V DC)	+ 10.8V DC /+ 21.6 V DC	+ 24 V DC	+ 26.4 V DC
Supply Ripple Voltage	0 V	0 V	0.25 V @ 100 Hz

The TEBS cashbox requires the unit is run at 24v (±10%).

3.1.2 Supply Currents

The supply current required to run the NV200 Spectral will vary during the phases of operation and the modules attached, see the tables below for 12vDC and 24vDC

NV200 Spectral Module Combination				Cashbox Type		12V DC		
NV200 Spectral	Spectral Payout	Bunch Note Feeder	Safe Interface	500, 1K, 2K2	TEBS	Standby (A)	Running (A)	Peak (A)
Y				y		0.25	2.00	3.00
					y	0.35	2.50	3.50
Y	Y			y		0.35	4.00	5.50
					y	0.45	4.00	5.50
Y		Y		y		0.35	2.50	4.00
					y	0.45	2.50	4.50
Y			Y	y		0.30	2.50	3.50
					y	0.40	3.50	4.50
Y	Y	Y		y		0.40	3.50	5.50
					y	0.50	4.50	5.50
Y		Y	Y	y		0.40	3.00	4.00
					y	0.50	4.00	5.50

NV200 Spectral Module Combination				Cashbox Type		24V DC		
NV200 Spectral	Spectral Payout	Bunch Note Feeder	Safe Interface	500, 1K, 2K2	TEBS	Standby (A)	Running (A)	Peak (A)
Y				y		0.15	2.00	3.50
					y	0.20	2.00	3.50
Y	Y			y		0.20	2.50	4.00
					y	0.25	2.50	4.00
Y		Y		y		0.20	2.00	4.00
					y	0.25	2.00	4.00
Y			Y	y		0.20	2.00	3.50
					y	0.25	2.00	3.50
Y	Y	Y		y		0.30	3.00	5.50
					y	0.35	3.00	5.50
Y		Y	Y	y		0.30	3.00	5.00
					y	0.35	3.00	5.00

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3.1.3 Power Supply Guidance

Check the power requirements of the host machine and other peripherals to dimension a suitable power environment for the machine setup.

The unit shall be supplied from a source specified as Electrical Energy Source Class 1 (ES1) to IEC/UL 62368-1, or specified as SELV according to IEC/UL 60950-1

TDK Lambda manufactures suitable power supplies. See table below for further details.

Power Supply Unit	Specification	RS Stock Code	Farnell Stock Code	Suitable for use with
TDK Lambda RWS-100B-24	+24 V DC / 4.5 A	813-9092	2443999	NV200 Spectral Standalone
TDK Lambda RWS-150B-24	+24 V DC / 6.3 A	813-9103	2444003	NV200 Spectral with TEBS **or** Spectral Payout Module
TDK Lambda RWS-300B-24	+24 V DC / 12.5A	813-9128	2419997	NV200 Spectral with TEBS **and** Payout

Caution!

Lower Voltage and Current supplies will cause issues in the device performance!

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3.1.4 Earth Bonding

It is very important that the NV00 Spectral is properly bonded to earth, using one of the earth tabs. Lack of proper bonding can cause communication issues and other failures.

Earthing on the standard chassis can be affixed to the lower screw mounting points at the side of the unit:

The TEBS cashbox has earthing points at the back of the chassis as shown below. The plating on the chassis must be broken to create a proper earthing point on the chassis, it is recommended to use a cutting screw but and tool that can cut away the plating will suffice.

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The resistance between the base plate and the Earth pin on the mains plug should be less than 0.7 ohms.

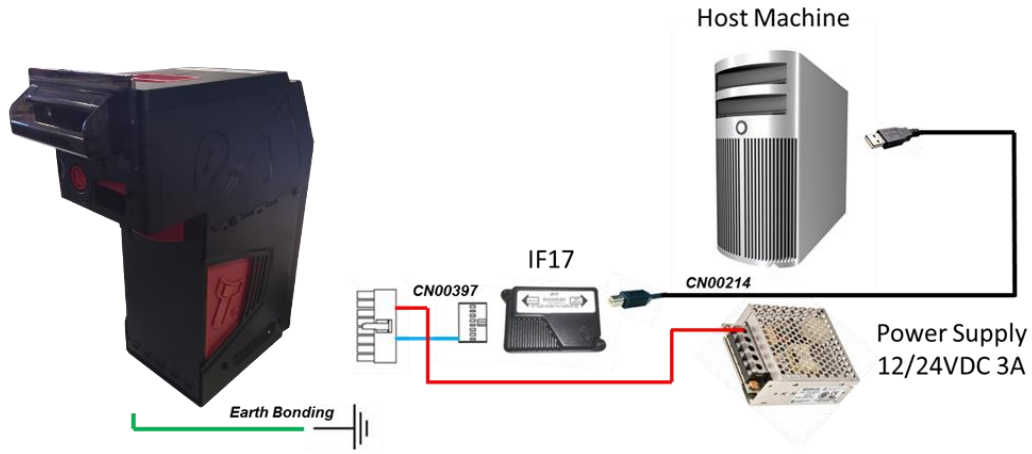
	Caution!
	Lack of proper earth bonding causes failures!

3.2 Interface Logic Levels

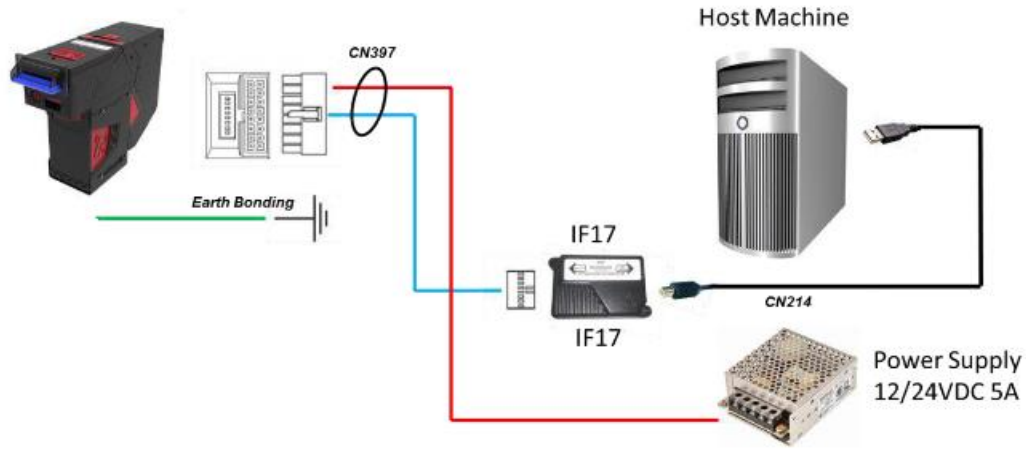
Interface Logic Levels	Logic Low	Logic High
Inputs	0V to +0.5V	3.7V min = High internal pullup
Outputs with 2K2Ω pull-up resistor	+0.6V	Pull-up voltage of host interface
Maximum Current Sink	50mA per Output	

3.3 Hardware Setup

3.3.1 NV200 Spectral with Docking Plate



3.3.2 Spectral Payout



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4 BASIC SOFTWARE INTEGRATION

4.1 Overview of SSP

The SSP protocol is a serial communication protocol designed to enable interconnection of various types of cash handling and coin validation equipment. It is highly recommended to use encrypted commands (eSSP) to provide the highest level of security. For some SSP Commands, Encryption is MANDATORY. These commands will be marked accordingly in this document. For more information regarding the eSSP protocol please contact support@innovative-technology.com

Communication between a NV200 Spectral and host machine is bi-directional, in a master-slave format. The master is the host machine, and the slave is the NV200 Spectral. Packets of data are sent between the devices, with the data bytes in hexadecimal format.

ITL SSP devices use a system of protocol levels to control the event responses to polls. This ensures that any changes to command responses will not affect a host machine until those changes have been implemented in that host machine software. Packet examples in this document will show the responses for protocol versions greater than 6 only. If you are using a protocol version lower than 6 then the responses may be different. It is recommended to update your software to handle the latest SSP protocol version.

4.1.1 Ports and Addresses

Each device using the SSP protocol has a pre-programmed address; used by the host machine to communicate with each device. The device will only respond to commands addressed to it and will echo its address in the response packet. This allows the host machine to know which device sent the packet.

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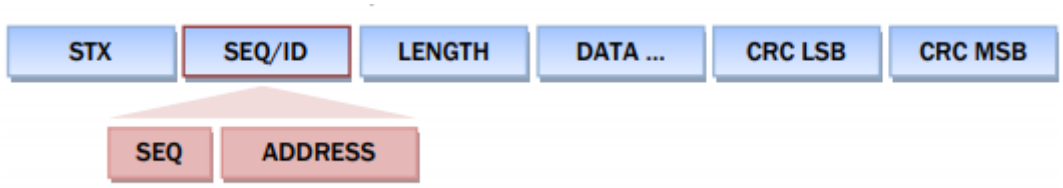
4.1.2 Packet Structure

SSP packets are constructed using a sequence of bytes where each position in the sequence of bytes represents a field, as shown below:



4.1.2.1 STX

The STX is a single byte indicating the start of a packet, defined as 0x7F. If **any** other part of the packet contains 0x7F, the last step before transmission of the packet should be to repeat that byte (0x7F becomes 0x7F 0x7F). This is called byte stuffing.

	Caution!
	Byte stuffing is used to encode any STX bytes that are included in the data to be transmitted. If 0x7F (STX) appears in the data to be transmitted then it should be replaced by 0x7F, 0x7F. Byte stuffing is done after the CRC is calculated, the CRC itself can be byte stuffed. The maximum length of data is 0xFF bytes

4.1.2.2 SEQ/ID

This byte is a combination of two items of data: The sequence flag (MSB, bit7) and the address of the device (bit 6 to bit 0, LSB).

Each time the master (host machine) sends a new packet to the slave (NV200 Spectral) it alternates the sequence flag. If the slave receives a packet with the same sequence flag as the last packet it will not execute the command but will simply repeat its last reply. In a reply packet from the slave device, the address and sequence flag match the command packet.

4.1.2.3 Length

The number of bytes of data in the data field, including the command and all associated data. It does not include the STX, SEQ/ID or CRC fields

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4.1.2.4 Data

The commands and/or data being sent in the packet.

4.1.2.5 CRC

The final two bytes are used for the Cyclic Redundancy Check (CRC). This is provided to detect errors during packet transmission. The CRC is calculated using a forward CRC-16 algorithm with the polynomial (X16 + X15 + X2 + 1). It is calculated on all bytes except the STX and initialised using the seed 0xFFFF. The CRC is calculated **before** byte stuffing.

4.1.3 Polling the Device

The Poll command (0x07) is critical to the operation of the NV200 Spectral. It is vital that all Poll commands (and associated responses) are handled correctly. Events such as credits (where the device has accepted and stored currency) will be passed across as a poll response.

The recommended poll command is the Poll with Ack command (0x56), which behaves in the same way as the Poll command (0x07). Some events will need to be acknowledged by the host with the Poll with Ack command. If this is the case, the response will not change until the event ack command (0x57) has been sent.

4.1.4 Packet Intervals

It is important to allow an interval between transmission of packets, this is to allow the NV200 Spectral to receive the packet correctly and format a response.

For the NV200 Spectral, ITL recommend sending a packet once the previous packet has been handled. But do not exceed a maximum pause of 1000ms for the next packet or poll to be sent**.**

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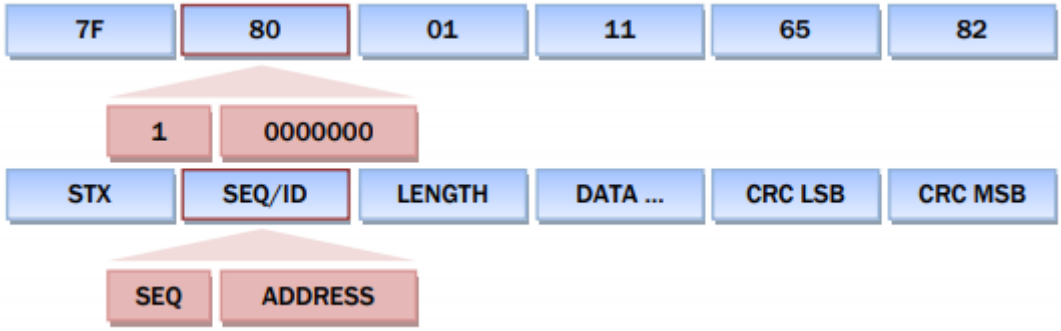
4.1.5 Packet Example

The format of an unencrypted sync command (0x11) to a NV200 Spectral located on address 0 would be constructed as follows:



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4.1.6 Encryption

Encryption is mandatory for all payout devices and optional for pay in devices. Innovative Technology LTD. recommends that encryption is used in all applications where it is within the capability of the host to perform the encryption and decryption. SSP with encryption is referred to as eSSP. The encryption algorithm used in eSSP is a standard encryption method used worldwide in software for data storage and transmission called Advanced Encryption Standard (AES). eSSP implements AES with a 128-bit key. Data is encrypted in blocks of 16 bytes, any unused bytes in a block should be packed with random bytes. The encryption key is 128 bits long, divided into two parts. The lower 64 bits are fixed and specified by the machine manufacturer, this allows the manufacturer control which devices are used in their machines. The default for this part is "01 23 45 67 01 23 45 67" (hex bytes). The higher 64 bits are securely negotiated by the slave and host at power up, this ensures each machine and each session are using different keys. The key is negotiated by the Diffie-Hellman key exchange method. For further information, contact support@innovative-technology.com

4.1.6.1 eSSP Packet Structure

The encryption packet is wrapped inside the data field of a standard SSP packet. The encrypted section is constructed from the fields as shown below.

4.1.6.1.1 eSTX

Single byte indicating the start of encrypted message; defined 0x7E. This byte is not encrypted

4.1.6.1.2 eLENGTH

The number of bytes of data in the data field (including the command and all associated data). It does not include any other fields.

4.1.6.1.3 eCOUNT

A 4-byte unsigned integer representing the sequence count of encrypted packages. The packets are sequenced using this count; this is reset to 0 after a power cycle and each time the encryption keys are successfully negotiated. The count is incremented by the host and device each time they successfully encrypt and transmit a packet and each time a received packet is successfully decrypted. After a packet is successfully decrypted the COUNT in the packet should be compared with the internal COUNT, if they do not match then the packet is discarded.

4.1.6.1.4 eDATA

The command and/or data to be sent in the packet.

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4.1.6.1.5 ePACKING

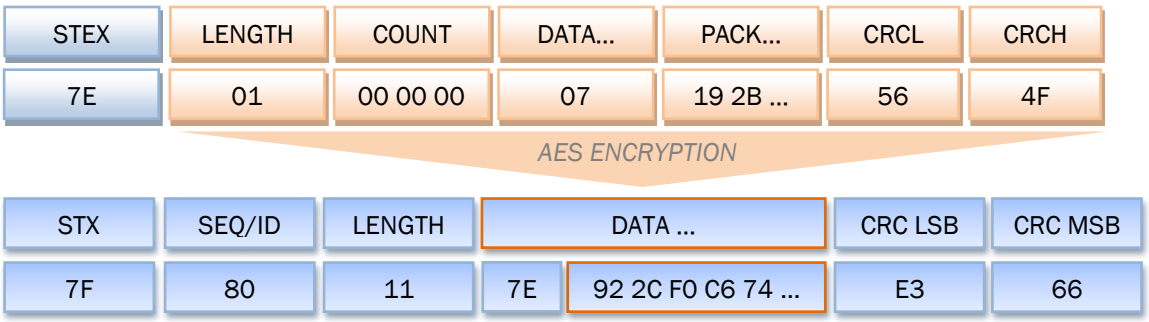
Random data to make the number of bytes usd in the fields LENGTH + COUNT + PACKING + CRCL + CRCH a multiple of 16 bytes. This is required for the AES algorithm.

4.1.6.1.6 eCRC

As in the SSP packet, low and high byte of a forward CRC-16 algorithm using the Polynomial (X16 + X15 + X2 + 1) calculated on all bytes except STEX. It is initialised using the seed 0xFFFF.

4.1.6.2 eSSP Packet Example

The final result of the encrypted section is then used in the data field of standard SSP packet as shown in figure 3.4 with an example of a POLL command (0x07).



4.1.6.3 Encryption Algorithm

The encryption algorithm used in eSSP is a standard encryption method used worldwide in software for data storage and transmission called Advanced Encryption Standard (AES). eSSP implements AES with a 128-bit key. Data is encrypted in blocks of 16 bytes, any unused bytes in a block should be packed with random bytes (ePACKING).

4.1.6.4 Key Negotiation

The key management is a big problem as it causes issues for manufacturers and operators servicing machines. The initial encryption keys must be set in each host and the peripherals. And then the key must be kept secret. This causes problems replacing parts in the machine without exposing the key. eSSP uses the Diffie-Hellman key exchange method. This is a secure method for both devices to agree a key, but the key is never transmitted. Refer to the Key Exchange flowchart for full key negotiation process.

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4.1.7 Polling the Device

The request status command and associated responses is critical to the operation of the NV200 Spectral. It is vital that all polls are handled correctly. Events such as credits (where the device has accepted and stored currency) will be passed across as a poll response.

Please observe the polling restrictions:

- A new poll can be sent once the previous operation is processed
- The maximum pause between two polls should be 1000ms

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4.1.8 Generic Response

The device will respond to all commands with the first data byte as one of the generic Events listed below.

Event	Code	Description
OK	0XF0	Returned when a command from the host is understood and has been, or is in the process of, being executed.
Slave Reset	0XF1	Returned after a reset command has been sent or a power off.
Command Not known	0XF2	Returned when an invalid command is received by a peripheral.
Wrong Number Of Parameters	0XF3	A command was received by a peripheral, but an incorrect number of parameters were received.
Parameter Out Of range	0XF4	One of the parameters sent with a command is out of range.
Command Cannot Be Processed	0XF5	A command sent could not be processed at that time. E.g. sending a dispense command before the last dispense operation has completed.
Software Error	0XF6	Reported for errors in the execution of software e.g. Divide by zero. This may also be reported if there is a problem resulting from a failed remote firmware upgrade, in this case the firmware upgrade should be redone.
Fail	0XF8	Command failure
Key Not Set	0XFA	The slave is in encrypted communication mode but the encryption keys have not been negotiated.

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4.2 Setup the NV200 Spectral

4.2.1 Establish Communication

The master device must send a Sync command (0x11) to check the correct operation of communication and to confirm the presence in the bus of a device. It also synchronises the SEQ bit between the host and the NV200 Spectral to allow correct communication.

If no reply is received to the request sent, it will indicate that the device is faulty or not connected. All the SSP peripherals must respond to a Sync, regardless of the SSP communication protocol level that has been implemented.

Host Command	Device Response
Sync (0x11) 7F 80 01 **11** 65 82	**OK (0xF0)** 7F 80 01 **F0** 23 80

4.2.2 Set Protocol Version

The Host Protocol Version command (0x06) is used to tell the NV200 Spectral which protocol level the host machine wants to use, the data byte after the command defines the level. The possible responses are below:

Host Command	Device Response
Host Protocol Version (0x11), setting the protocol version to 8. 7F 80 02 **06 08** 03 94	NV200 Spectral can use version 8, so responds OK (0xF0) 7F 80 01 **F0** 23 80
Host Protocol Version (0x11) setting the protocol version to 9 7F 80 02 **06 09** 06 14	NV200 Spectral cannot use version 9, so responds FAIL (0xF8) 7F 80 01 **F8** 10 00

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4.2.3 Setup Request

The next command to be sent is the Setup Request command (0x05).
The setup request provides information relating to the current configuration of the NV200 Spectral, the information below is provided in the response:

Data	Byte Offset	Size (Bytes)	Notes
Unit Type	0	1	0x06 = Spectral Payout
Firmware Version	1	4	ASCII data of the device firmware versión (e.g. 0110 = 1.10)
Country Code	5	3	ASCII code of the device dataset (e.g. 45 55 52 = EUR)
Value Multiplier	8	3	The value to multiply the individual channel values by, to get the full value. If this value is zero then it indicates that the NV200 Spectral is using a protocol version 6 or greater dataset, where the full values are given in the expanded segment of the return data
Number of Channels	11	1	The highest channel used in this dataset. e.g. If the dataset has 4 note denominations in it, the value given here will be 4.
Channel Values	12	n	A variable size array of bytes, 1 byte per channel in the dataset. When this number is multiplied by the Value Multiplier it will give the full value for each channel. If the Value multiplier is zero then these values will be zero.
Channel Security	12 + n	n	An obsolete value showing the security level. This is set to 2 if the Value Multiplier is > 0, otherwise it shows 0
Real Value Multiplier	12 + (n * 2)	3	The value by which the channel values can be multiplied to show their full value. e.g. 5.00 EUR = 500 cents
Protocol Version	15 + (n * 2)	1	The current protocol version set on the device
Expanded channel country code	16 + (n * 2)	n * 3	Three-byte ASCII country code for each channel. This allows multi-currency datasets to be supported in SSP. These bytes are only given on protocol versions >=6
Expanded channel value	16 + (n * 5)	n * 4	4 bytes for each channel value. These bytes are given only on protocol versions >= 6.

Host Command	Device Response
Setup Request (0x05) 7F 00 01 **05** 1E 08	**OK (0xF0) – followed by data bytes outlined in table above.** 7F 00 35 **F0 06 30 34 35 33 47 42 50 00 00 01 04 05 0A 14 32 02 02 02 02 00 00 64 07 47 42 50 47 42 50 47 42 50 47 42 50 05 00 00 00 0A 00 00 00 14 00 00 00 32 00 00 00** 05 40

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4.2.4 Set Note Routing

**** Encryption Mandatory.**

When using the Spectral Payout you need to tell the device where to store each denomination. This can either be the payout module (if you want to recycle this note and make it available for payout), or to the cashbox (notes stored in the cashbox cannot be paid back to customers). The command to configure this routing is Set Denomination Route (0x3B). This command is volatile, when the Spectral Payout is reset the channels will all have their route set to cashbox as default.

This command must be sent for each denomination in the dataset.

Data	Byte Offset	Size (Bytes)	Notes
Requested Route	0	1	0 = route for payout, 1 = route to cashbox
Denomination value	1	4	Value of requested denomination to route (4 byte integer)
Country Code	5	3	ASCII code of the denomination (e.g. 45 55 52 = EUR)

Packet example below:

Host Command	Device Response
Set Denomination Route (0x3B) 7F 00 09 **3B 00 F4 01 00 00 47 42 50** F3 98	**OK (0xF0)** 7F 00 01 **F0** 20 0A

If the Spectral Payout cannot process the command it will respond with COMMAND CANNOT BE PROCESSED (0XF5) and an error byte giving the failure reason:

Data	Error
1	No payout connected
2	Invalid Currency Detected
3	Payout module failure

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4.2.5 Set Inhibits

This command sets the channel inhibit level for the device. Each byte sent represents 8 bits (channels of inhibit).

Packet example below:

Host Command	Device Response
Set Inhibits (0x02) 7F 00 03 **02 07 00** 2B B6	**OK (0xF0)** 7F 00 01 **F0** 23 80

4.2.6 Get All Levels

Use this command to return all the stored levels of denominations in the device (including those at zero level).

Host Command	Device Response
Get All Levels (0x22) 7F 80 01 **22** CF 82	**OK (0xF0)) – followed by the stored levels of denomination.** 7F 00 01 **F0 04 64 00 14 00 00 00 45 55 52 41 00 32 00 00 00 45 55 52 00 00 64 00 00 00 45 55 52 0C 00 C8 00 00 00 45 55 52** 84 D0

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4.3 Enable the NV200 Spectral

When the device setup is complete, the NV200 Spectral must be enabled before notes can be inserted. These commands effectively "turn on" the device so it can begin normal operation. For the Spectral Payout you must send two different Enable commands; Enable (0x0A) will enable the validator, Enable Payout Device (0x5C) will enable the payout module (this is only necessary when you want to pay out notes, you can still store notes in the payout without enabling the payout module).

****Encryption Mandatory for the Enable Payout Device Command****

Host Command	Device Response
Enable (0x0A) 7F 80 01 **0A** 3F 82	**OK (0xF0)** 7F 80 01 **F0** 23 80
Enable Payout Device (0x5C) 7F 00 02 **5C 00** 0A C8	**OK (0xF0)** 7F 00 01 **F0** 20 0A

Enable Payout Device (0x5C) has one data byte. Set to 0 to immediately enable the validator, set to 1 will make the Spectral Payout perform a start-up procedure to check that everything is operational as expected. It will return BUSY to poll commands while it is completing this procedure.

If the Spectral Payout fails to enable, it will respond with COMMAND CANNOT BE PROCESSED (0XF5) and an error byte giving the failure reason:

Data	Error
1	No payout connected
2	Invalid Currency Detected
3	Busy
4	Empty Only (NV11 only – Spectral Payout will not send this error)
5	Device Error

4.3.1 Polling of the Device

When the validator is enabled, the host machine should send Poll commands (0x07) every 200ms to the validator. This provides two functions:

1) The validator will remain enabled while it is receiving POLL commands. If the validator does not receive a Poll within the poll timeout (10 seconds) it will timeout and the validator will disable.
2) The validator responds to Poll commands with every event that has occurred since the last poll. It is therefore important to poll regularly to avoid missing credit events etc.

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4.3.2 Note Pay-In

The NV200 Spectral bezel will illuminate when the validator is enabled. At this point, banknotes can be inserted into the validator.

Proceed to pay-in notes

The host machine must poll the Spectral Payout on a regular basis. When the notes are inserted into the bezel, the note path mechanism will start to move the note into the validator.

The flow of the poll responses when a note is inserted will be as follows:

Action	Poll Response
Note Inserted	**0xEF (Read)** *Data byte = 0* *Note is being read/validated.*
Note Validated	**0xEF (Read)** *Data byte = x* *Note has been validated. X = channel value of the note that has been detected.*

When the note has been validated and the channel number reported as above, the note is held in the Escrow position.

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The next command that the validator receives will determine how it processes the note:

Host Command	Device Response
Poll (0x07) Accept the note.	**0xFO (OK)** *Validator accepts the note and begins stacking it in the cashbox or storing it in the payout.* **0xF0 (OK) 0xCC (Stacking)** *Note is in the process of being stacked/stored* **0xF0 (OK) 0xEE (Credit)** *Note has reached a position where it cannot be returned to the customer, credit can be given on the host machine.* **0xF0 (OK) 0xEB (Stacked)** *Note is stacked in the cashbox* ***Or*** **0xFO (OK) 0xDB (Note Stored in Payout)** *Note is stored in the Spectral Payout module*
Hold (0x18) Hold the note. This command must be sent again within 5 seconds to keep holding the note, otherwise the escrow will timeout and the note will be returned to the customer.	**0xFO (OK)** *Note is held in the escrow position for a further 5 seconds.*
Reject (0x08) Reject the note.	**0xF0 (OK)** *Note will be rejected and returned to the customer.* *Keep polling the device and watch for the Rejecting (0xED) and Rejected (0xEC) events to follow the progress of the note as it is rejected.*

To know which note denominations have been accepted, send the Get All Levels command (0x22). This should only be sent when the Pay-In has finished (Poll commands return OK only)
This command returns the stored levels of each denomination in the dataset, even if the level is zero.

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4.3.3 Note Pay-Out

**** Encryption Mandatory**

Payout Amount simply requests the Spectral Payout to pay an amount; the Spectral Payout then decides which notes to use to complete the transaction. It uses an intelligent algorithm to best maintain a level of notes and avoid the need for excessive refilling. It is recommended to use this command unless you have a specific requirement to manage the note levels or notes dispensed.

4.3.3.1 Enable device for note pay-out operations

The Spectral Payout module must be enabled before it will accept a command to pay-out.
The Enable Payout Device (0x5C) command is used to enable the device.

Host Command	Device Response
Enable Payout Device (0x5C) 7F 00 02 **5C 00** 0A C8	**OK (0xF0)** 7F 00 01 **F0** 20 0A

If the Spectral Payout cannot enable it will respond with COMMAND CANNOT BE PROCESSED (0xF5) and an error byte giving the failure reason. See Section 4.3 for further information.

4.3.3.2 Payout Amount

The Payout Amount command (0x33) allows the Validator to decide which notes to pay-out based on options set within the device. The data in the packet is as follows:

Data	Byte Offset	Size (Bytes)	Notes
Payout Value	0	4	4 byte integer of the full penny amount. (e.g. 5€ = 500)
Country Code	4	3	ASCII code of the currency (e.g. 45 55 52 = EUR)
Option Byte	7	1	Send 0x19 to test payout amount (validator will reply whether it is possible to complete the request or not. It will not pay out the notes.). Send 0x58 to payout the amount requested (the validator will pay out the notes if it is possible to do so, otherwise it will respond with an error)

If the requested amount cannot be paid out, the Spectral Payout will respond with COMMAND CANNOT BE PROCESSED (0XF5) and an error byte giving the failure reason:

Data	Error
1	Not enough value in device
2	Cannot pay exact amount
3	Busy
4	Device Disabled

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Packet example of a Payout Amount command:

Host Command	Device Response
Payout Amount (0x33): 7F 80 09 **33 F4 01 00 00 45 55 52 58** C3 EE *Request to pay-out 5€.*	**OK (0xF0)** 7F 80 01 **F0** 23 80
Poll (0x07): 7F 80 01 **07** 12 02	*Keep polling the device after the Spectral Payout has responded OK to the pay-out request.* *The Spectral Payout will send Dispensing (0xDA) and Dispensed (0xD2) events in response to Polls, so you can track the progress of the pay-out request.*

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4.4 Refill

It is important to ensure that the Spectral Payout has enough notes stored to complete customer transactions. Routing notes the Spectral Payout as discussed previously is recommended to ensure that these levels are maintained. However, it is also possible to refill the Spectral Payout if notes are running low (or for example to refill the Payout module at the start of a day if it has been emptied the previous night).

To do this, you should implement a refill mode in your software. This mode should enable the validator to accept notes but should not credit the value as if it were a customer. It should also get the current level of notes in the Spectral Payout so that the person knows how many notes to refill.

When inserting notes into the validator, a fitness test is performed meaning that any notes that are poor quality will be sent to the cashbox instead of the Payout module. This is to reduce the probability of a jam in the Payout module caused by a poor-quality note. It is possible to enable Refill mode on the Spectral Payout, which will return these poor-quality notes to the person refilling the Payout rather than stacking them in the cashbox.

To do this send the Set Refill Mode command (0x30) as follows:

Host Command	Device Response
Set Refill Mode (0x30) 7F 80 06 **30 05 81 10 11 01** 52 F5 *This turns refill mode **on**.*	**OK (0xF0)** 7F 80 01 **F0** 23 80
Set Refill Mode (0x30) 7F 80 06 **30 05 81 10 11 00** 57 75 *This turns refill mode **off.***	**OK (0xF0)** 7F 80 01 **F0** 23 80
Set Refill Mode (0x30) 7F 80 05 **30 05 81 10 01** 94 EE *This checks if Refill Mode is on or off.*	**OK (0xF0) + 1 data byte (0x00 = Off, 0x01 = On)** 7F 80 02 **F0 01** 3A 20

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4.5 Collection

****Encryption Mandatory**

Float by Denomination allows you to specify the number of each denomination to be stored in the payout module, any excess notes of each denomination will be sent from the payout module to the cashbox.

Float By Deonimation

The Float By Denomination command has a number of parameters, shown in the table below:

Data	Byte Offset	Size (Bytes)	Notes
Individual Requests	0	1	The number of individual requests in this command
Number To Be Left In The Device	1	2	The number to remain in the payout
Denomination Value	3	4	4 byte integer of the full penny amount. (e.g. 5€ = 500)
Country Code	7	3	ASCII country code of the denomination to be paid out.
Repeat For Each Denomination			
Option Byte	Last	1	Send 0x19 to test the float request (notes not paid). Send 0x58 to float the amount requested

For request failure, the device responds with COMMAND CANNOT BE PROCESSED and a data byte showing the error code.

Data	Error
1	Not enough value in device
2	Cannot pay exact amount
3	Busy
4	Device Disabled

Packet example of a Float By Denomination command below

Host Command	Device Response
Float Amount (0x3D) 7F 00 0D 3D **44 01 04 00 F4 01 00 00 45 55 52 58** 33 54	**OK (0xF0)** 7F 00 01 **F0** 20 0A

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4.6 Empty

** Encryption Mandatory

We recommend using the Smart Empty command (0x52) as it will provide a summary of the notes that were moved to the cashbox during the empty operation.

During this procedure, all notes from the Spectral Payout are moved to the cashbox. After sending the Smart Empty command, send Poll commands to follow the progress of the Smart Empty operation

Host Command	Device Response
Smart Empty (0x52) 7F 80 01 **52** EC 03	**OK (0xF0)** 7F 80 01 **F0** 23 80
Poll (0x07) 7F 80 01 **07** 12 02	Smart Emptying (0xB4) 7F 80 0B **F0 B3 01 F4 01 00 00 47 42 50 E8** 49 A8 *Gives the value emptied so far.* *Repeated until the device gives the Smart Emptied response.*
Poll (0x07) 7F 80 01 **07** 12 02	Smart Emptied (0xB4) 7F 00 0B **F0 B4 01 E8 03 00 00 47 42 50 E8** CC 0A *Give the values emptied to cashbox after the Smart Empty operation has completed.*

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4.7 Cashbox Operation Data

After any Smart Empty, Float or Dispense command the Cashbox Payout Operation Data command (0x53) can be sent. This command returns the amount sent to cashbox during the last Dispense, Float or Smart Empty command. The response packet format is shown below:

Data	Byte Offset	Size (Bytes)	Notes
Generic OK	0	1	OK (0xF0)
Number of Denominations	1	1	Number of denominations in the report.
Denomination Quantity	2	2	The number of notes of that denomination in the report. For example, if 10 x £5 notes were floated, the number here would be 10.
Denomination Value	4	4	The value of the denomination in the report. For example, if 10 x £5 notes were floated, the value here would be 50.
Country Code	8	3	ASCII Country Code
Repeat	11	X	Repeat above blocks for each denomination in the report
Unknown Notes	11 + X	4	The number of notes sent to cashbox that the hopper could not identify

Check for unhandled events

It is essential to send a Poll command before any pay-in/pay-out operation. If the reply is different to "OK", it is highly recommended study the response or wait until the current operation is completed.

Host Command	Device Response
Poll (0x07) 7F 80 01 **07** 12 02	**OK (0xF0)** 7F 80 01 **F0** 23 80

Sending commands while dispensing/floating/emptying

Dispensing, floating and emptying are crucial operations. Do not send other commands (except for POLL) during these operations in order to avoid changing the priority of command processing.

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4.8 Data Logging

The implementation of packet logs is recommended. Seeing what is being sent /received from the Validator will aid in any trouble shooting that may be required.

The Commands should be shown unencrypted in the log so trouble shooting is possible.

Required fields:

- Unencrypted Transit Data
- Unencrypted Receive Data
- Time (both Transmit and Receive)

Desirable field:

- Com Port
- Command/Response

Having a well presented log will aid in Trouble shooting, the layout below is recommended.

12:48:56.021 COM8 => 7F 10 01 0A 7F 89 | Enable
12:48:56.043 COM8 <= 7F 10 01 F0 63 8B | OK

12:48:56.221 COM8 => 7F 90 01 07 51 83 | Poll
12:48:56.243 COM8 <= 7F 90 01 F0 60 01 | OK

Encrypted commands/responses should be shown in both an encrypted and unencrypted format, the log below is our preferred format.

12:51:30.304 COM8 => 7F 10 11 7E 08 20 00 00 00 3C 0A 00 00 00 47 42 50 07 8C 38 DA 87 | Encrypted | Get Denomination Route

12:51:30.304 COM8 => 7F 10 08 3C 0A 00 00 00 47 42 50 1F FE | Unencrypted | Get Denomination Route

12:51:30.324 COM8 <= 7F 10 11 7E 01 21 00 00 00 F0 DD E7 C9 7C 85 EE C9 74 38 24 B2 50 | Encrypted | OK

12:51:30.324 COM8 <= 7F 10 02 F0 00 06 60 | Unencrypted | OK

Saving the file indexed by YY-MM-DD will aid in organisation, files can be over written and only need extracting if errors are seen, we would recommend a 7 Day cycle (6 files, 1 being written).

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4.9 SSP Download

The implementation of the SSP update process is recommended. Network connected cabinets and applications communicating in SSP should have the functionality to update the devices attached through the application software.

WARNING!

This is a complex operation and failure to implement correctly may damage units. Please exercise extreme caution when writing firmware to the device.

A firmware/dataset file is composed of the following sections:

The **Header block** contains details about the file including validator type, versioning information and download configuration data used by the validator during the update.

It is simply the first 128 bytes of the main firmware/dataset file and transmitted to the validator as an SSP command.

The response should be OK (0xF0) if the file is the correct type for this validator, or HEADER_Fail (0xF9) if this file cannot be used to update this validator.

The **RAM block** contains the code run on the validator during the update process. This controls the operation of the validator during the update process and is erased on reset or power loss.

From this point the SSP packet format is not used. The data is written directly to the validator using the serial port.

After the RAM file has been successfully transmitted to the validator, the execution of the program should halt for 2.5 seconds to allow the validator to run the RAM code.

The **Firmware/dataset block** contains the update that will be applied to the validator.

Transmit the data in 4kbyte blocks. Each block will be acknowledged by the checksum. In case of an error the block will be rejected and needs to be re-issued.

To test the download functionality a deliberately corrupted packet and send to the device. The NV200S will respond invalid so the correct packet has to be re-issued.

Once all bytes have been transferred please send a Reset (0x01).

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5 ERROR HANDLING

The following pages show the possible errors on a NV200 Spectral Range. When an error occurs the NV200 Spectral and/or Spectral Payout may provide error flash codes, the table below shows what these codes represent.

5.1 NV200 Spectral

Flashes		Indicated Status / Error	Recommended Action
Red	Blue		
1	1	Note Path Open	Close the lid of the NV200 Spectral validator it will click into place as it shuts.
	2	Note Path Jam	1. Power down the NV200 Spectral 2. Open the NV200 Spectral using the red catch on top and inspect the note path for any note debris 3. If there isn't any evidence of a note carefully remove the NV200 Spectral from the base using the red catch on the front. 4. A note could be just sticking out from the cashbox, remove power and the NV200 Spectral head. 5. If a note is visible remove the note. 6. Re-attach the head and power. 7. If the jam isn't cleared remove the cash box.
	3	Unit Not Initialised	The NV200 Spectral will need to be returned to your nearest repair centre for repair
2	1	Cashbox Removed	Insert the cashbox. If it is a TEBS cashbox and the error is displayed with the cashbox inserted, remove the outer housing and check the barn door flag is operating
	2	Cashbox Jam	Remove and open the cashbox to manually remove the jammed note.
	3	No TEBS Detected	Remove the NV200 Spectral head by lifting the red latch on the front of the unit. Replace the unit ensuring the NV200 Spectral is flush with the front of the TEBS unit. If the unit is displaying this error but is connected to a standard cashbox the NV200 Spectral cashbox flag should be changed in Validator Manager. If this doesn't solve the issue attempt a power cycle of both the NV200 Spectral and TEBS.
	4	Barcode Fail	If a new bag had been inserted and the unit fails to read the barcode; attempt a power cycle of the TEBS base by removing and replacing the 4 pin Molex on the left-hand side of the unit. If the unit doesn't recover a new bag will need to be inserted, replace the bag.
	5	Cashbox Unlocked	Issue an unlock command to the TEBS, physically unlock and relock the unit ensuring the lock has been completely turned.

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			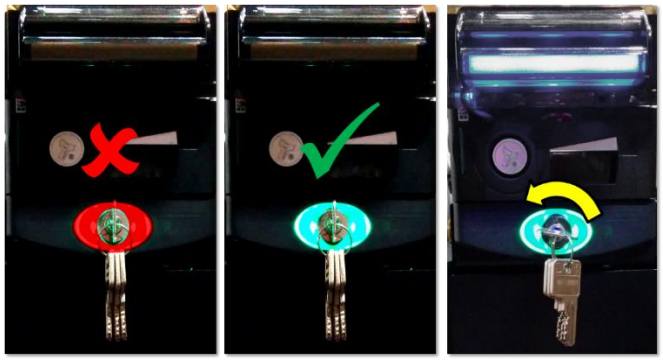
	6	Currency Mismatch	Remove the current TEBS bag and reinsert a new bag.
	7	Firmware Error	Contact ITL support.
	8	Incompatible TEBS	The TEBS build revision is not supported by NV200 Spectral. Must be build revision 9 or higher.
3	1	Firmware Checksum Error	There has been an issue with the attempted download, retry the download with the recovery section on validator manager, if this fails arrange for the unit to be returned to the nearest repair centre; details of which can be found on our website.
	2	Interface Checksum Error	The firmware loaded doesn't contain the primary interface from the previous firmware. Download with the IF file containing the correct protocol.
	3	EEPROM Checksum Error	There has been an issue with the attempted download, retry the download with the recovery section on validator manager, if this fails arrange for the unit to be returned to the nearest repair centre; details of which can be found on our website.
	4	Dataset Checksum Error	
4	1	Power Supply too Low	Check the voltage on your power supply is within the specified voltage range as outlined in Section 3.1 If the voltage appears to be correct, check to ensure the power supply voltage doesn't vary by more than 10% under maximum current draw.
	2	Power Supply too High	Check the voltage on your power supply is within the specified voltage range as outlined in Section 3.1 If the voltage appears to be correct, check to ensure the power supply voltage doesn't vary by more than 10% under maximum current draw.
	3	Card Format	The data card inserted is incorrect, format the card using the latest NVCardUtilities.
	4	Payout Reset	The Spectral Payout is in the process of resetting, wait for it to recover.

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5	1	Firmware Mismatch	The Firmware on the device connected doesn't match the firmware on the NV200 Spectral. Ensure the Firmware supports the connected device.
	2	Payout Jam	The spectral payout has encountered an issue and a note has jammed, follow the steps as described in Section 5.9
	4	Payout Jam recovery in progress	The spectral payout encountered a jam and is attempting to recover. 5 notes will be moved to the cashbox, from the payout. Once the unit has completed this it will go back in service.

5.2 Spectral Payout

The LED on top of the Spectral Payout module can flash the following codes to indicate its status and aid troubleshooting

Flashes		Indicated Status / Error
Long	Short	
3	2	Sensor error
3	3	Tape error
3	4	Diverter Error
3	5	EEPROM Error
3	1	Other

Flashes		Indicated Status
Colour	Flash	
Green	Slow	Waiting for host machine to enable the payout module
Green	Fast	Idle
Blue	Fast	Busy – A payout/float/empty/pay-in is in progress
Turquoise	Fast	Waiting for NV200 Spectral to send the startup command

5.3 TEBS Cashbox

The TEBS cashbox can display a flash code on the lock cam.

Flashes		Indicated Status / Error	Recommended Action
Red	Blue		
3	2	Camera not Responding	Arrange for the unit to be returned to the nearest repair centre; details of which can be found on our website.
3	3	EEPROM Error	
3	4	TEBS Log CRC Error	Send the Clear TEBS Log command through validator manager this will reset the logs and the error should clear.

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5.4 Bunch Note Feeder (BNF)

The LED strip on the BNF note path can flash error codes to aid with troubleshooting, see below

Flashes		Indicated Status / Error	Recommended Action
Yellow	Cyan		
1	1	BNF Lid Open	Close the BNF Lid
	2	Pay In Path Jam	Check the upper note path (where notes are inserted) and clear and jam/debris
	3	Pay Out Path Jam	Check the upper note path (where notes are returned) and clear and jam/debris
2	1	Note Transit Error	Open BNF lid, check that path is clear then close lid.
	2	Note Out Error	Open feeder and NV200 Spectral lid, clear out note from inside feeder, check reject tray for note half rejected, close lid to clear error
	3	Motor Stall	Open feeder lid, clear out notes from under tongue, close lid to reset
3	1	PSU Voltage	Power supply is above or below the operational range. Use power supply that meets the requirements in Section 3.1
	2	Note In Calibration Fail	Remove all notes from tray, clean lightpipe in tray, power cycle to reattempt startup, if issue persists return to nearest service centre
	3	Note Out Calibration Fail	Remove all notes from tray, power cycle to reattempt startup, if issue persists return to nearest service centre
	4	Note In Speed Fail	Remove all notes and power cycle to reattempt calibration, if persists return
	5	Note Out Speed Fail	Remove all notes and power cycle to reattempt calibration, if issue persists return to nearest service centre
4	2	EEProm Initialisation Fail	Return to nearest service centre
	3	Download Fail	NV200 Spectral could not update BNF, power cycle to reattempt download

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5.5 Error Events

5.5.1 Unsafe jam

This event is given when a note has jammed in the NV200 Spectral.

Conditions:

A note has been jammed in the note path or upper cashbox/TEBS path.

Error Handling:

Disconnect the power supply. Remove the NV200 Spectral head. Open the NV200 Spectral note path to check where the note has been jammed – please check the upper cashbox/TEBS note path as well.

The jammed note can then be removed.

How to Simulate:

Insert an invalid note and hold your fingers in front of the bezel, the note won't be able to reject and will jam in position after approximately 40 seconds.

Packet example of an Unsafe Jam Event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Unsafe Jam (0xE9)** 7F 80 02 **F0 E9** 4A 22

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5.5.2 Disabled

This event is given to a Poll Command if the NV200 Spectral has been disabled.

Conditions

For the NV200 Spectral to become disabled one of following scenarios has occurred:

- A Disable Command received by the NV200 Spectral.
- A Poll Timeout, this could be due to a loss in communication to the unit or an excessive delay between polls.
- The NV200 Spectral (not Payout) has become Jammed.
- If the cashbox has removed
- If the NV200 Spectral is dispensing/floating notes.

Error Handling:

Sending an Enable Command will enable the device in case coms have dropped out.

If the unit Disables again manual intervention will be required to Clear the Jam.

Allow the NV200 Spectral to finish dispensing.

How to Simulate:

Stop polling for at least 10 seconds.

Send a payout/float command.

Send a disable command.

Packet example of an Disabled Event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Disabled (0xE8)** 7F 80 02 **F0 E8** 4A A2

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5.5.3 Fraud

The NV200 has detected an unusual movement of a note during the pay-in likely in order to fool the system to register credits with no money added.

Conditions:

The Strim sensor on the front of the NV200 Spectral has been interrupted during Note transport

Error Handling:

Send reset command to clear, if consistent inspection is recommended.

How to Simulate:

interrupt the Strim sensors signal while accepting a note by inserting a second note.

Packet example of an Fraud Attempt event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Fraud Attempt (0xE6)** 7F 80 03 **F0 E6 02** C0 7C

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5.5.4 Stacker Full

The NV200 Spectral can't detect movement in the cashbox stacker, indicating the cashbox is full.

Conditions:

The cashbox stacker flag is in the open position so the NV200 Spectral opto sees the cashbox is full

Error Handling:

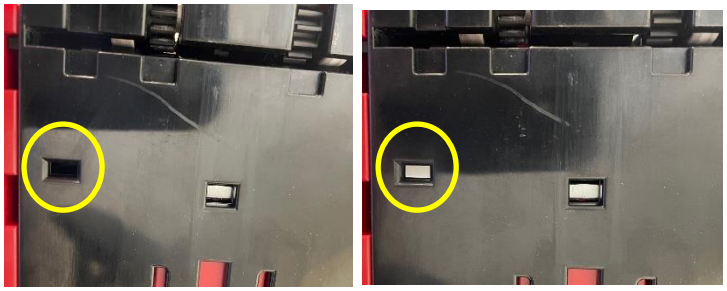
Empty the cashbox.

Check the flag can move.

If continues then the unit should be sent to an approved repair centre.

How to Simulate:

Filling the cashbox will simulate this error.



Packet example of an Stacker Full Event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Stacker Full (0xE7)** 7F 80 02 **F0 E7** 6D A2

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5.5.5 Payout Jammed

The Spectral Payout has become jammed and will no longer operate.

Conditions:

If a jam occurs in the Spectral Payout module, the device will attempt to run a jam recovery process. Please do not interrupt the device while it is doing so.

If the jam recovery process was unsuccessful the unit will report a Jammed event.

Error Handling:

Disconnect the power supply. Remove the NV200 Spectral head, then slide the Spectral Payout module upwards to remove it from the chassis.

WARNING!

Disconnect power BEFORE removing the NV200 Spectral

With Spectral Payout module removed from the chassis, follow the steps below:

1) **Open the access doors**
   The Spectral Payout has two access doors to allow better serviceability, making it easier to clear a note jam.
   To open the top door slide the red latch on top of the module forwards, pinch against the raised edge and lift the door, as per the picture below:

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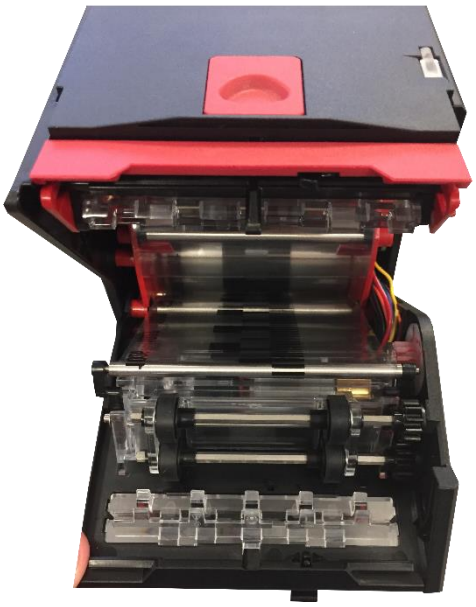
To open the second door, press the red latch inside the first door as per the picture below. The second door will spring open:



Notes can now be removed from both areas where visible. Once the notes are removed follow the next step to ensure that tapes are properly tensioned.

Turn slightly in both directions to check tapes are properly tensioned

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2) Tension tapes

Using the small hex key that comes with the module, wind the tapes slightly until the tapes are properly tensioned. If they are already correctly tensioned then you do not need to wind tapes.

How to Simulate:

Issue a payout and block the note between the Payout Spectral and the NV200 Spectral e.g. using a thin wire.

Packet example of a Payout Jammed Event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Payout Jammed (0xD5)** 7F 80 0A **F0 D5 01 E6 00 00 00 45 55 52** 2B C6

5.5.6 Incomplete Payout

The device has detected a discrepancy on power-up noting that the last payout request was interrupted (possibly due to a power failure).

Conditions:

This can happen due to a power failure during a payout process or a reset command during payout process.

Error Handling:

Send another payout request when restarted with the value calculated as below:

Initial request data – paid data of incomplete payot event = new payout

How to Simulate:

Issue a payout command and remove power while payout is in progress. Incomplete payout event is given after power-up as response to one of the first poll commands.

Packet example of an Incomplete Payout Event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Incomplete Payout (0xDC)** 7F 80 0E **F0 DC 01 FC 08 00 00 88 13 00 00 45 55 52** CC 1B

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5.5.7 Incomplete Float

The device has detected a discrepancy on power-up noting that the last float request was interrupted (possibly due to a power failure).

Conditions:

This can happen due to a power failure during a float process or a reset command during float process.

Error Handling:

Send another float request when restarted (initial request data – floated data of incomplete float event = new float)

How to Simulate:

Issue a float command and remove power while payout is in progress. Incomplete float event is given after power-up as response to one of the first poll commands.

Packet example of an Incomplete Float Event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Incomplete Float (0xDD)** 7F 80 0E **F0 DD 01 FC 08 00 00 88 13 00 00 45 55 52** CC 1B

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5.5.8 Jam Recovery

This response is given while the Payout is trying to clear a detected Jam.

Error during payout will appear fist.

WARNING!

Interrupting the Jam Recovery could cause incorrect levels.

Conditions:

The payout has detected a jam; the payout is/has started its anti-jam procedure.

Up

Error Handling:

The unit should be left to complete this procedure, this error will be replaced by a jammed response if manual intervention is needed.

If the jam is cleared, then the unit will go back to normal operation.

How to Simulate:

Insert 5 notes to be stored in the payout, the first 2 notes can be the same denomination, the 3rd note should be a different denomination and the last 2 notes should be different to the 3rd note.

Remove power to the unit and remove the NV200 Spectral and the Sepctral Payout.

WARNING!

Disconnect power BEFORE removing the NV200 Spectral

Manually wind the notes and remove the 3rd note.

Reconnect the Spectral Payout to the NV200 Spectral and run the unit.

Request a payout of the 3rd notes denomination.

The note won't be found and the Spectral Payout will start the jam recovery procedure.

Packet example of a Jam Recovery Event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Jam Recovery (0xB0)** 7F 80 02 **F0 B0** 9C 23

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5.5.9 Error During Payout

An error has occurred while paying out a note, the error will be shown with the final byte.

Value	Meaning
0x00	Note not correctly detected as it is route (reverse validation fail)
0x01	Note jammed in transport
0x02	Cashbox error e.g. stacker full, removed, jammed
0x03	Payout stalled e.g. unable to seek note in payout
0x04	Payout cancelled due to poll timeout

Packet example of an Error during Payout Event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Error during Payout (0xB1)** 7F 80 0C **F0 B1 01 00 00 00 00 45 55 52 00 E8** 9C 23

5.5.9.1 0x00 Reverse Validation Fail

Conditions:

The note being paid out was incorrectly validated for this denomination. This note will be stacked.

Error Handling:

Re-issue the payout/float.

How to Simulate:

To create this failure run the NV200 Spectral and insert a note.

Remove power to the NV200 Spectral and remove the Spectral Payout.

Manually remove the note and then place a different note (different denomination) in the same position.

Reconnect the unit and issue a float command.

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5.5.9.2 0x01 Note Jammed in Transport

Conditions:

This can be reported for multiple reasons.

A slot in the payout is missing a note. A note is jammed in the unit (if jam recovery is an option then it will be reported after the jam recovery). The stacker plate is out of position. A failure in Coms has happened. The diverter is open at the end of the payout. If timed well then it can happen if the cashbox is removed during payout.

Error Handling:

Disconnect the power supply. Remove the NV200 Spectral head, then slide the

Spectral Payout module upwards to remove it from the chassis.

With Spectral Payout module removed from the chassis, follow the steps below:

WARNING!

Disconnect power BEFORE removing the NV200 Spectral

1) **Open the access doors**
   The Spectral Payout has two access doors to allow better serviceability, making it easier to clear a note jam.

   To open the top door slide the red latch on top of the module forwards, pinch against the raised edge and lift the door, as per the picture below:

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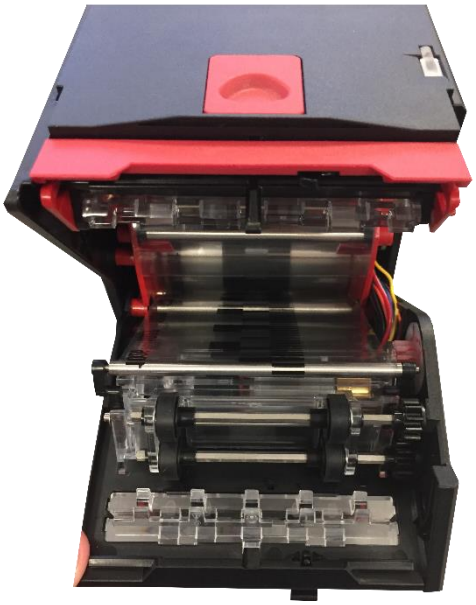
To open the second door, press the red latch inside the first door as per the picture below. The second door will spring open:



Notes can now be removed from both areas where visible. Once the notes are removed follow the next step to ensure that tapes are properly tensioned.

Turn slightly in both directions to check tapes are properly tensioned

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2) Tension tapes

Using the small hex key that comes with the module, wind the tapes slightly until the tapes are properly tensioned. If they are already correctly tensioned then you do not need to wind tapes.

How to Simulate:

Issue a payout command.

When the note is being paid out stop the drum moving with the winding key.

5.5.9.3 0x02 Cashbox Error

Conditions:

Either the cashbox has been removed during payout, or the stacker is full. In case a note needs to be stacked during payout a cashbox issue can't be present

Error Handling:

Investigate and fix the cashbox condition.

How to Simulate:

Remove the cashbox after issue a payout command.

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5.5.9.4 0x03 Payout Stalled

Conditions:

The payout can't physically get to a required point in the tape, possible on very bad jams. This can be due to bad jams limiting the tapes movement.

Error Handling:

Please check if the tape turns using the winding key.

In case of an defective tape please send the unit to an Approved Repair centre.

How to Simulate:

Prevent the tape from moving by using the winding key and issue a payout command.

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5.5.9.5 0x04 Payout cancelled due to poll timeout

Conditions:

The host hasn't communicated to the unit for 10 seconds so the unit has timed out.

Error Handling:

Don't stop polling the unit during payout.

How to Simulate:

Stop polling the unit during payout.

5.5.10 Payout Halted

This response is given when a payout, float or empty process has been interrupted by the user.

Conditions:

For this response to occur the user has to have sent a Halt command.

Re-issue a payout command for the remaining value, if the value isn't available then another device may need to payout or operator interaction may be required.

Error Handling:

To avoid this error don't send halt commands during paying, floating or emptying.

How to Simulate:

Send a halt command during paying, floating or emptying

Packet example of a Payout Halted Event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Payout Halted (0xD6)** 7F 80 0A **F0 D6 01 FA 05 00 00 45 55 52** 4D 49

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5.6 Power Off Handling

If the power is removed from the Spectral Payout while it is operating note movement one of the events will be given depend on when the power is removed.

5.6.1 Note Into Stacker At Reset

Conditions:

The power is removed before the note is fully inside the NV200 and still partly in the payout.

Description:

Reported when a note has been transferred from the payout device into the cashbox stacker as part of the power-up procedure. The credit for this note had already been given when it was originally paid into the payout device.

Packet example of an Note Into Stacker At Reset Event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Note Into Payout At Reset (0xCA)** 7F 80 09 **F0 CA F4 01 00 00 45 55 52** D0 F9

5.6.2 Note Into Store at Reset

Conditions:

The power is removed before the note is fully inside the Spectral Payout and the NV200 Spectral could confirm that the note was stored.

Description:

Reported when a note has been transferred to the payout device as part of the power-up procedure.

Packet example of an Note Into Store at Reset event below:

Host Command	Device Response
Poll (0x07) 7F 80 01 07 12 02	**Note Into Store At Reset (0xCB)** 7F 80 09 **F0 CB D0 07 00 00 47 42 50** B7 2D

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