Innovative Technology

INTELLIGENCE IN VALIDATION

BV30
[GA02188]

User Manual

User Manual BV30

Document Name:	BV30 Manual [GA02188]
Document Version:	Version 1.2
Date of Release:	24.05.2021

TABLE OF CONTENTS

User Manual BV30

1   DOCUMENT INTRODUCTION

1.1   Contact Information

Head Office

Innovative Technology Ltd

Innovative Business Park,

Derker Street, Oldham

OL1 4EQ, England

Email: sales@innovative-technology.com

Phone: +44 161 626 9999 (Main)

Email: support@innovative-technology.com

Phone: +44 161 507 1818 (Technical Support)

Further Innovative Technology Ltd. representatives can be found on our website.

www.innovative-technology.com

1.2   Related Documents

This document should be read together with the following:

For SSP/eSSP:

Protocol Manual – SSP (GA138) : SSP Interface Protocol Specification for integration

SSP Implementation Guide (GA973) : Information for programmers and integrators

For other third party interface protocols please contact support@innovative-technology.com.

1.3   Manual Amendments

Rev.	Date	Amendment Details	Issued by
1.0	DD/MM/YYYY	First Issue	SK

1.4   Copyright

This document is Copyright © Innovative Technology Ltd. 2020. No part of this publication may be reproduced in any form or by any means used to make any derivative such as translation, transformation, or adaptation without permission from Innovative Technology Ltd. The contents of this document may be subject to change without prior notice.

1.5   Limited Warranty

Innovative Technology Ltd warrants each of its hardware products to be free from defects in workmanship and materials under normal use and service for a period commencing on the date of purchase from Innovative Technology Ltd or its Authorized Reseller, and extending for the length of time stipulated by Innovative Technology Ltd.

A list of Innovative Technology Ltd offices can be found on the website. If the product proves defective within the applicable warranty period, Innovative Technology Ltd will repair or replace the product. Innovative Technology Ltd shall have the sole discretion whether to repair or replace, and any replacement product supplied may be new or reconditioned.

The foregoing warranties and remedies are exclusive and are in lieu of all other warranties, expressed or implied, either in fact or by operation of law, statutory or otherwise, including warranties of merchantability and fitness for a particular purpose.

Innovative Technology Ltd shall not be liable under this warranty if it's testing and examination disclose that the alleged defect in the product does not exist or was caused by the customer's or any third person's misuse, neglect, improper installation or testing, unauthorized attempts to repair, or any other cause beyond the range of the intended use. In no event will Innovative Technology Ltd be liable for any damages, including loss of profits, cost of cover or other incidental, consequential or indirect damages arising out the installation, maintenance, use, performance, failure or interruption of an Innovative Technology Ltd product, however caused.

User Manual BV30

1.6   Product Safety Information

Throughout this user manual, we may draw your attention to key safety points that you should be aware of when using or maintaining the product.

These safety points will be highlighted in a box, like this:

<table>
<tr><td>⚠️</td><td>Caution!</td></tr>
<tr><td colspan="2">This is example text.</td></tr>
</table>
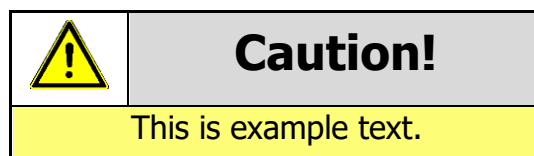
This user manual and the information it contains is only applicable to the model stated on the front cover, and must not be used with any other make or model.

1.7   Disclaimer

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

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

Innovative Technology Ltd does not accept liability for any errors or omissions contained within this document. Innovative Technology Ltd shall not incur any penalties arising out of the adherence to, interpretation of, or reliance on, this standard.

User Manual BV30

⚠ ⚡ ⚠	**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.

User Manual BV30

2   PRODUCT INTRODUCTION

2.1   General Description

The BV30 is a compact, light-weight bill acceptor ideal for amusement and low value vending applications. Proven field reliability, quick transactions and easy maintenance make the unit future proof.

Exceptional value, the BV30 allows a bill acceptor to be installed for the same price as a coin mech.

2.2   Key Features

1. Compact bill acceptor
2. Simple design
3. Exceptional value
4. Ideal for amusement, kiddie rides & jukebox applications

2.3   Typical Applications
- Gaming
- Amusement
- Vending

User Manual BV30

2.4   Component Overview
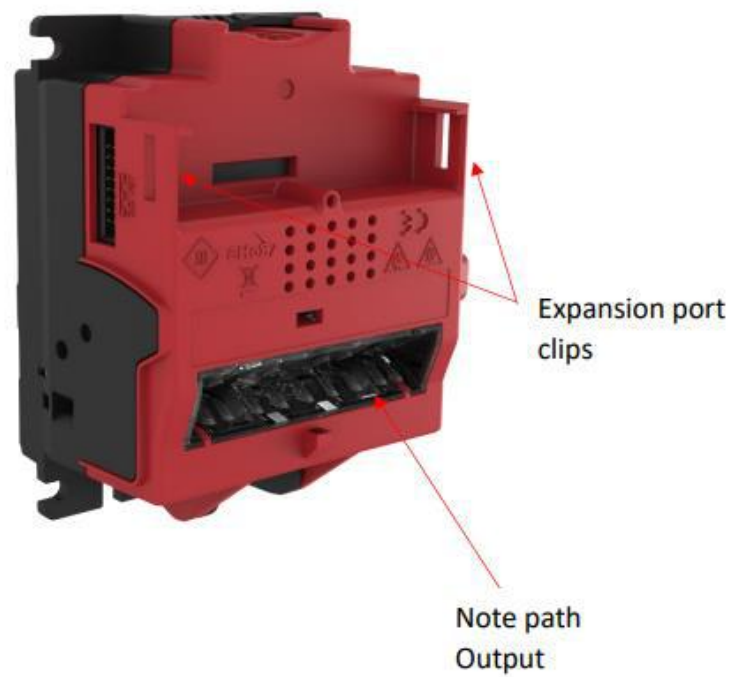
2.5 Bezel Options

The BV30 is fitted with a standard 72mm bezel. This is the only bezel option for this product.

2.6 Cashbox Options

The BV30 does not have a built-in cashbox, it is designed to be used in stacker-less/free fall applications. When bank notes are successfully validated the BV30 will transport the note through the validator and drop it out of the back of the unit.

⚠️	**Caution!**
A cashbox/bag should be placed under the BV30 to catch the notes, leaving enough space to ensure that the notes are completely clear of the BV30 body.	

User Manual BV30

3   MECHANICAL INSTALLATION

3.1   Compatibility

3.1.1   Hardware Compatibility

3.1.1.1   Machine Mounting

The BV30 is a suitable fitting replacement for the following ITL products only:

- BV20

Innovative Technology Ltd. has a policy of continuous product improvement.

3.1.1.2   Machine Interfacing

By design the BV30 is pin to pin compatible with the suitable fitting replacement products listed above. No changes to existing machine harnessing are required.

User Manual BV30

3.1.1.3 Power Supply

It is vital that the BV30 is connected to a power supply capable of providing the required power environment. A weak power supply causes malfunctioning of the BV30 such as note rejects or missing credits. If the BV30 is used as a fitting replacement for an older model or product we recommend to check the power supply specifications of the machine. The power supply of the machine might be suitable for the older model or product but not suitable for the BV30.

⚠️	**Caution!**
A weak power supply causes malfunctioning!	
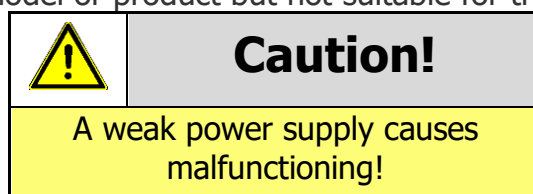
3.1.2 Software Compatibility

3.1.2.1 Interface Protocols

When using the BV30 as a fitting replacement for an older model or product, some events such as credits may be given faster. This is due to improved firmware routines and faster motors being used. This may cause missing events such as credits in those host machines where timeouts are defined for the older model or product. Contact the machine manufacturer for full compatibility of the BV30.

⚠️	**Caution!**
Timing issues may cause missing events such like credits!	
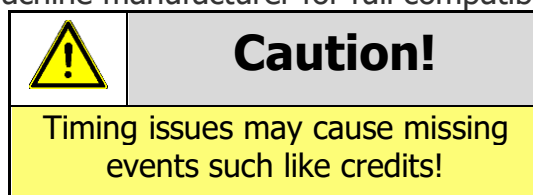
3.1.2.2 Re-programming

For reprogramming the BV30 always use the latest version of Validator Manager, available for download on the Innovative Technology website. Older versions may not support the BV30. For further details on reprogramming refer to [Dataset/Firmware Programming](#)

⚠️	**Caution!**
Older versions of Validator Manager may not support the BV30!	
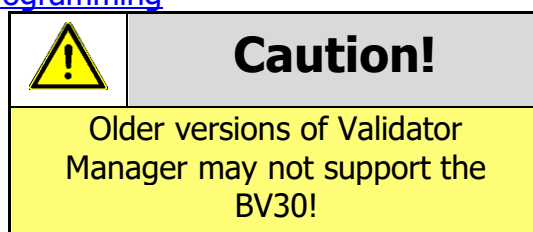
3.2   Machine Mounting

3.2.1   Machine Mounting

The BV30 has mounting points around the bezel to allow secure mounting to the host machine. Refer to the diagram below for the mounting point locations and measurements:
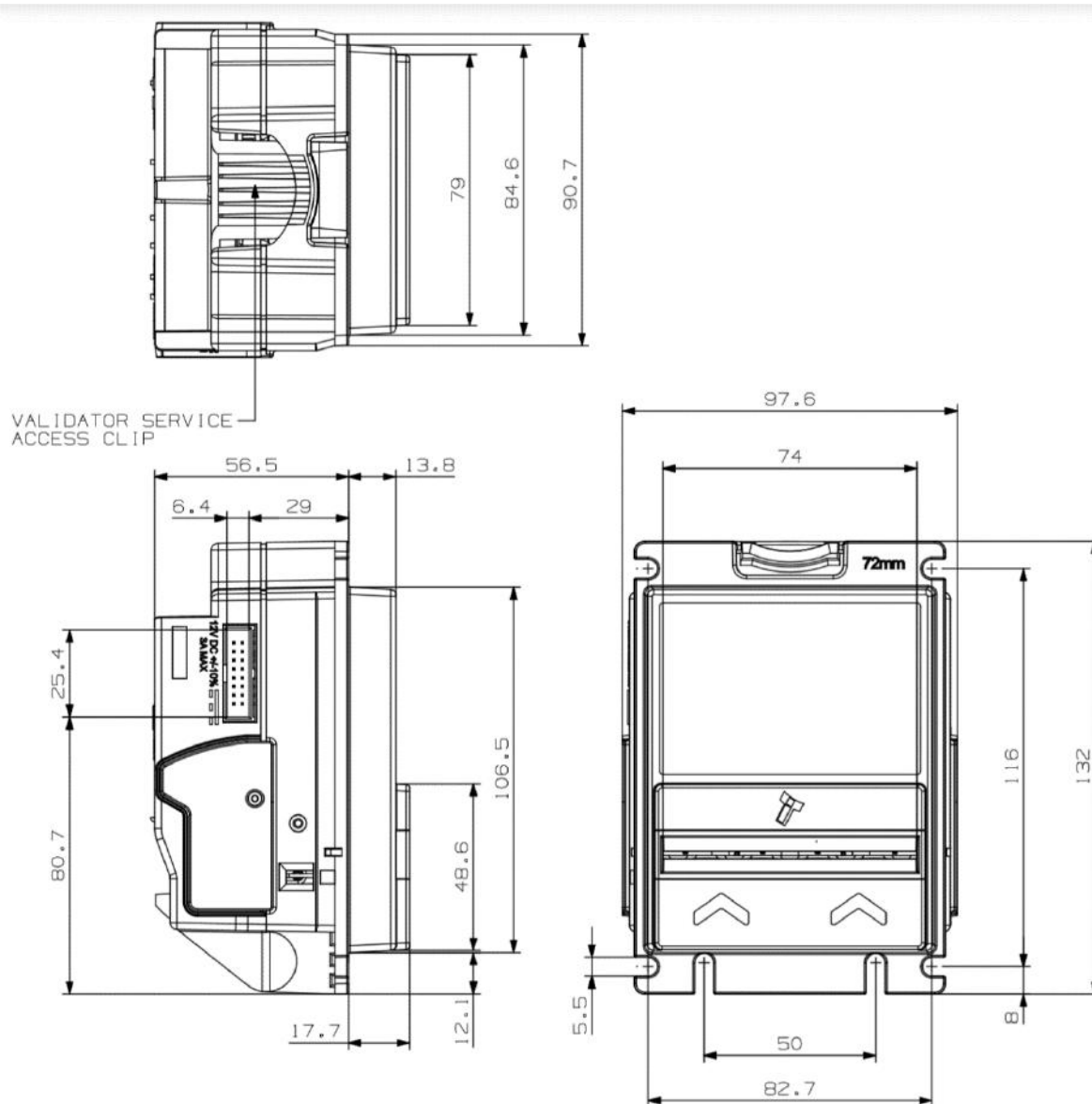
3.2.2   Screw Specifications

The scope of delivery does not include screws for machine mounting. See table below for screw specification reference.

Type	Head Diameter		Head Height		Bolt Diameter		Bolt Length	
	Min	Max	Min	Max	Min	Max	Min	Max
Flat Head	7	-	2	-	2.5	4.5	15	42
Pan Head	7	-	2	-	2.5	4.5	15	42

User Manual BV30

4   SOFTWARE INSTALLATION AND CONFIGURATION

4.1   Introduction
The BV30 leaves the factory pre-programmed with the latest dataset and firmware files. However, it is important to ensure your device is kept up to date with the latest dataset and firmware. This section will give you a brief overview of the various update possibilities with the BV30. For detailed instructions please refer to the relevant manual package supplied with the software or contact support@innovative-technology.com.

4.2   Software Downloads
All software from Innovative Technology Ltd is free of charge and can be downloaded from the website www.innovative-technology.com/support/secure-download once registered and logged in. If you are not registered, please create an account via the Create an account form. A confirmation email will be sent to the registered email address once all contact details have been successfully submitted.

4.3   Drivers
The ITL drivers allow you to connect any of our validators to a compatible Windows device. If you are connecting via an IF17 then you will not need to follow this process as they are signed Microsoft Drivers and should install automatically. If this isn't the case or your computer is disconnected from the network, there is a standalone package included within the driver downloads.

4.4   Dataset/Firmware Programming

4.4.1   Validator Manager

4.4.1.1   General Description
Validator Manager is a utility which allows the user to reprogram any of ITL's validators, hoppers as well as coin and note recycler. Please note that admin rights are required during installation. The validator must be in SSP for the Validator Manager to detect the device.

4.4.1.2   System Requirements

- Windows XP SP3 or above
- .Net Framework 4
- 256mb ram
- 50mb hard disk free
- Connected BV30 with active com port

⚠️	**Caution!**
We have seen instances where one of the dll's (itdata1.dll) used in Validator Manager are flagged as a Trojan, this is a false positive and if this happens you will need to add a rule to your antivirus to allow the file to run.	

4.4.1.3 Hardware Setup

The connection example below shows how to connect the BV30 to the host machine (PC) using the IF17:
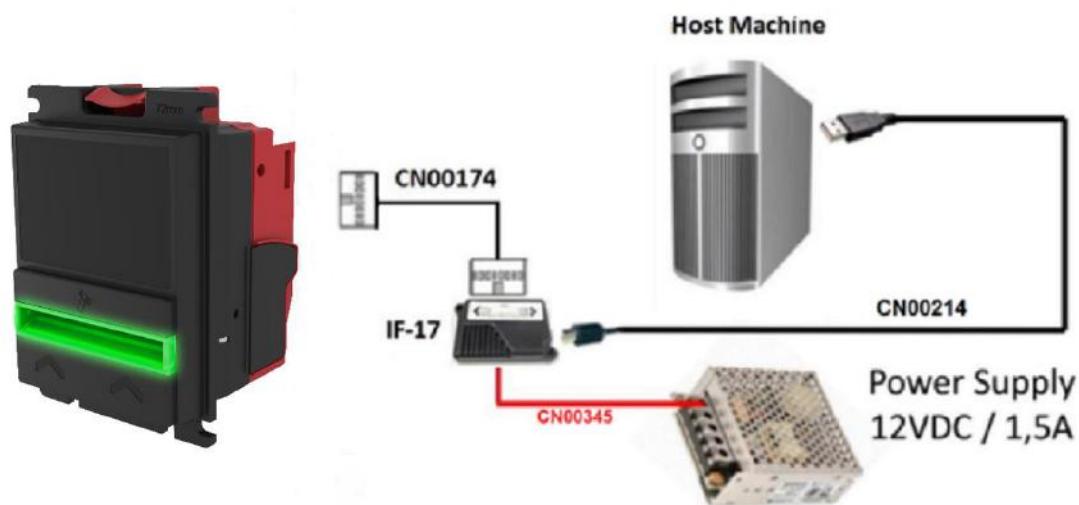
4.4.1.4 Switching to Programming Mode (SSP)

Before programming via the Validator Manager the BV30 needs to be switched to its programming mode (SSP interface). Please refer to APPENDIX for the procedure for doing this.

4.4.1.5 Programming the device

Once you have switched the unit into SSP, open Validator Manager and click detect devices. This will scan all active com ports for a unit, if your BV30 fails to connect please ensure the correct drivers are installed and the unit is in SSP.

By selecting the Program tab, you can reprogram the BV30. To begin the upload, click open file, then browse to the file location (usually Downloads) before clicking OK.
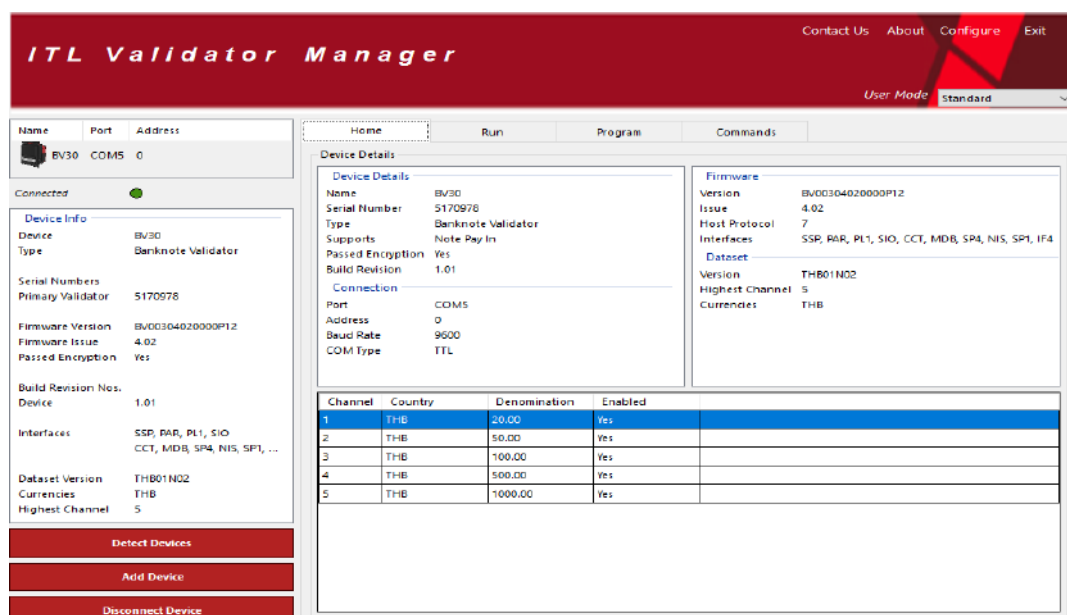
Once the file has been selected its information will be populated and the Program device tab will become active. Finally hit 'Program Device', the unit's bezel will now begin to flash signaling the update has begun.

⚠️	**Caution!**
	Interrupting the download process can result in the unit entering a non-functional state, once the process has started it cannot be halted.
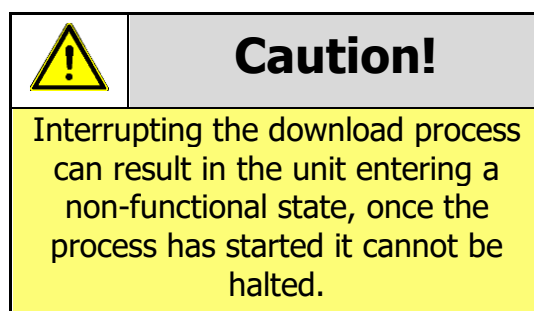
When completed the unit will restart and a pop up box will appear saying Device Programming Complete.

4.4.2 DA3

4.4.2.1 General Description

The DA3 is a hand-held validator programming system that enables the user to re-program ITL banknote validators in the field, without the use of a PC. Dataset and firmware files for different validator models can be stored on the DA3. Once programmed the user can update or override existing software as well as test the functionality of the validator, away from the host machine.

4.4.2.2 System Requirements

- Windows XP SP3 or above
- .Net Framework 4
- 256mb ram
- 50mb hard disk free
- Connected DA3 with active com port
- Data Flash Card (PA01121) ***optional***

4.4.2.3 Re-programming via DA3

Open Device Programming System software and add the dataset files you will use.

Set "Match" update mode if you want to update the BV30 with a new version of the dataset currently programmed on the BV30 dataset.

Set "Override" update mode if you want to change the dataset that is currently on the BV30 to a different dataset (either different currency or different denominations.

Drag and drop dataset for updating to the left part of the window and click "Update Files" under the DA3 column below:

Disconnect the DA3 from the PC and connect it to the BV30 using a ribbon cable. Ensure that the cable is inserted into the "Validator" connection which is labelled on the back of the DA3. Connect power to the DA3, either using the jack plug connect or using power from the host machine using the "Host Machine" connection.

Using the small "Mode Select" button choose Match Download or Override Download depending on the file options selected in Step 1. Then press the "Play" button on the DA3 and the downloading process will begin. The LEDs around the button will rotate when the update is in progress.

When the update is complete the "Play" button will illuminate green and the BV30 will restart. Allow 30 seconds after the BV30 restarts before disconnecting it from the DA3.

If the programming fails, the "Play" button will illuminate red. The Match Download LED or Override Download LED (depending on the download type) will flash a to indicate the failure reason. This will be one long flash, followed by a number of short flashes, explained in the table below:

Number of Short Flashes	Failure Reason	Resolution
2	No Validator Connection Found	Check that the BV30 is in SSP mode and is connected to the "Validator" side of the DA3
3	No Valid Download Files Found	If performing a Match update, the file on the DA3 does not match the file on the BV30.

If performing an Override update, the file on the DA3 is not compatible with the BV30. |
| 4 | Download Fail | Retry the download |

4.4.3   Remote Updates

The BV30 supports remote updates via the SSP Protocol. Refer to the SSP implementation guide for information on this remote update process.

⚠️	**Caution!**
This is a complex operation and incorrect implementation may damage the units.	

5   PROTOCOLS AND INTERFACING

5.1   Introduction

The BV30 supports standard industry protocols. Interfaces that are not listed may be available upon request. For any queries regarding interfaces that are not listed please contact support@innovative-technology.com.

⚠️	**Caution!**
The use of an encrypted protocol (preferable eSSP) is strongly recommended to achieve the highest security!	

5.2   Interface Connector

The BV30 has a 16-pin connector to allow interfacing and programming, this is the same 16-pin connector as the other ITL banknote validators. The pin numbering of the socket is shown below:
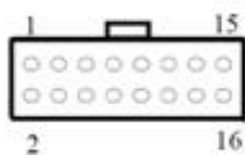
5.3   User Interface

The BV30 has a multi-function configuration button located on the side of the unit.
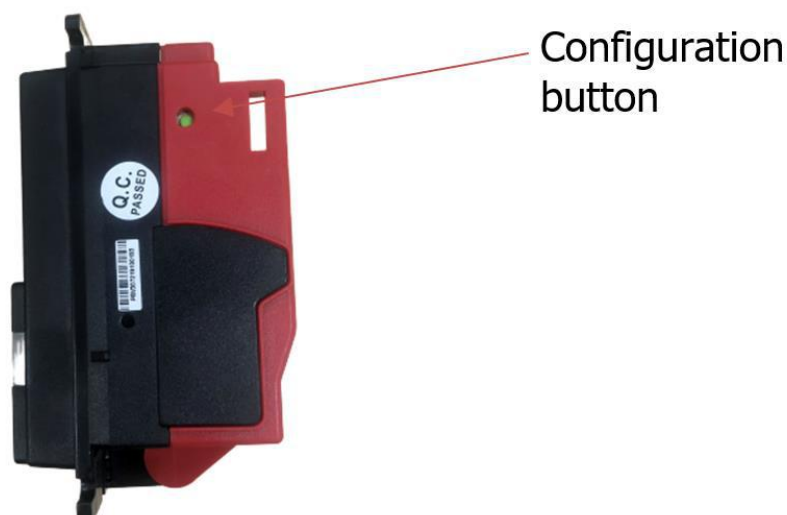
The different functions of the configuration button are listed in Section 8.2

5.4   SSP and eSSP

5.4.1   General Description

Smiley® Secure Protocol (SSP) and Encrypted Smiley® Secure Protocol (eSSP) are field proven secure interfaces specifically designed by Innovative Technology Ltd. to address the problems by cash handling systems in gaming machines. Problems such as acceptor swapping, re-programming acceptors and line tapping are all addressed. This interface is recommended for all new designs. Innovative Technology Ltd. provides full SDK packages upon request including Interface Specification, Implementation Guide as well as source code examples for C++, C#.NET and Linux. Please contact support@innovative-technology.com for further information.

5.4.2   Pin Assignments

Pin	Name	Type	Description
1	Vend 1	Output	Serial Data Out (Tx)
2	Vend 2	Output	DA3 Data Logging
3			
4	Factory Use Only – Do not connect		
5	Inhibit 1	Input	Serial Data In (Rx)
6			
7			
8			
9			
10			
11			
12			
13			
14	Factory Use Only – Do not connect		
15	+ Vin	Power	+12VDC Supply
16	0V	Power	0V Supply (GND)

5.4.3   Setup Examples

The drawings below highlights how to connect the BV30 to an SSP or eSSP host machine using available cables and interfaces from Innovative Technology Ltd. For cable drawings please refer to APPENDIX
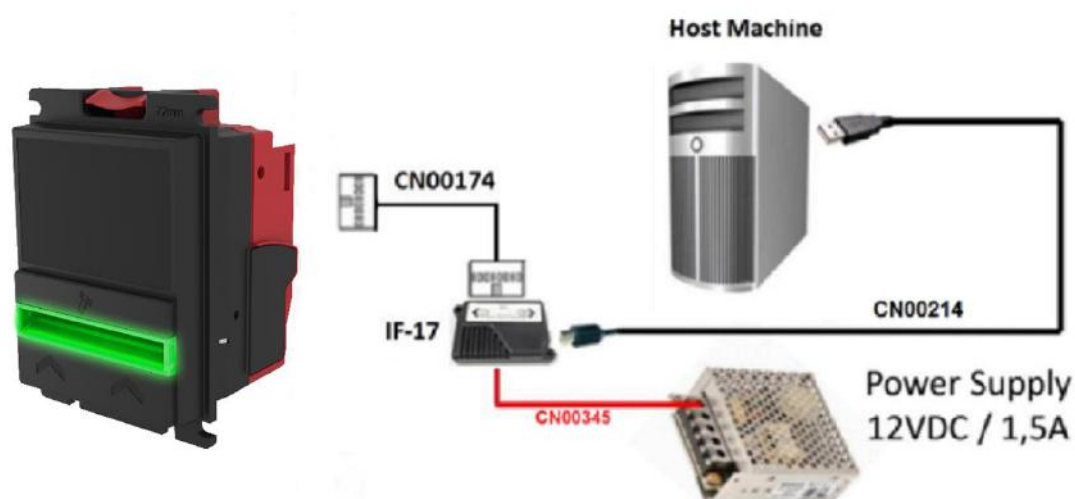
Type	ITL Part Number	Description	Details
Cable	CN00174	Ribbon Cable	http://www.innovative-technology.com/shop/cables/dual-essp-interface-for-smart-hopper-a-smart-payout-detail
Cable	CN00345	DA3 / IF17 / IF18 Power Cable	http://innovative-technology.com/shop/cables/da3-if17-if18-power-cable-detail
Cable	CN00214	USB Type A to B	http://www.innovative-technology.com/shop/cables/usb-a-to-b-cable-assembly-detail
Interface	IF17	TTL to USB Converter	http://www.innovative-technology.com/shop/accessories/if17-interface-converter-detail

5.5   ccTalk®

5.5.1   General Description

ccTalk® is a serial communications protocol designed by Money Controls to allow 3-wire interfacing between a host and cash handling peripherals. Please contact support@innovative-technology.com for further information.

⚠	**Caution!**
Innovative Technology Ltd. provides full SDK packages including Interface Specification, Implementation Guide as well as source code examples for SSP respectively eSSP only!	

5.5.2   Pin Assignments
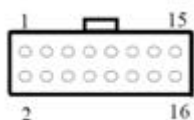
Pin	Name	Type	Description
1	Vend 1	Output	Serial Data (link to Pin 5)
2	Vend 2	Output	DA3 Data Logging
3			
4			
5	Inhibit 1	Input	Serial Data (link to Pin 1)
6			
7			
8			
9			
10			
11			
12			
13			
14	Factory Use Only – Do not connect		
15	+ Vin	Power	+12VDC Supply
16	0V	Power	0V Supply (GND)

5.5.3   ccTalk® DES Encryption

When using ccTalk® DES encryption, the BV30 and host machine must exchange a secret key which forms the basis of the communication encryption. This exchange is performed in a Trusted Mode maintaining security. The Trusted Mode can only be entered by a physical access to the BV30.

User Manual BV30

5.5.4   Setup Example Drawing/s

User Manual BV30
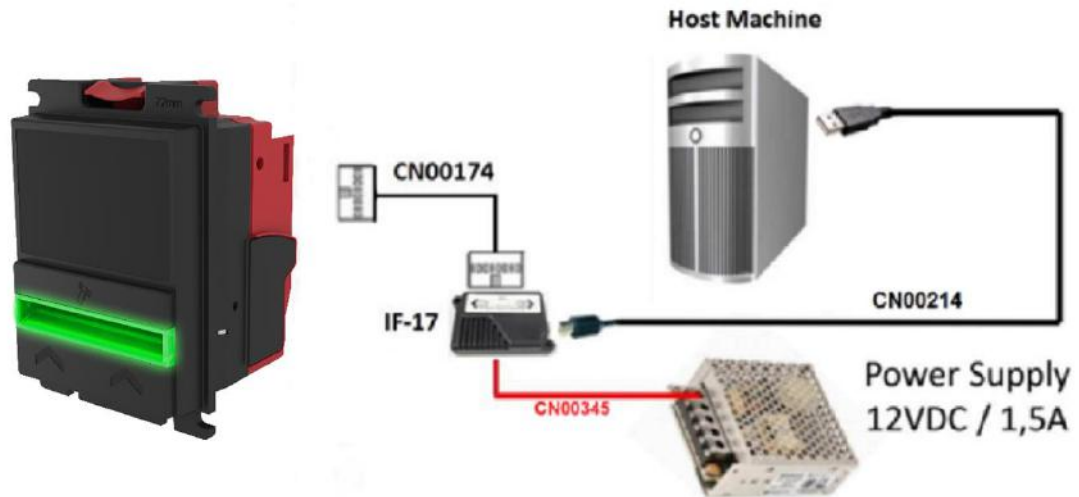
5.6   SIO and SI2

5.6.1   General Description

SIO (Serial Input/Output) is a very basic and low level serial communication interface. Messages are not echoed back. SIO uses 300 baud whereby SI2 uses 9600 baud. Please contact support@innovative-technology.com for SIO Interface Specification or other details.

⚠️	**Caution!**
SIO and SI2 are outmoded and not recommended for new developments!	

⚠️	**Caution!**
Innovative Technology Ltd. provides full SDK packages including Interface Specification, Implementation Guide as well as source code examples for SSP respectively eSSP only!	

User Manual BV30

5.6.2   Pinout

Pin	Name	Type	Description
1	Vend 1	Output	Serial Data Out (Tx)
2	Vend 2	Output	Not Used
3			
4			
5	Inhibit 1	Input	Serial Data In (Rx)
6			
7			
8			
9			
10			
11			
12			
13			
14		Factory Use Only – Do not connect	
15	+ Vin	Power	+12VDC Supply
16	0V	Power	0V Supply (GND)

User Manual BV30

5.7   MDB

5.7.1   General Description

MDB (Multi-Drop Bus) is used in the vending industry and is now an open standard in the NAMA (National Automatic Merchandising Association) so that all vending and peripheral equipment communicates identically. MDB uses a master-slave model where the VMC (Vending Mechanism Controller) is the master that can communicate with up to 32 slaves (e.g. banknote validator or coin acceptor). Please contact support@innovative-technology.com for further information.

⚠	**Caution!**
Innovative Technology Ltd. provides full SDK packages including Interface Specification, Implementation Guide as well as source code examples for SSP respectively eSSP only!	

5.7.2   Pinout
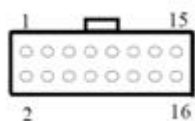
Pin	Name	Type	Description
1	Vend 1	Output	Serial Data Out (Tx)
2	Factory Use Only – Do not connect		
3			
4			
5	Inhibit 1	Input	Serial Data In (Rx)
6	Factory Use Only – Do not connect		
7			
8			
9			
10			
11			
12			
13			
14			
15	+ Vin	Power	+12VDC Supply
16	0V	Power	0V Supply (GND)

5.7.3   IF5 Interface

An BV30 running MDB can use an IF5, an external interface box, which regulates the power supply and opto-isolates the communication lines. Typically vending machine's power supply higher voltage than the maximum for the BV30. The IF5 drops this higher voltage down to the required level.

5.7.4   MDB PSU

⚠	**Caution!**
An IF5 cannot be use with BV30 110PSU	

BV30 can be used with MDB PSU, which allows to use validator directly with MDB applications

5.8   Parallel

5.8.1   General Description

Parallel is a 4-way output interface. The first 4 channels have their own individual output which means that only a maximum of 4 channels can be used. If a note is recognised the relevant Vend line is set to low for a period of 100 ± 3ms. Pulses outside these limits should be rejected as a precaution against false triggering.

⚠	Caution!
	Parallel is an unsecure interface and should not be used for new developments!

5.8.2   Pinout
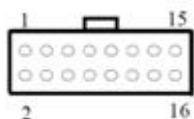
Pin	Name	Type	Description
1	Vend 1	Output	Credit Output Channel 1
2	Vend 2	Output	Credit Output Channel 2
3	Vend 3	Output	Credit Output Channel 3
4	Vend 4	Output	Credit Output Channel 4
5	Inhibit 1	Input	Inhibit Input Channel 1 by holding HIGH, hold LOW to enable
6	Inhibit 2	Input	Inhibit Input Channel 2 by holding HIGH, hold LOW to enable
7	Inhibit 3	Input	Inhibit Input Channel 3 by holding HIGH, hold LOW to enable
8	Inhibit 4	Input	Inhibit Input Channel 4 by holding HIGH, hold LOW to enable
9	Busy	Output	Output Busy Signal, Active LOW when BV30 is in transporting, reading or stacking a note
10	Escrow	Input	Input Escrow Control, Enable escrow function by holding LOW
11	USB +	Data	Not Used
12	USB -	Data	Not Used
13	USB Vcc	Power	Not Used
14	Factory Use Only		Do not connect
15	+ Vin	Power	+12VDC Supply
16	0V	Power	0V Supply (GND)

5.8.3 Inhibit Control

The Inhibits can be used to either enable or disable the acceptance of those banknotes programmed on channels 1, 2, 3 and 4. The Inhibits are internally held high and must be set to low (GND) to enable banknote acceptance. If no Inhibit is set to low (GND) the Master Inhibit is set and the BV30 is disabled.

5.8.4 Escrow Control

The BV30 has a single note escrow facility. This allows the BV30 to hold onto the note once validated, and then only stack the note into a cashbox when the host machine confirms that the Vend operation has been completed. Please refer to 9.7 for timing diagram and further details.

5.8.5 Busy Control

This is a general-purpose busy signal. It is active low (pin 9) while the BV30 is in operation.

5.8.6 Low Power Mode

The Low Power Mode can be used to reduce the power consumption of the BV30 when idle. When the Low Power Mode option is set, the BV30 goes into the Low Power Mode after about 6 seconds after the BV30 is powered up and remains in this state until a note is entered. Following a note insertion, the BV30 returns to Low Power Mode approximately 1 second after a credit is given or note is rejected. Please refer to 9.8 for timing diagram and further details.

⚠️	**Caution!**
In Low Power Mode the front sensor is checked every second which can lead to a delay in accepting the note when it is presented!	

⚠️	**Caution!**
Configuration button functions are only available during power up before the BV30 goes into Low Power Mode!	

5.8.7 IF10 Interface

The IF10 is an interface that allows serial SSP to be used in machines without the need of updating the machine software. The IF10 is connected between the BV30 and the host machine. The IF10 communicates with the BV30 in serial SSP which gives more security along the length of the cable. The IF10 should be mounted close

User Manual BV30

to the host machine control board where the IF10 converts to the parallel connection.

5.9 Binary

5.9.1 General Description

In the event that the machine needs more than 4 denominations to be recognised but the host machine cannot take advantage of the serial communication method then the BV30 can be set to give a binary pattern output on the four parallel output pins. If the BV30 is set to Binary it will issue the vend signals as a binary pattern on the parallel outputs for 100 ± 3 ms. In this way a maximum of 15 different notes can be accepted and 4 notes individually inhibited.

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 ± 3 ms. Pulses outside these limits will be rejected as a precaution against false triggering due to noise.

For example, if a note programmed on channel 3 is credited vend 1 (2^0 = 1 decimal) and vend 2 (2^1 = 2 decimal) will be active low for 100 ± 3 ms.

⚠️	**Caution!**
Binary is an unsecure interface and should not be used for new developments!	

5.9.2 Pinout
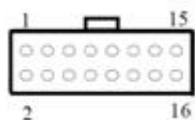
Pin	Name	Type	Description
1	Vend 1	Output	Credit Output binary 2^0 = 1 decimal
2	Vend 2	Output	Credit Output binary 2^1 = 2 decimal
3	Vend 3	Output	Credit Output binary 2^2 = 4 decimal
4	Vend 4	Output	Credit Output binary 2^3 = 8 decimal
5	Inhibit 1	Input	Inhibit Input Channel 1
6	Inhibit 2	Input	Inhibit Input Channel 2
7	Inhibit 3	Input	Inhibit Input Channel 3
8	Inhibit 4	Input	Inhibit Input Channel 4
9	Busy	Output	Output Busy Signal
10	Escrow	Input	Input Escrow Control
11	USB +	Data	Not Used
12	USB -	Data	Not Used
13	USB Vcc	Power	Not Used
14	Factory Use Only		Do not connect
15	+ Vin	Power	+12VDC Supply
16	0V	Power	0V Supply (GND)

5.9.3 Inhibit Control

The Inhibits can be used to either enable or disable the acceptance of those banknotes programmed on channels 1, 2, 3 and 4. The Inhibits are internally held high and must be set to low (GND) to enable banknote acceptance. If no Inhibit is set to low (GND) the Master Inhibit is set and the BV30 is disabled.

5.9.4 Escrow Control

The BV30 has a single note escrow facility. This allows the BV30 to hold onto the note once validated, and then only stack the note into a cashbox when the host machine confirms that the Vend operation has been completed. Please refer to 9.7 for further details.

5.9.5 Low Power Mode

The Low Power Mode can be used to reduce the power consumption of the BV30 when idle. When the Low Power Mode option is set, the BV30 goes into the Low Power Mode after about 6 seconds after the BV30 is powered up and remains in this state until a note is entered. Following a note insertion, the BV30 returns to Low Power Mode approximately 1 second after a credit is given or note is rejected. Please refer to 9.8 for timing diagram and further details.

⚠️	**Caution!**
In Low Power Mode the front sensor is checked every second which can lead to a delay in accepting the note when it is presented!	

⚠️	**Caution!**
Configuration button functions are only available during power up before the BV30 goes into Low Power Mode!	

5.9.6 IF9 Interface

The IF9 is an interface that allows serial SSP to be used in machines without the need of updating the machine software. The IF9 is connected between the BV30 and the host machine. The IF9 communicates with the BV30 in serial SSP which gives more security along the length of the cable. The IF9 should be mounted close to the host machine control board where the IF9 converts to the binary connection.

5.10 Pulse

5.10.1 General Description

Pulse can be used for the acceptance of up to 16 channels. When a note is recognised vend 1 (pin 1) will pulse a pre-set number of times. The amount of pulses as well as the high/low pulse ratio is configurable. For programming and configuration please refer to Section 4 of this User Manual.

⚠️	**Caution!**
Pulse is an unsecure interface and should not be used for new developments!	

5.10.2 Pinout

Pin	Name	Type	Description
1	Vend 1	Output	Credit Output Pulse Stream
2	Vend 2	Output	Not Used
3	Vend 3	Output	Not Used
4	Vend 4	Output	Not Used
5	Inhibit 1	Input	Inhibit Input Channel 1
6	Inhibit 2	Input	Inhibit Input Channel 2
7	Inhibit 3	Input	Inhibit Input Channel 3
8	Inhibit 4	Input	Inhibit Input Channel 4
9	Busy	Output	Output Busy Signal
10	Escrow	Input	Input Escrow Control
11	USB +	Data	Not Used
12	USB -	Data	Not Used
13	USB Vcc	Power	Not Used
14	Factory Use Only		Do not connect
15	+ Vin	Power	+12VDC Supply
16	0V	Power	0V Supply (GND)

5.10.3 Inhibit Control

The Inhibits can be used to either enable or disable the acceptance of those banknotes programmed on channels 1, 2, 3 and 4. The Inhibits are internally held high and must be set to low (GND) to enable banknote acceptance. If no Inhibit is set to low (GND) the Master Inhibit is set and the BV30 is disabled.

5.10.4 Escrow Control

The BV30 has a single note escrow facility. This allows the BV30 to hold onto the note once validated, and then only stack the note into a cashbox when the host machine confirms that the Vend operation has been completed. Please refer to 9.7 for further details.

5.10.5 Busy Control

This is a general-purpose busy signal. It is active low (pin 9) while the BV30 is in operation.

5.10.6 Low Power Mode

The Low Power Mode can be used to reduce the power consumption of the BV30 when idle. When the Low Power Mode option is set, the BV30 goes into the Low Power Mode after about 6 seconds after the BV30 is powered up and remains in this state until a note is entered. Following a note insertion, the BV30 returns to Low Power Mode approximately 1 second after a credit is given or note is rejected. Please refer to 9.8 for timing diagram and further details.

⚠️	**Caution!**
In Low Power Mode the front sensor is checked every second which can lead to a delay in accepting the note when it is presented!	

⚠️	**Caution!**
Configuration button functions are only available during power up before the BV30 goes into Low Power Mode!	

5.10.7 Credit Hold Function

If this function is enabled the BV30 will take the notes as normal but then wait until the escrow line is toggled low/high before it will then give out the pulses per denomination as set. After the pulses have been given, the BV30 will wait for another low/high toggle until the full value of credit pulses are given.

For example, with a setting of 2 pulses per dollar, a five dollar bill will give 2 pulses 5 times.

A Typical use of this option would be for a Pool table with a game price of $1. You could insert a $5 note and press a button that toggles the escrow line and releases the pool balls, this would then allow you to play the first game. The Validator holds onto the remaining credits until the game has finished and the button is pressed

again allowing the next game to begin, this continues until all the credits have been used.

The busy line remains low throughout the whole process and the BV30 remains inhibited until all pulses are given.

5.10.8 IF15 Interface

The IF15 is an interface that allows serial SSP to be used in machines without the need of updating the machine software. The IF15 is connected between the BV30 and the host machine. The IF15 communicates with the BV30 in serial SSP which gives more security along the length of the cable. The IF15 should be mounted close to the host machine control board where the IF15 converts to the pulse connection.

5.11 SIO and SI2

5.11.1 General Description

SIO (Serial Input/Output) is a very basic and low level serial communication interface. Messages are not echoed back. SIO uses 300 baud whereby SI2 uses 9600 baud. Please contact support@innovative-technology.com for SIO Interface Specification or other details.

⚠	**Caution!**
SIO and SI2 are outmoded and not recommended for new developments!	

⚠	**Caution!**
Innovative Technology Ltd. provides full SDK packages including Interface Specification, Implementation Guide as well as source code examples for SSP respectively eSSP only!	

There are 4 different combinations of SIO available: -SIO 300 Baud -SIO 300 Baud (Disabled at Start up) – A software enable must be sent to enable the validator. -SIO 9600 Baud -SIO 9600 Baud (Disabled at Start up) – A software enable must be sent to enable the validator.

The Baud rate of communications can be set at either 300 or 9600 using the Validator Manager Software. The data format according to the Baud rate used is shown in below table.

Baud Rate	Start Bits	Data Bits	Stop Bits
300	1	8	2
9600	1	8	1

BV30 will receive and transmit the following event codes.

Recognised Receive Codes to BV30		Transmitted Codes from BV30	
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	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		

User Manual BV30

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

Example transactions are shown below (see table 13):

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➔	

6   ROUTINE MAINTENANCE

6.1   Introduction

The BV30 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 BV30 may at some time require cleaning, belt changing or note path clearing.

6.2   Recommended Cleaning Intervals

Innovative Technology Ltd recommends to clean the optical lenses every month or as required. Dirt, dust or other residue leads to bad note acceptance and other performance degradation. Please refer to 6.3 for comprehensive cleaning instructions.

6.3   Cleaning BV30

Disconnect the power **BEFORE** carrying out any cleaning operations to avoid the risk of causing damage to the validator

⚠	**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 BV30, only use a clean dry cloth or a mild detergent where absolutely necessary.	

1.   Unclip Bezel from BV30 by pressing Lozenge Release Catch and pulling bezel

User Manual BV30

2. Wipe dirt and debris away from the wheel and lightpipe with a piece of cloth

User Manual BV30
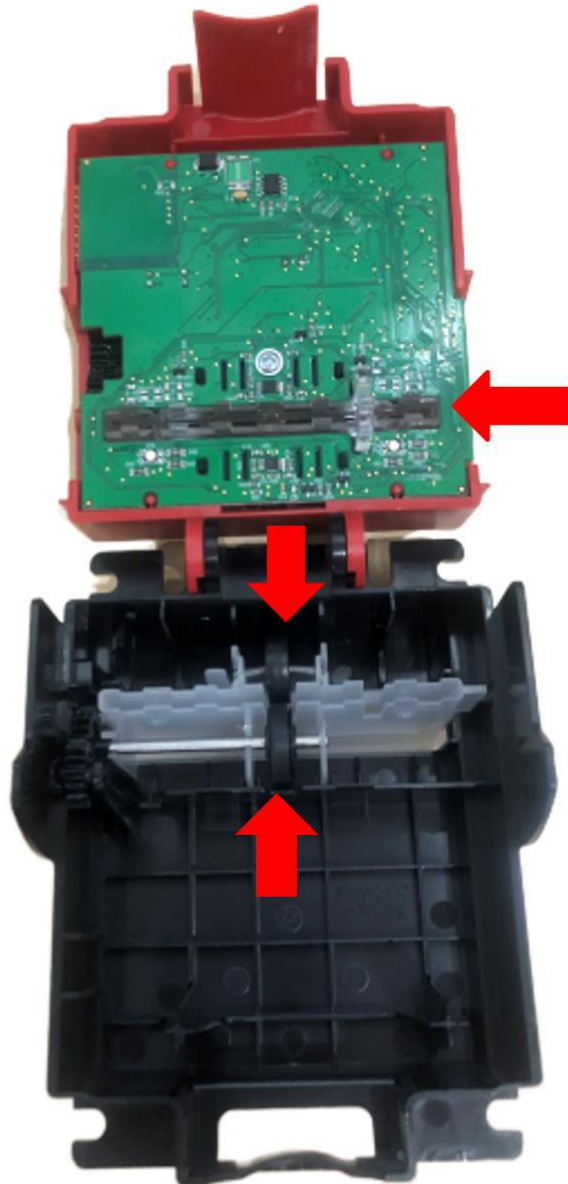
6.4　Clearing a Jam

1. Press the Lozenge Release Catch and softly pull open bezel	
2. Carefully pull the banknote from behind BV20 until it has come from validator head.	

6.5 Re-initialisation of the sensors

For this procedure, please use ITL Diagnostic Tools (v.2.0.2 and higher) and Green calibration paper LB00160.

1. Connect validator using IF-17/DA2 adapter only, open Diagnostic Tools program and choose active com-port:

2. Then click "Initialise" Tab:

3. 3. Validator will start initialization procedure.
Once the motor run continuously, insert green calibration paper

User Manual BV30

User Manual BV30
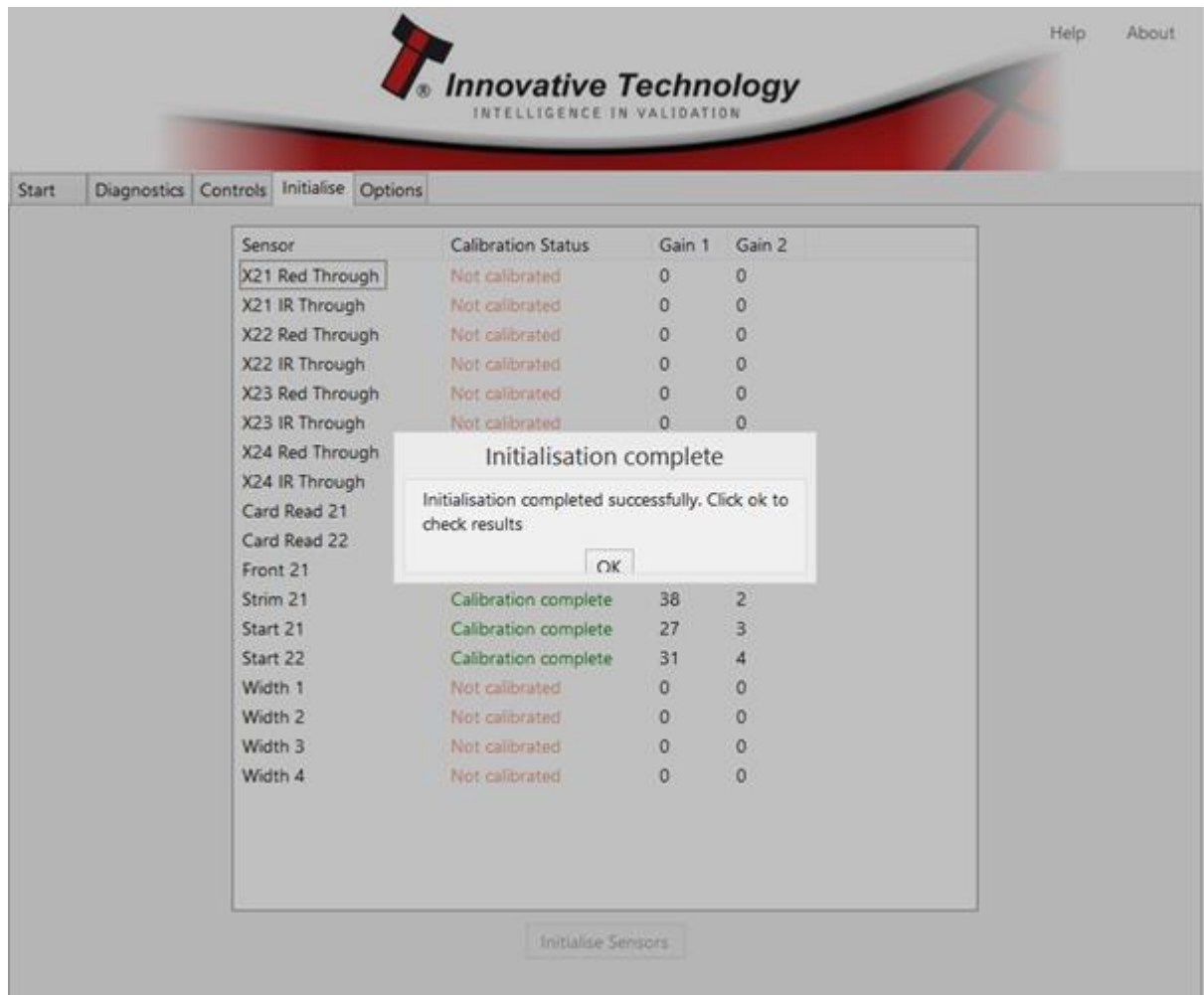
4. Initialize process complete:
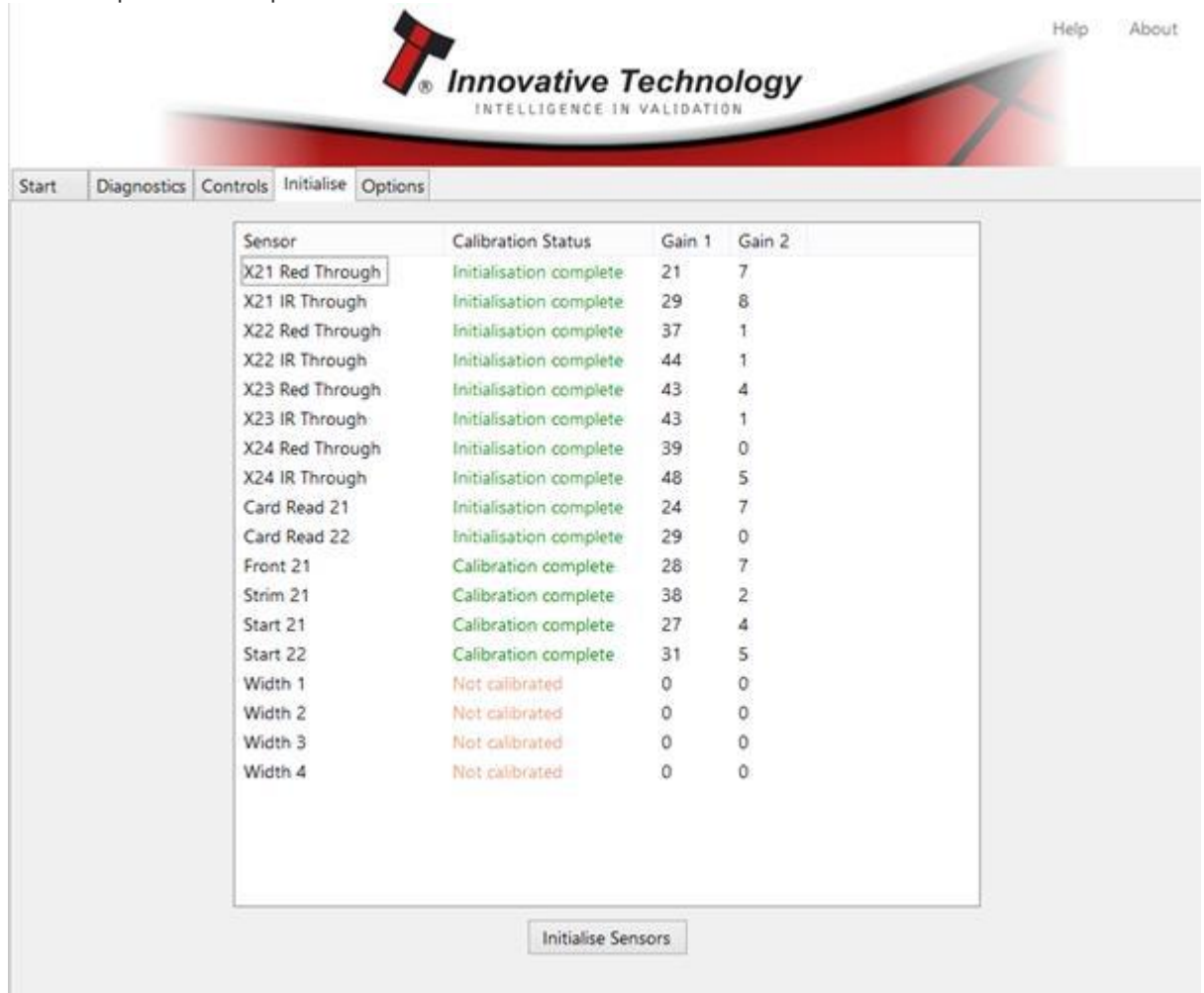
If some of statuses are red, try to repeat initialization procedure.

Having same result, probably validator require repairing/some elements replacing.

For initialization file receiving, please, contact support@innovative-technology.com

User Manual BV30

6.6   BV30 First Level Support

6.6.1   Bezel Flash Codes

The BV30 has built in fault detection facilities. If there is a configuration or other error, the BV30 front bezel will flash to indicate the status. Refer to the table below for a summary of the flash codes:

Red Flashes	Blue Flashes	Error	Recommend Action
1	2	Note Path Jam	Check the note path and clear any jammed notes as per Section 6.4
	3	Unit Not Initialised	Initialise the unit as per Section 8.10
	4	Sensor Covered	Check the unit for any debris then fully clean the unit as Section 6.4
3	1	Firmware Checksum	Try to reprogram the firmware/dataset as per Section 4.4
	2	Interface Checksum	Try to reprogram the firmware/dataset as per Section 4.4
	3	EEPROM Checksum	Return to the nearest authorised service centre for repair
	4	Dataset Checksum	Try to reprogram the firmware/dataset as per Section 4.4
4	1	PSU Voltage too Low	Check the power supply meets the specification in Section 7.4
	2	PSU Voltage too High	Check the power supply meets the specification in Section 7.4

6.6.2   Configuration Button Functions

The BV30 has a multi-function configuration button that can perform several operations:

User Manual BV30

Configuration Button	Power Status	Function
Quick Double Press	Powered ON	Current Interface Indicator
Press and Hold until Bezel illuminates, then release	Powered ON	Toggle between Primary Protocol and SSP
Press and Hold as Power is Applied	Powered OFF then ON	Resets Encryption Key to Default

6.6.3   Check Power Connection

In cases where the BV30 is not powering on, check that the 16-pin connector is securely connected to the validator. A locating tab ensures that this cannot be connected incorrectly when using the ribbon cable sold by Innovative Technology Ltd.

If the cable is connected correctly, ensure that the cable is in good working condition and is not damaged. Finally, check that the Power Supply is providing the voltage/current required using a voltmeter or multi-meter.

6.6.4   Communication with the host

If there is no communication between the BV30 and the host machine check that the 16-pin connector is securely connected to the validator and that there is no damage to the cable.

With the BV30 powered on, check the protocol that is being used to ensure it is configured correctly for the host machine. Section 8.2 explains how to check the protocol. Refer to the lookup table below to determine which protocol is currently in use:

Flashes	Interface	Cct plain	Cct 8-bit	No Escrow Timeout	DES	Low Power	High Speed	Pulse High	Pulse Low	Pulse per £	SIO start dis	Credit Hold	Binary
1	SSP												
2	Pulse							ms/10	ms/10	value		3	
3	MDB												
4	IF30												
5	IF31												
6	Cctalk	1	2	3	4								
7	SIO			3			1				2		
8	Parallel			2									1
9	SP4							ms/10	ms/10	value		3	
10	NS												
11	IF32						1						

(not all protocols in this table are supported by the BV30, refer to Section 6 for a list of supported protocols)

---

7   TECHNICAL DATA

7.1   Dimensions
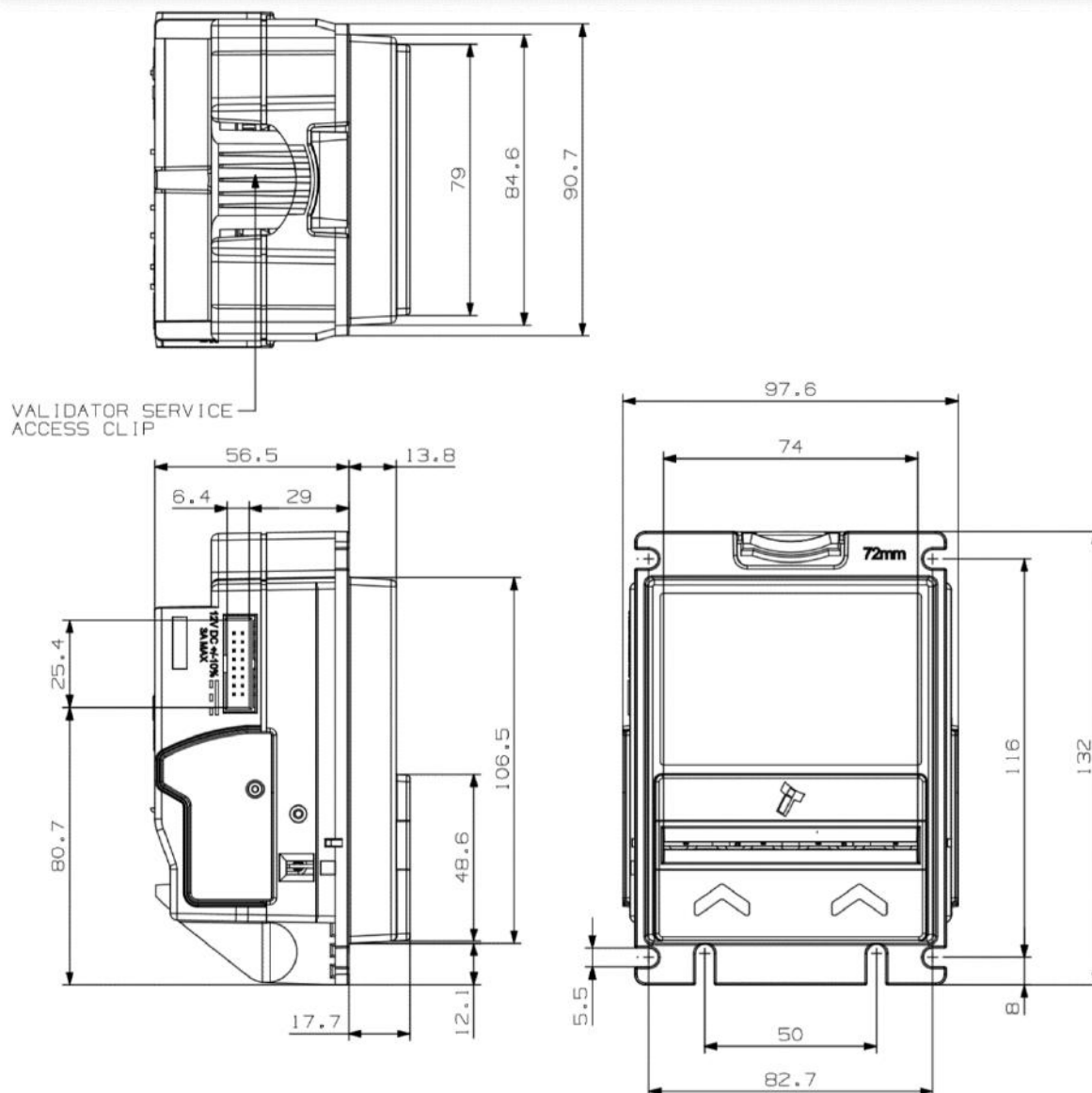
7.2   Weight

Unit	Weight
BV30	300g

7.3   Environmental Requirements

Environment	Minimum	Maximum
Temperature	+3°C	+3.7V to +12V
Humidity	5%	95% Non-condensing

7.4   Power Requirements

7.4.1   Supply Voltages

Supply Voltage	Minimum	Nominal	Maximum
Supply Voltage (V DC)	+ 10.8 V DC	+ 12 V DC	+ 14.2 V DC
Supply Ripple Voltage	0 V	0 V	0.25 V @ 100 Hz

7.4.2   Supply Currents

Supply Current	Maximum
Standby	0.15 A
Running	0.54 A
Peak	1.50 A

7.4.3   Power Supply Guidance

The BV30 requires a stable 12 V DC / 1.5 A power supply. Please check the power requirements of your host machine and other peripherals to dimension a suitable power environment for your machine setup.

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

Power Supply Unit	Specification	RS Stock Code	Farnell Stock Code
TDK Lambda SWS50-12	+12 V DC / 4.3 A	466-5869	1184645

7.5   Interface Logic Levels

Interface Logic Levels	Logic Low	Logic High
Inputs	0V to +0.5V	+3.7V to +12V
Outputs with 2K2Ω pull-up resistor	+0.6V	Pull-up voltage of host interface
Maximum Current Sink	50mA per Output	

7.6   Reliability Data

Below is an explanation outlining the Mean Cycles Between Failure (MCBF) & Mean Cycles Between Interruption (MCBI) for the BV30. Where a cycle is defined as a note accepted or rejected.

The difference between MCBF and MCBI is that a failure is classed as an event which will require a service call – e.g. unit is seeing poor acceptance. Whereas an interruption is an event which store/site staff could rectify without a trained engineer present – e.g. clearing a jam.

The MCBF of the BV30 is 100,000.

7.7   Media Requirements

Due to the bezel size of the BV30, it cannot accept notes that are wider than 72mm. The minimum and maximum dimensions for notes in are as follows:

	Minimum	**Maximum**
Length	110mm	180mm
Width	57mm	72mm

User Manual BV30

8 COMPLIANCES AND APPROVALS

8.1 EC Declaration of Conformity

- RoHS
- EN Directives
- UL
- REACH
- WEEE
- Central Bank Approvals

<< Back to Contents

9   APPENDIX

9.1   Cable Drawings

CN00174 Ribbon Cable (validator to IF-17):
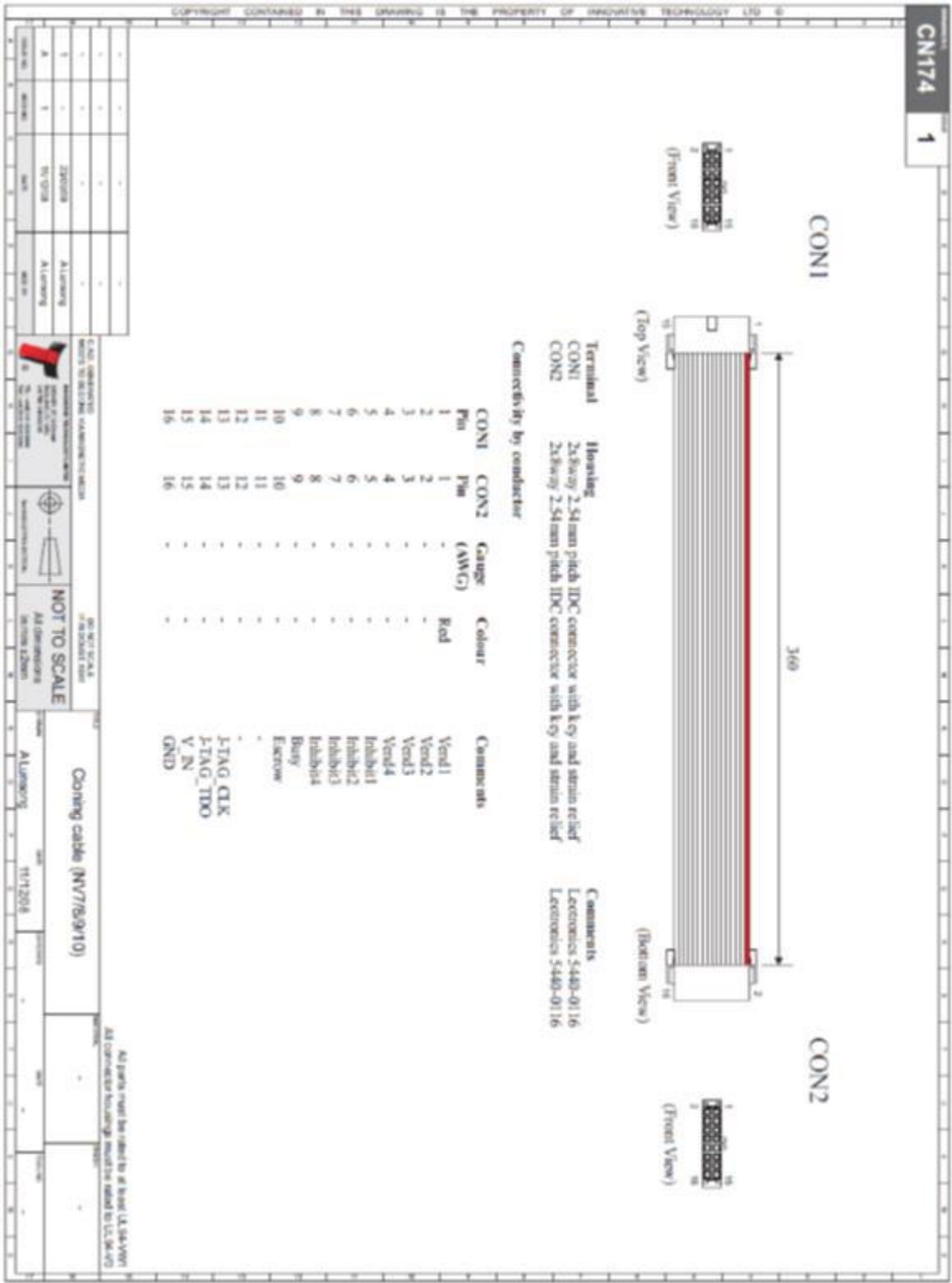
300mm or longer

User Manual BV30

IF17/IF18/DA3 Power Cable:

IF17/IF18/DA3 Power Cable:
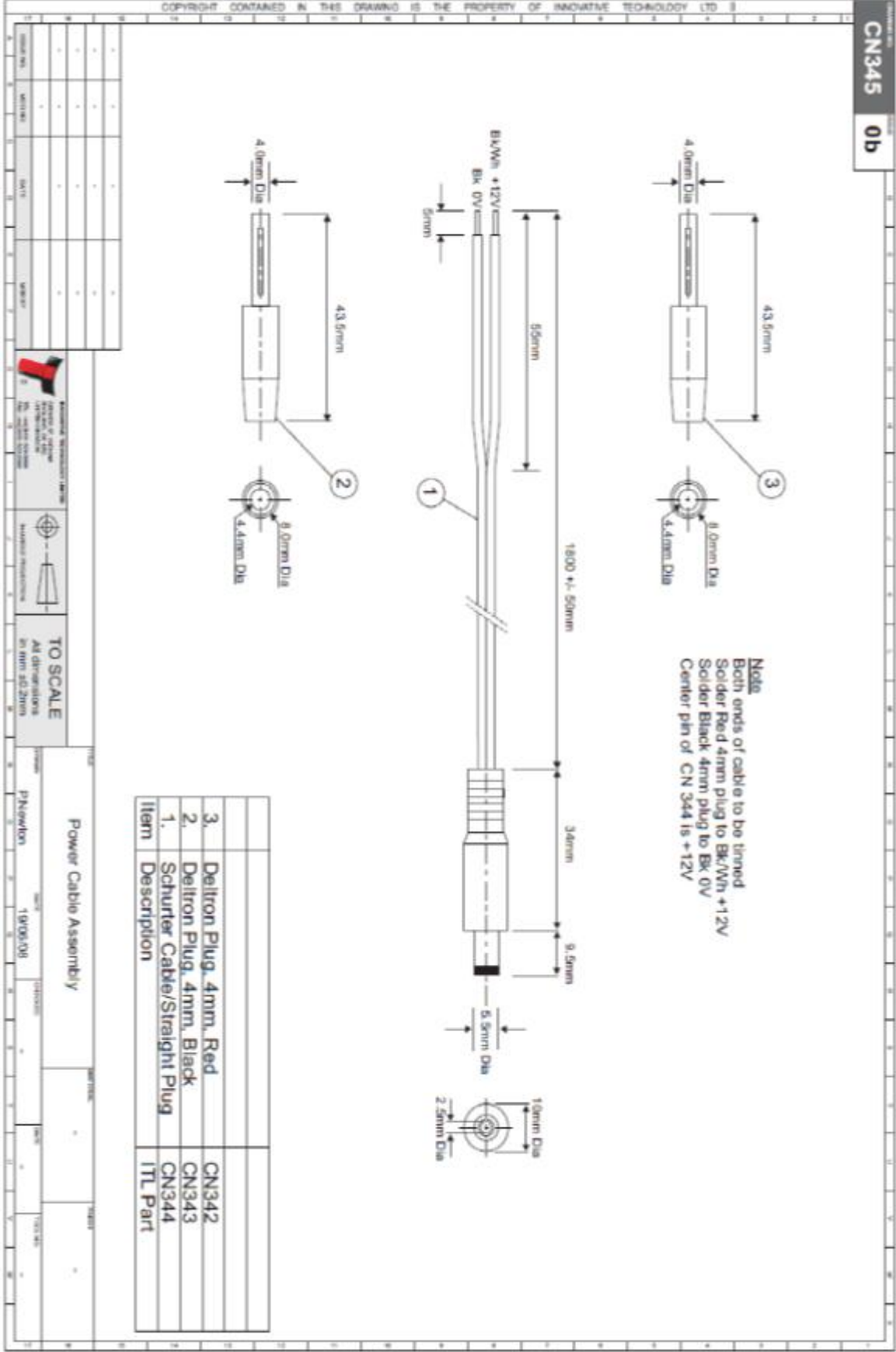
<u>CN00214</u> **USB A-B Cable** (host to IF-17):

ITL Part Number	Description	Details
CN214	USB Cable	USB 2.0 Compliant Type A to Type B cable

9.2   Connector Specifications

Type	Vendor	Part Number	Pins	Pitch	Polarising
Housing	Leotronics	2652-2161	2x8	2.54mm	With Key
Crimp	Leotronics	2653-2000			Female
Housing	Molex	90142-0016	2x8	2.54mm	With Key
Crimp	Molex	90119-2121			Female

9.3   Switching to Programming Mode (SSP)

Press and Hold the Configuration Button for at least 2 seconds whilst the BV30 is powered up. The Bezel LED will flash rapidly to indicate that SSP is being loaded. Once this process has finished the BV30 will reset. The BV30 will now be in Programming Mode (SSP) and allow connection to a PC via a DA2 adapter or connection to a DA3.

9.4   File Naming Convention

```
THB01N02_BV00304012514000_IF_01
```

Dataset Code | Firmware Code | Firmware Interfaces

Dataset Code **THB 01 N 02**

- **3 Letter Currency Code.** As defined by ISO4217
- **Denomination code.** A two-figure number to distinguish between datasets for the same currency that contain different denominations
- **Validator Type**
  - 1 – NV10USB
  - 2 – BV20
  - 3 – BV50
  - 5 – BV100
  - 6 – NV20
  - B – NV9USB
  - N – BV30
  - E – NV9USB+
  - F – NV9ST
  - 0 – SH/SCS
- **Version Number.** The version number is incremented each time changes are made to dataset

Firmware Code   BV0030   401   2514000

- **Validator Type**
  - BV0020 – BV20
  - BV0050 – BV50
  - BV0100 – BV100
  - BV0030 – BV30
  - NV0200 – NV200
  - NV0009 – NV9USB
- **Firmware Version.** 3 digit number incremented with each release of firmware
- **Mod Number.** Internal ITL modification number

IF_01

Firmware Interfaces.
The interfaces included within the firmware file.
IF_01
SSP   - Smiley ® Secure Protocol
PAR*   - Parallel
PL1*   - Pulse
BIN*   - Binary
CCT   - ccTalk
MDB   - Multi Drop Bus
SIO   - Serial Input/Output
IF_02
SSP   - Smiley ® Secure Protocol
Other customer specific interfaces
IF_03*
SSP   - Smiley ® Secure Protocol
CC1*   - ccTalk Hopper Emulation
CC2*   - ccTalk Payout
CC4*   - ccTalk Note Float Payout

* -Only available for specific validators

User Manual BV30
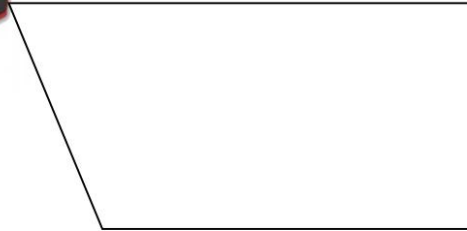
9.5   Free Fall Cashbox Advice

When installing BV30, adequate space in width and length must be allowed for received notes to be free falling behind BV30. Notes not allowed free falling will cause validator to malfunction.

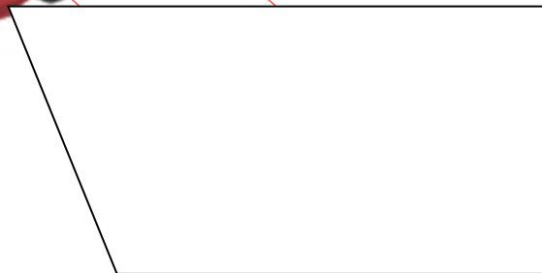Opening dimension must be large enough to allow the longest note to fall through

Depth must be sufficient to store the required number of notes

Front face of the cash box should fit into the recess of the rear of BV30 unit

The top of the cash plate should fit into the recess of the rear of BV30 unit
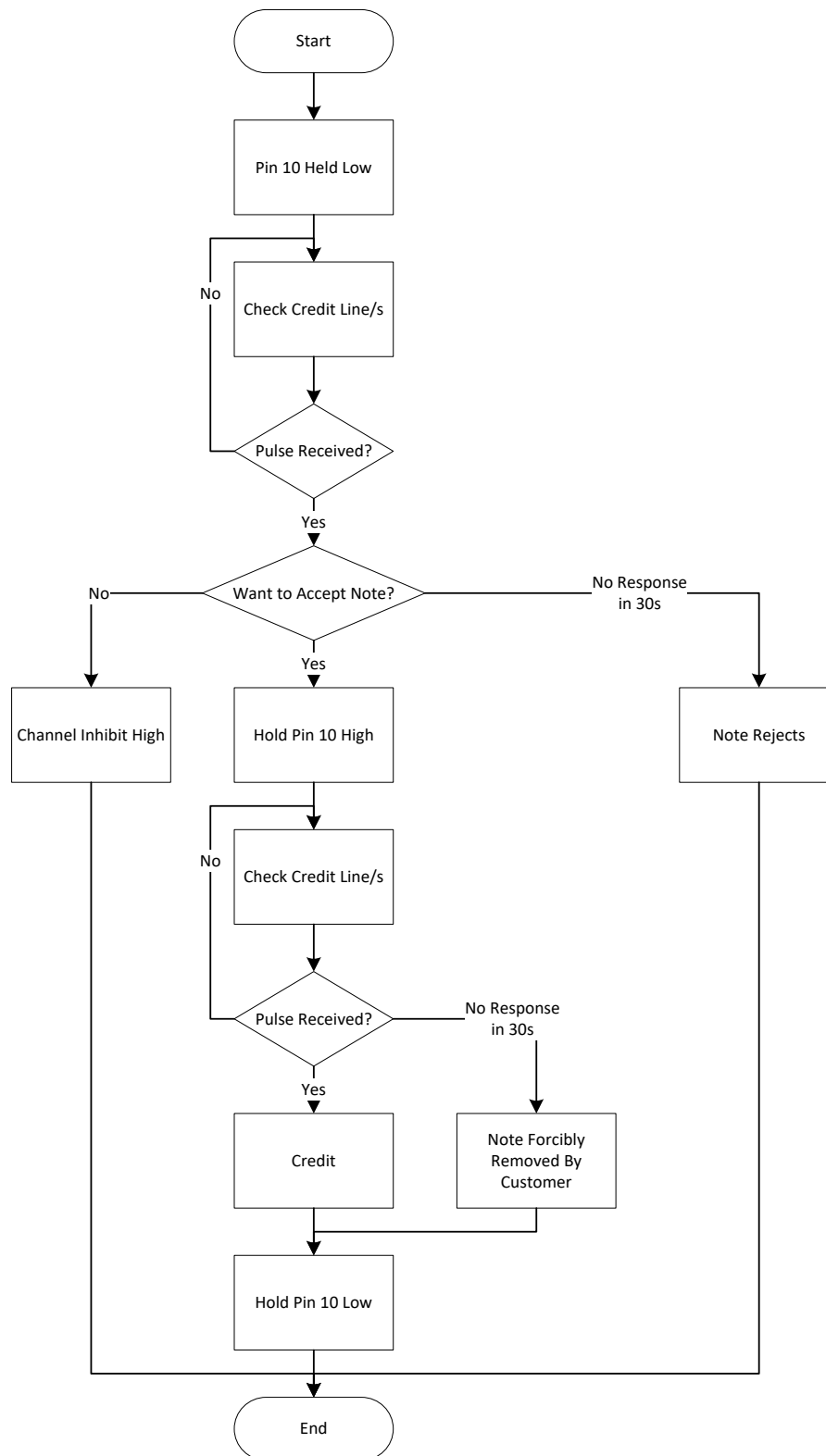
9.6   ccTalk DES Encryption – Trusted Mode

The DES compatibility can be toggled on/off using Validator Manager version 3.3.12 or later. On the menu select Tools - Set Validator Options. On the General Options tab, the "cct DES encrypted" checkbox will be available when ccTalk® (CCT) interface is set. Click Apply Changes once the validator is configured as required. In DES Trusted mode host requests the security keys of peripheral. Once obtained, the keys need not be transferred again until the peripheral is replaced. For key exchanging, please power on unit in ccTalk protocol and wait for a several seconds for key exchanging.

Use configuration button for rollback any previously set ccTalk key to original (see Configuration Button options, section 7.2).

9.7   Escrow Control

The BV30 has a single note escrow facility. This allows the BV30 to hold onto the note once validated, and then only stack the note into a cashbox 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 user after 30 seconds. If the host machine itself aborts the transaction by setting the corresponding inhibit input high, the note is returned immediately. The sequence of operation is as follows:

User Manual BV30

```
                          ┌──────────┐
                          │  Start   │
                          └────┬─────┘
                               │
                          ┌────▼──────┐
                          │ Pin 10    │
                          │ Held Low  │
                          └────┬──────┘
                               │
              No          ┌────▼──────────┐
              ┌───────────│ Check Credit  │
              │           │ Line/s        │
              │           └────┬──────────┘
              │                │
              │           ┌────▼──────┐
              │           │  Pulse    │
              │           │ Received? │
              │           └────┬──────┘
              │             Yes│
```

Start
Pin 10 Held Low
No — Check Credit Line/s
Pulse Received?
Yes

No — Want to Accept Note? — No Response in 30s

Channel Inhibit High

Yes — Hold Pin 10 High — Note Rejects

No — Check Credit Line/s

Pulse Received? — No Response in 30s

Yes

Credit — Note Forcibly Removed By Customer

Hold Pin 10 Low

End

⚠️	**Caution!**
Only book the credit on the second Vend pulse!	

9.7.1   Escrow Timing Diagram
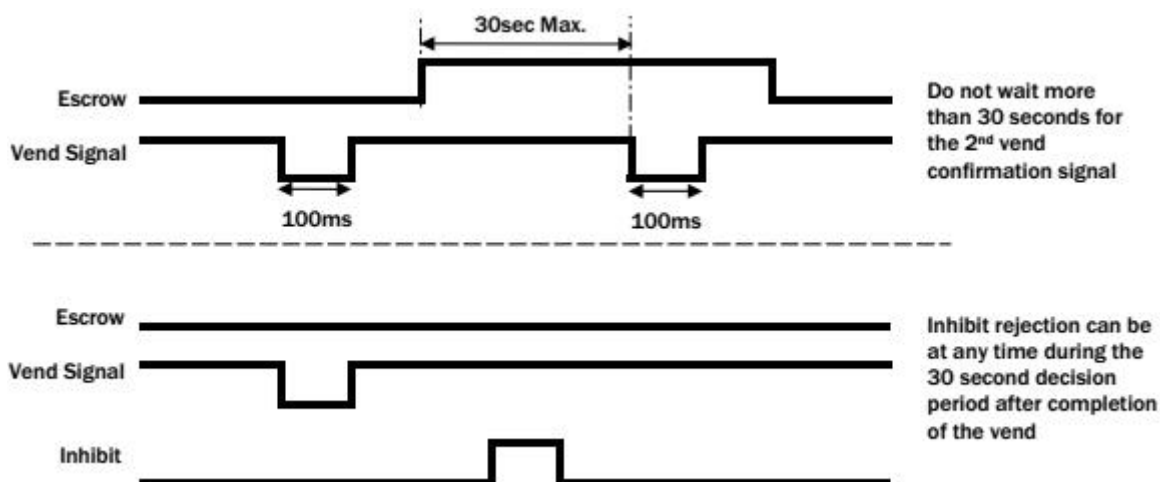
9.8   Low Power Mode Timing Diagram

⚠️	**Caution!**
Low Power Mode can only be used with the above Parallel, Pulse and Binary Protocols and only be enabled by correctly completing the configuration cards or Validator Manager Program.	

Low Power Mode can be used with all none serial communication protocols to reduce the power consumption of the BV30 when idle. When the BV30 is in this state the current consumption is reduced to approximately 1.2mA. The BV30 goes into low power mode approximately 4 seconds after the validator is powered up and remains in this state until a note is entered (Time A). Following a note insertion the BV30 returns to Low Power mode approximately 1 second after the Busy line goes High (After credit is given or note is rejected). (Time B)
Low Power mode uses 3 control lines: Vend – Pin 1, Inhibit – Pin 5 and Busy – Pin 9

User Manual BV30

<< Back to Contents

When the Validator is enabled the Inhibit Line is Low and the Busy Line is High. This remains the same until a note is inserted (Time A).
When a note is inserted under the front sensor the BV30 wakes up and the busy line goes low to indicate that the validator is in use. The busy line remains low during the validating and stacking process and once the note has been successfully validated and stacked the vend line goes low to issue the credit.
After the credit is issued the busy line goes high and approximately 1 second after the busy line goes high (Time B) the BV30 goes back into low power mode.
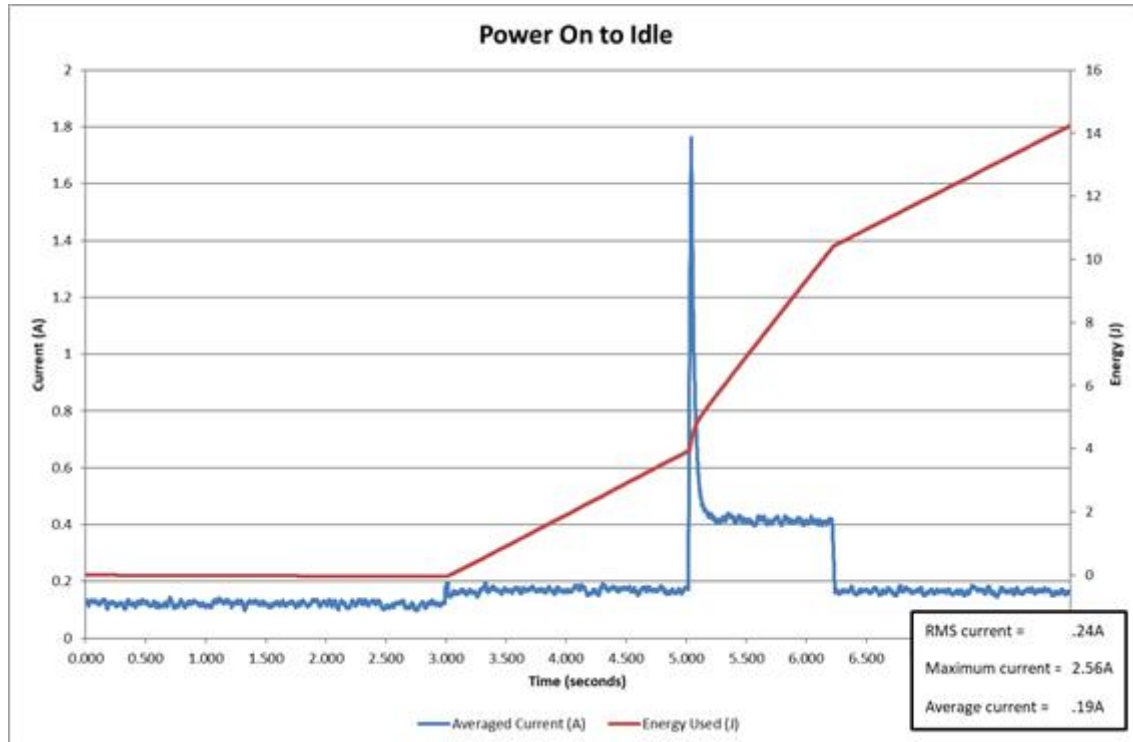
9.9 Energy Profiles

9.9.1 Purpose of test

- To test the current usage at various stages of operation.
- SOP ITLUKDOCID-165993146-266 to be used.
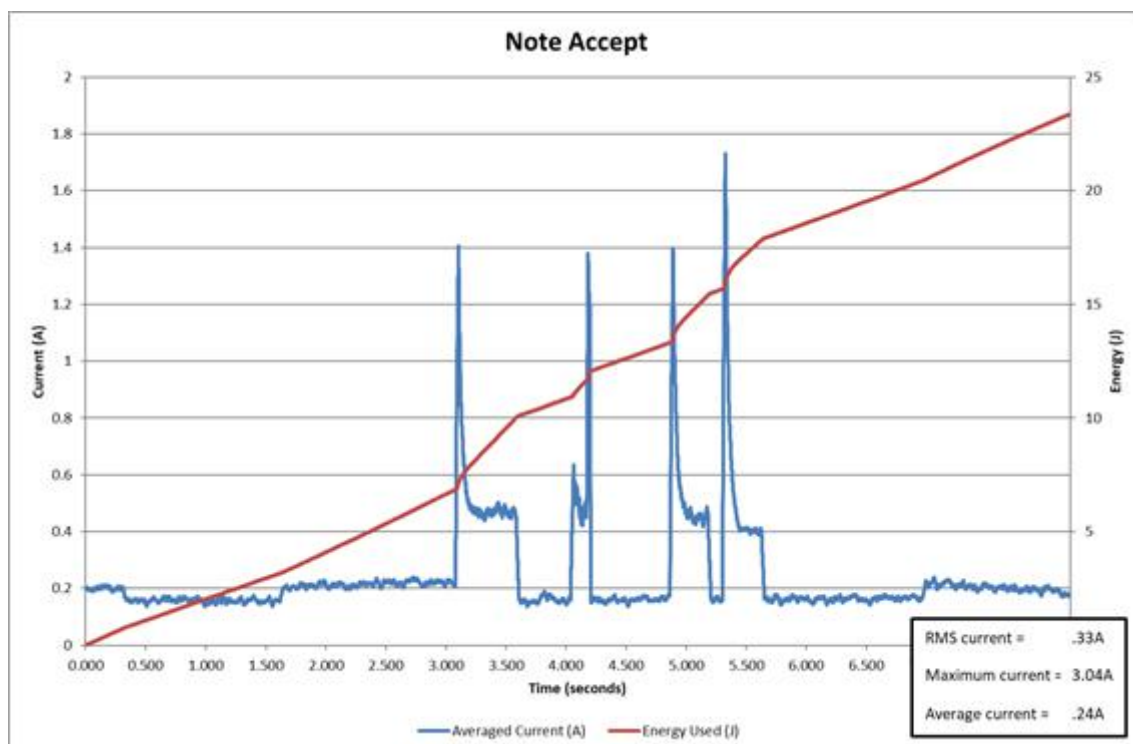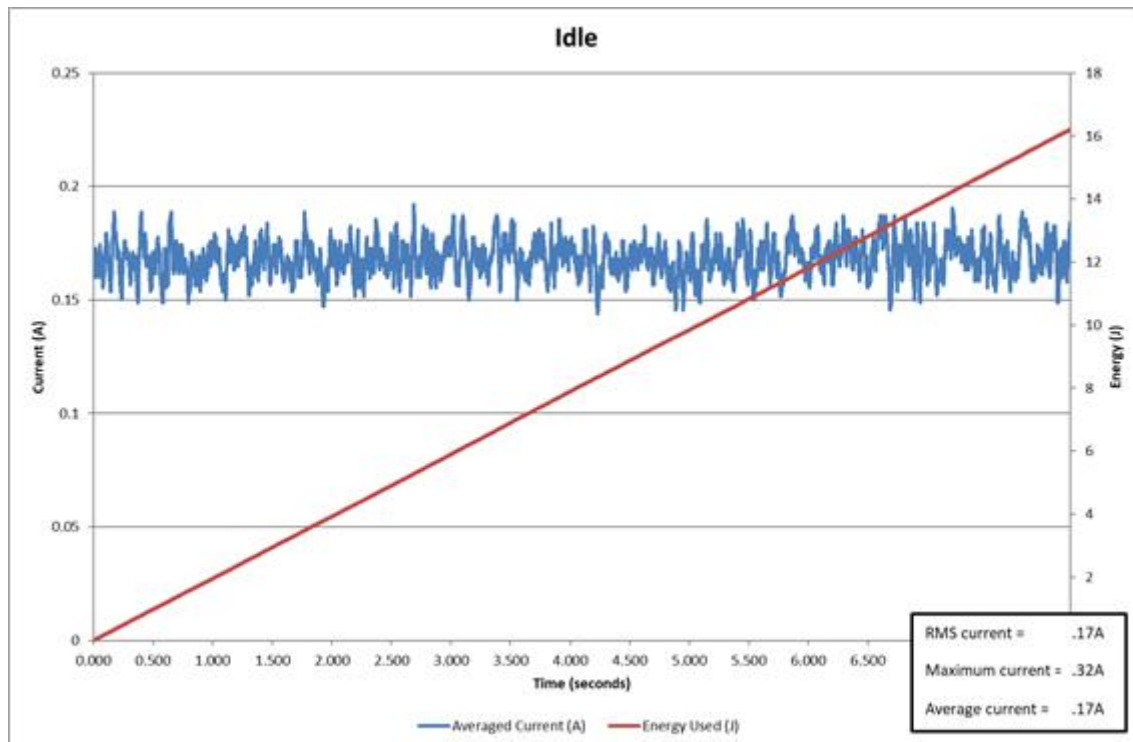
9.9.2 Pass Fail Criteria

- Pass – Current not exceeding 3A over a prolonged period
- Fail – Current exceeds 3A over a prolonged period
- 3A is the peak current as stated in the product specification for BV30

User Manual BV30

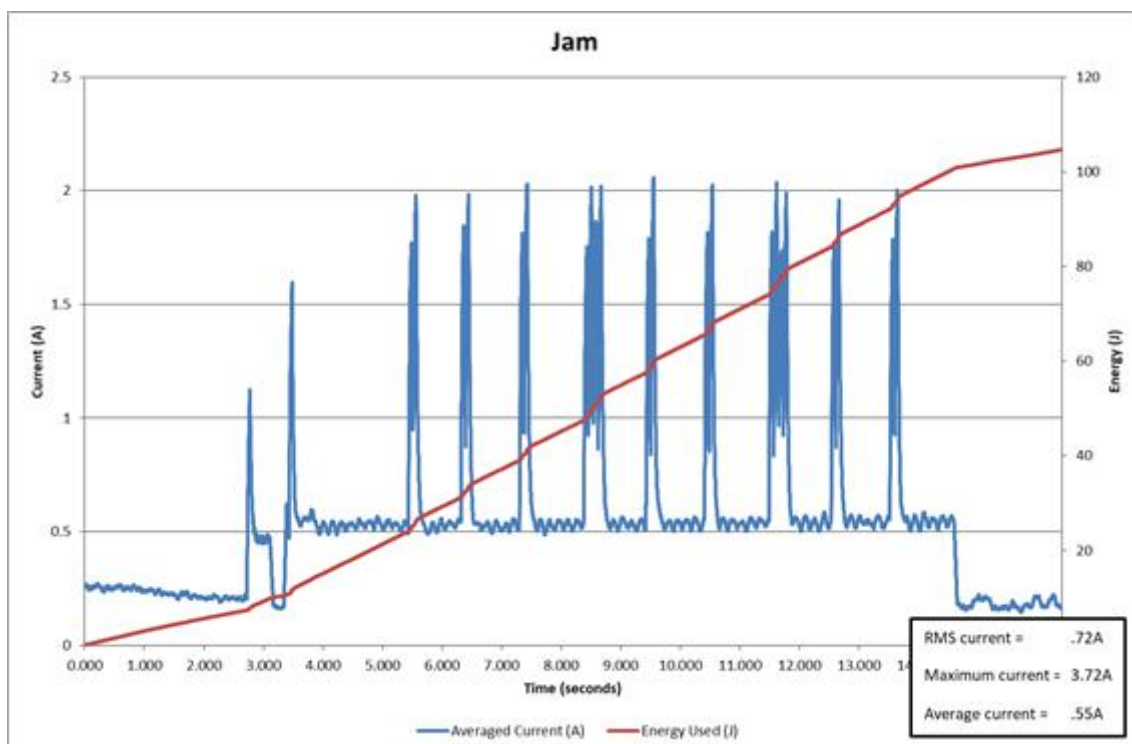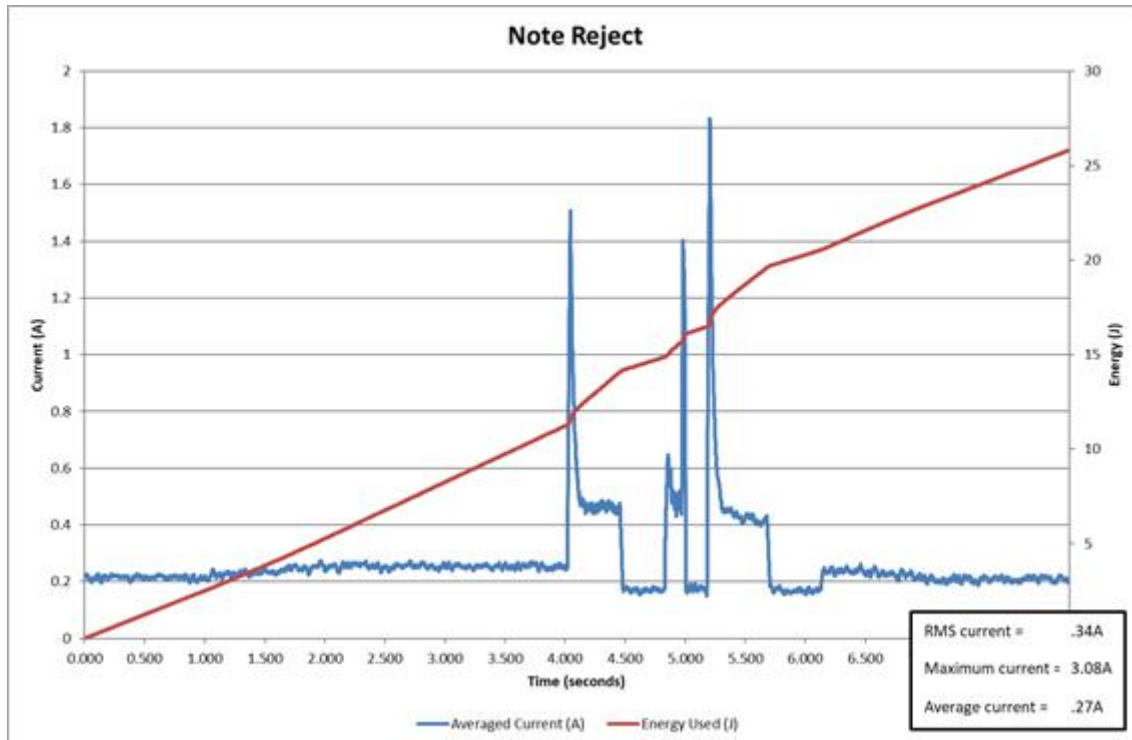## 9.9.3   Result
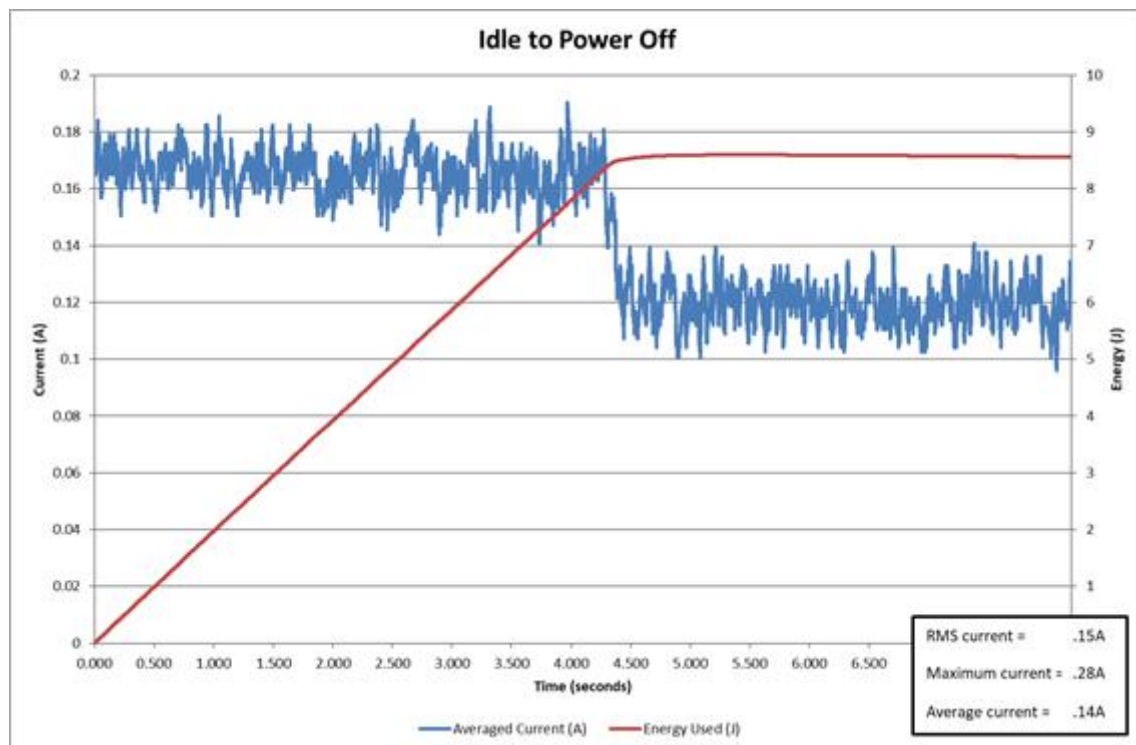
User Manual BV30

User Manual BV30

9.9.3.1 Conclusion and Recommendations

- BV30 operating within product specification.

9.9.3.2 Compiled by

- Brian Doyle

User Manual BV30