SECTION 4

SMART Hopper
MANUAL SET

MECHANICAL
AND ELECTRICAL
MANUAL

INTELLIGENCE IN VALIDATION

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SMART HOPPER MANUAL SET – SECTION 4

4. MECHANICAL AND ELECTRICAL MANUAL

This section is one part of a complete manual set: Design Engineers who are designing a host machine cabinet, or looking to integrate the SMART Hopper unit into an existing cabinet should read this section.

This section contains the all the mechanical and electrical information a designer needs to effectively integrate the SMART Hopper unit into a host machine.

4.1 Introduction

The SMART Hopper unit is made up of two basic components: the Smart Hopper and the base plate.

The SMART Payout unit is a device that can validate, store and later dispense coins of mixed denominations.

4.2 Assembly and Fitting Instructions

> ### ⓘ Note on Safety
>
> 1) **Do not put a hand into the hopper while power is applied.**
> 2) **It is possible for a static charge to be transferred onto the coins during normal operation. The coins should be discharged to earth before they are accessible to the user.**
> 3) **The base plate should always be connected to earth**

Connecting the SMART Hopper module to the base plate is a simple operation, described in the steps outlined here:

1. Secure the mounting plate using the 6 fixing holes shown in in diagram below:-
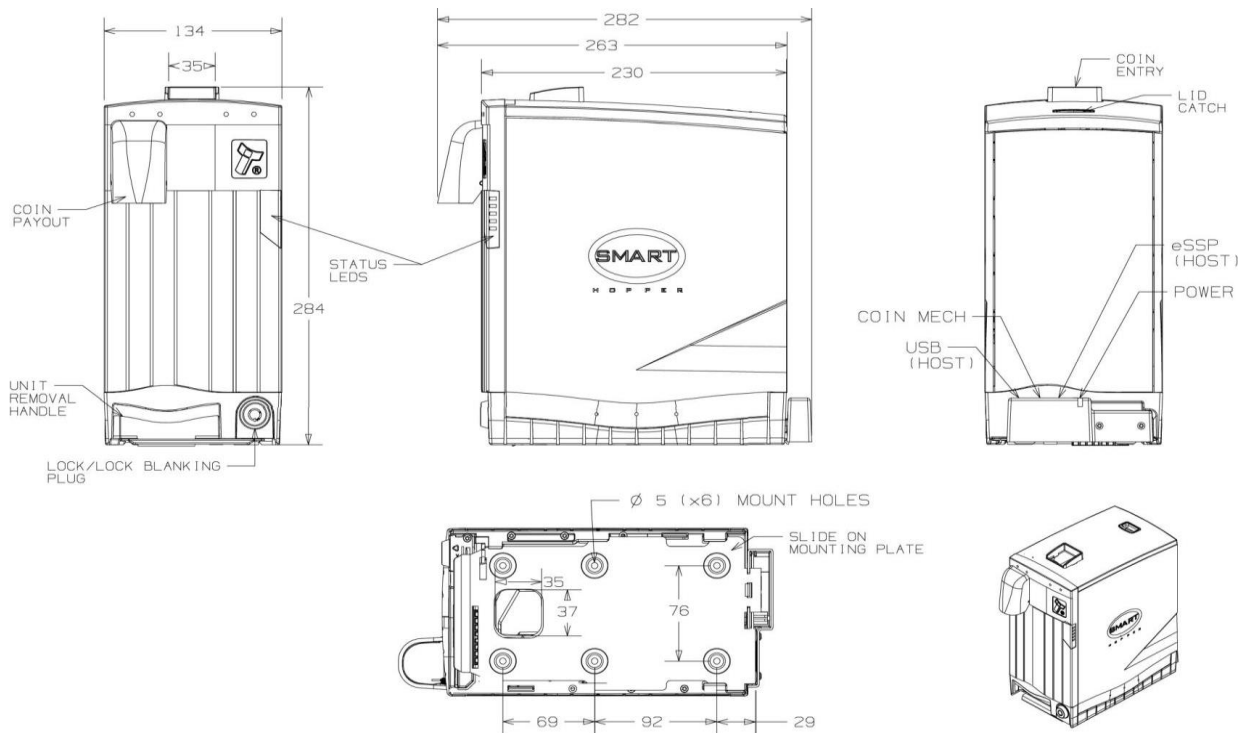

> ### ⚠️ WARNING!
>
> **Always ensure the bottom cash box exit on the underside of the SMART Hopper is clear to allow coins to exit. Failure to do so can result in permanent damage to the internal mechanisms**

2. Connect the cable from the host machine to the connector on the rear of the mounting plate. See Section 2.2.6 - Interface Connector for connection details.

   What each connector used for:-
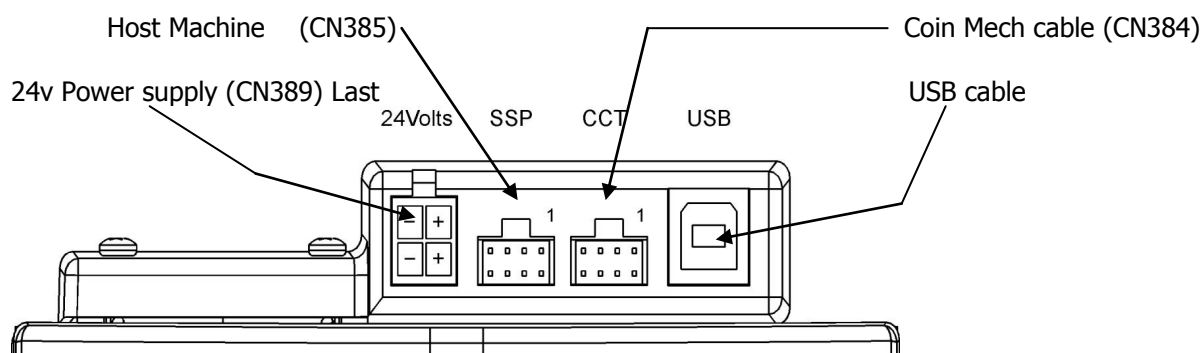
3. Slide the hopper onto the base plate; ensuring the hopper is fully pushed into position.

4. Apply power to the machine.

4.3   Technical Specifications

The full technical specifications for the SMART Hopper unit can be found in Section 6, Appendix B of this manual set. A brief summary is given here:

DC Voltage	Minimum	Nominal	Maximum
Absolute limits	21.6 V	24 V	26.4 V
Supply ripple voltage	0 V	0V	0.25 V @ 100 Hz
Supply Current:			
Standby			200 mA
Running			3 A
Peak (motor stall)			6.5 A

Interface Logic Levels	Logic Low	Logic High
Inputs	0 V to 0.5 V	+3.7 V to +12 V
Outputs (2.2 kΩ pull-up)	0.6 V	Pull-up voltage of host interface
Maximum current sink		50 mA per output

We recommend that your power supply is capable of supplying 24V DC at 8 A.

4.4   Earth Bonding

It is **very** important that the base plate is bonded to earth, as lack of proper bonding can cause communication issues and failures with the SMART Hopper unit.

The earth bond should be made to any of the 6 holes in the bottom of the base plate and be bonded to mains earth, typically through the Power Supply Unit.

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

4.5   Cable Specifications

The **minimum** specification for wire used in power cables for the SMART Hopper unit is given here:

| Minimum AWG	Nominal current rating	Peak current rating	Cable rating	Insulation rating
24	3 A	6.5 A	8 A	80 °C

Do not use wire of an inferior specification, as this can cause operating problems with the SMART Hopper unit.

4.6   Electrical Interfaces

SMART Hopper

All the connectors needed to set up the SMART Hopper unit are easily accessible on the bottom base: there are four connectors that are used to allow interfacing and programming:
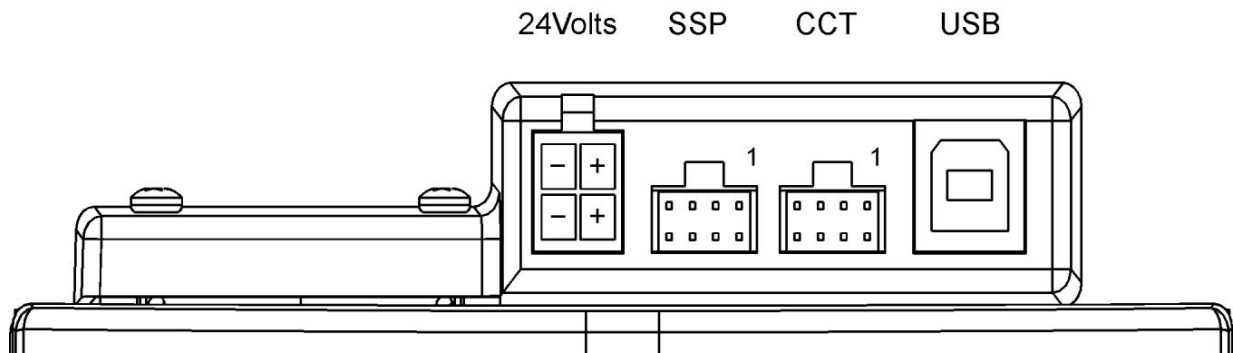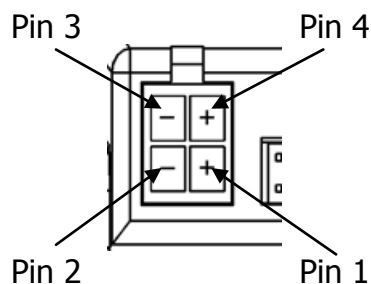

	Information
Power always required regardless of connection type.	

Power is always required on pins 3 and 4 of the 4 way connector.

The first connector is a 4 pin socket used to power up the SMART Hopper.

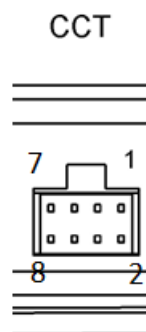| Pin	Description
1	+24V DC
2	0V / Ground Connection
3	N/C
4	N/C

Interface communication from the SMART Hopper unit to the host machine can communicate via SSP or CCT coin mech.

The SSP pin numbering of the socket is shown below, as well as an overview of the socket connections:

SSP
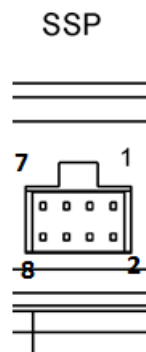
Pin	Description
1,3&4	N/C
2	0V / Ground Connection
7	Serial Data Out (Tx)
8	Serial Data In (Rx)

The Coin Mech pin numbering of the socket is shown below, as well as an overview of the socket connections:

CCT

Pin	Description
1	+12 V
2	0V / Ground Connection
7	Serial Data Out (Tx)
8	Serial Data In (Rx)

The USB connector is a standard Type B USB socket. The USB socket can be used for programming the SMART Hopper unit and also bench testing – a USB 2.0 compliant Type 'A' to 'B' lead can be used to do this. USB cables should be electrically shielded and less than 5 metres long. **Please note:** Direct USB should **NOT** be used for Host communications. If USB is required than our IF17 (TTL to USB) should be used.

USB
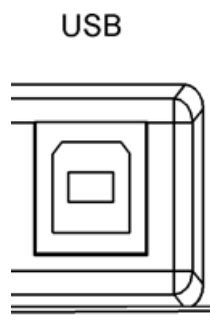
4.7   Basic Operation

The SMART Hopper unit is a device that can store and later dispense a large number of mixed denomination coins.

The SMART Hopper unit has two Light Emitting Diode (LED) indicators that are used to show the status of the unit (one Red, one Green) – these can be found on the front of the unit. If the SMART Hopper unit is operating normally, only the Green LED should be lit: when operating normally this LED will flash once every second.

The SMART Hopper unit has inbuilt fault detection. If there is a configuration or other error, the Status Indicator LEDs will flash in a particular sequence.

A summary of the Flash Codes for the SMART Hopper is shown below:
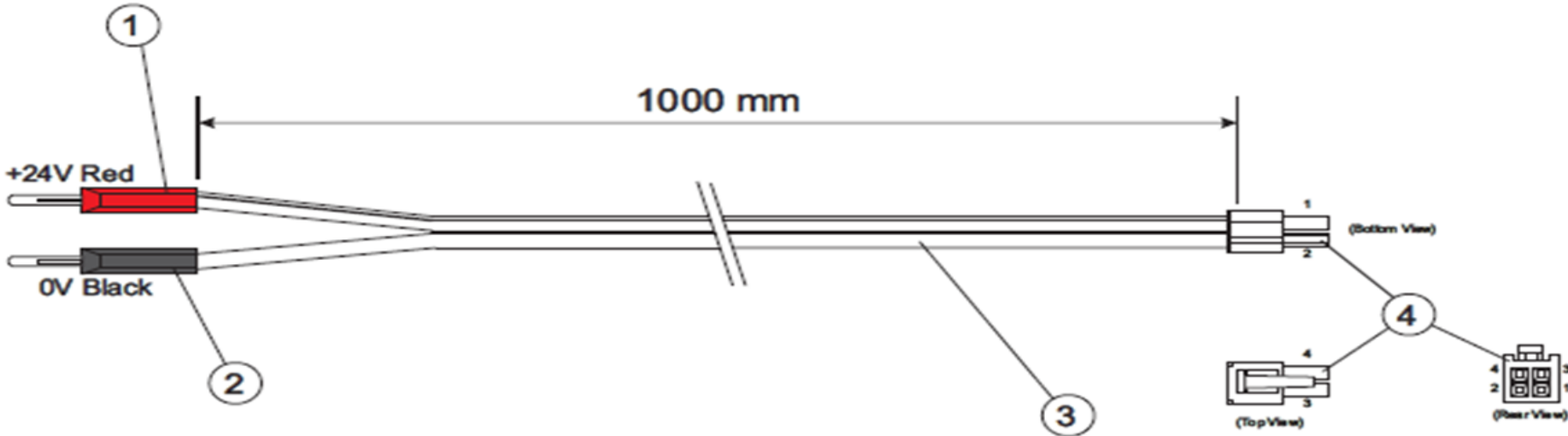
Status Indicators		Flashes	Indicated Error	Comments
Red	**Green**			
	🟢	0	No LEDs lit	No power
🔴		1	Hopper Disabled	
		2	Calibration Fault	
		3	No Encryption Key set	
		4	Coin Jam	Remove trapped coin (see Section 2.1 of this manual set)
		5	Fraud Attempt Detected	
		6	Hopper Empty	Check coins in Hopper and levels are correct in software.
		7	Memory Checksum Error	
		8	Hopper sensors are not Initialised	
		9	Lid removed	Check lid on ok, if ok problem with sensor return to ITL.

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4.8   Spare Parts

Hopper module

The SMART Hopper module has several cables designed to be used with the module are available, and these are shown below:

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

COMMENTS:

Any commercially available USB 2.0 compliant Type A to Type B cable is suitable – these are available from many different sources. The cable should be electrically shielded and less than 5 metres long.

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ITL Part Number	Description	Details
CN389	SMART Hopper power cable	Provides 24V supply only to SMART Hopper

COMMENTS:

Please consult the tables on the next page for pin out and connector information.

⚠️ **WARNING!** **Use correct wire gauges**	If you choose to make your own cables, you must make sure that the wire gauges are suitable for use with the SMART Hopper unit. The minimum wire gauge for the CN389 power cables is **24 AWG**, with **22 AWG** being recommended.

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CN389 Parts List

Item	Qty	Description	Supplier	Alternative
A	1	4mm Stackable Plug, Red	Deltron 553 Series 553-0500	Farnell 553-0500-01
B	1	4mm Stackable Plug, Black	Deltron 553 Series 553-0100	Farnell 553-0100-01
C	1	Polarised Audio Wire, 2 x 0.5mm AWG 20-18	---	---
D	1	4 Circuit Receptacle Housing,4.2mm PE Series UL94V-2	Tyco	Farnell 794954-4
E	2	22 AWG stranded wire, PVC insulated	Tyco	Farnell 1586315-1

CN389 Connectivity

Connector	Pin	Gauge	Colour	Comments
CON1	1	22 AWG	Black/Red	24V (Hopper Power)
	---	---	Black	0V (Hopper GND)
CON2	---	---	Black/Red	24V (Hopper Power)
	1	22 AWG	Black	0V (Hopper GND)
CON3	1	22 AWG	Black/Red	24V (Hopper Power)
	2	22 AWG	Black	0V (Hopper GND)

ITL Part Number	Description	Details
CN385	SMART Hopper User Interface cable	Connects SMART Hopper to Host for eSSP/SSP communications. Requires 24V power cable.

COMMENTS:

Please consult the tables on the next page for pin out and connector information.

⚠ **WARNING!**

Use correct wire gauges

If you choose to make your own cables, you must make sure that the wire gauges are suitable for use with the SMART Hopper unit. The minimum wire gauge for the CN385 power cables is **24 AWG**, with **22 AWG** being recommended.
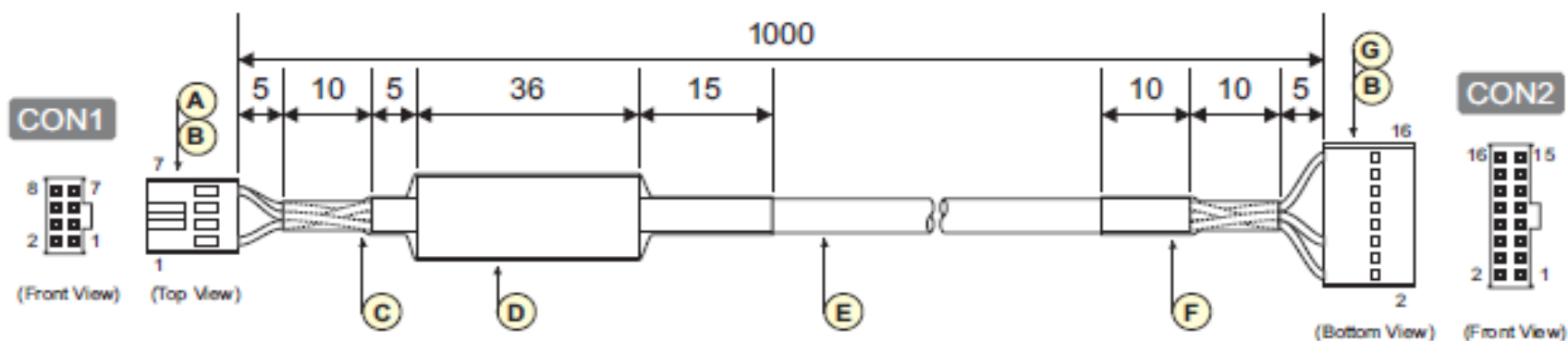
CN385 Parts List

Item	Qty	Description	Supplier	Alternative
A	1	4 way 2.54mm pitch with key	Molex 3901-2165	Farnell 90142-0008
B	8	Tin plated female crimp	Molex 39-00-0038	Farnell 9733272
C	1	66mm Long, Black heat shrink sleeve	---	---
D	1	K5A RH 14.2x6.35x36 sleeve core	Paddiford	---
E	1	4-core AWM style 2462 24AWG cable	---	---
F	1	20mm long, black heat shrink sleeeve	---	---
G	1	2x8 way 2.54mm pitch with key	Molex	Farnell 90142-0016

CN385 Connectivity

Connector	Pin	Gauge	Colour	Comments
CON1	2	24 AWG	Black	Comms_GND
	7	24 AWG	Orange	Vend_1 (SSP_TX)
	8	24 AWG	Brown	Inhibit_1 (SSP_RX)
CON2	16	24 AWG	Black	Comms_GND
	1	24 AWG	Orange	Vend_1 (SSP_TX)
	5	24 AWG	Brown	Inhibit_1 (SSP_RX)

Part Number	Description	Details
CN391	SMART Payout eSSP interface cable	Provides 12V supply and eSSP communications to SMART Payout

COMMENTS:

Please consult the tables on the next page for pin out and connector information.

⚠️ **WARNING!**

Use correct wire gauges

If you choose to make your own cables, you must make sure that the wire gauges are suitable for use with the SMART Payout unit. The minimum wire gauge for the CN397 power cables is **24 AWG**, with **22 AWG** being recommended.

CN397 Parts List

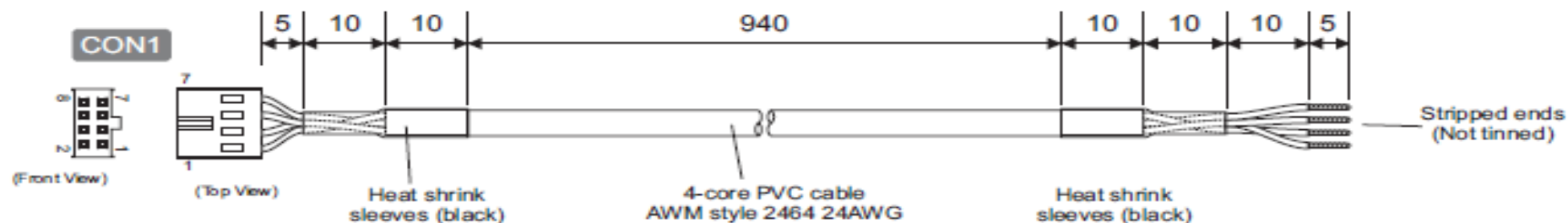| Item	Qty	Description	Supplier	Alternative
A	1	2 x 8 way 4.2mm pitch latched housing, 6A derated	Molex 3901-2165	Farnell 1632113
B	4	Tin plated female crimp	Molex 39-00-0038	Farnell 1462545
C	1	Type 'T' toroidal core, 16.5 x 8.2 x 16mm	Paddiford 10-13-165082160-0	RS 261-8928
D	2	Black heat shrink sleeving	---	---
E	1	3 core 24 AWG stranded cable, AWM type 2464	---	---
F	10	Black heat shrink sleeving	---	---
G	2	22 AWG stranded wire, PVC insulated	---	---
H	1	Stackable black 4mm banana plug	Deltron 553-0100-01	Farnell 1101106
I	1	Stackable red 4mm banana plug	Deltron 553-0500-01	Farnell 1101199
J	1	2 x 8 way 2.54mm pitch housing with key	Molex 90142-0016	Farnell 3291613
K	4	Tin plated crimp	Molex 90119-2110	Farnell 9733272

CN397 Connectivity

CON1	CON2	CON3	CON4	Gauge	Colour	Comments
		Pin				
16	1	---	---	24 AWG	Orange	SSP_Txd
14	5	---	---	24 AWG	Brown	SSP_Rxd
9	---	---	1	22 AWG	Red	V IN
1	16	1	---	24/22 AWG	Black	GND

Notes:
CON1 Pin 1 has two wires crimped together. CON2 Pin 15 has a crimp fitted but this is not connected.

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ITL Part Number	Description	Details
CN384	SMART Hopper to Coin Mech	Connects SMART Hopper to Coin Mech communications. Requires 24V power cable.

CON1

(Front View)   (Top View)

5 | 10 | 10 | 940 | 10 | 10 | 10 | 5

Heat shrink sleeves (black)

4-core PVC cable AWM style 2464 24AWG

Heat shrink sleeves (black)

Stripped ends (Not tinned)

COMMENTS:

Please consult the tables on the next page for pin out and connector information.

⚠ **WARNING!**

Use correct wire gauges

If you choose to make your own cables, you must make sure that the wire gauges are suitable for use with the SMART Hopper unit.

CN384 Parts List

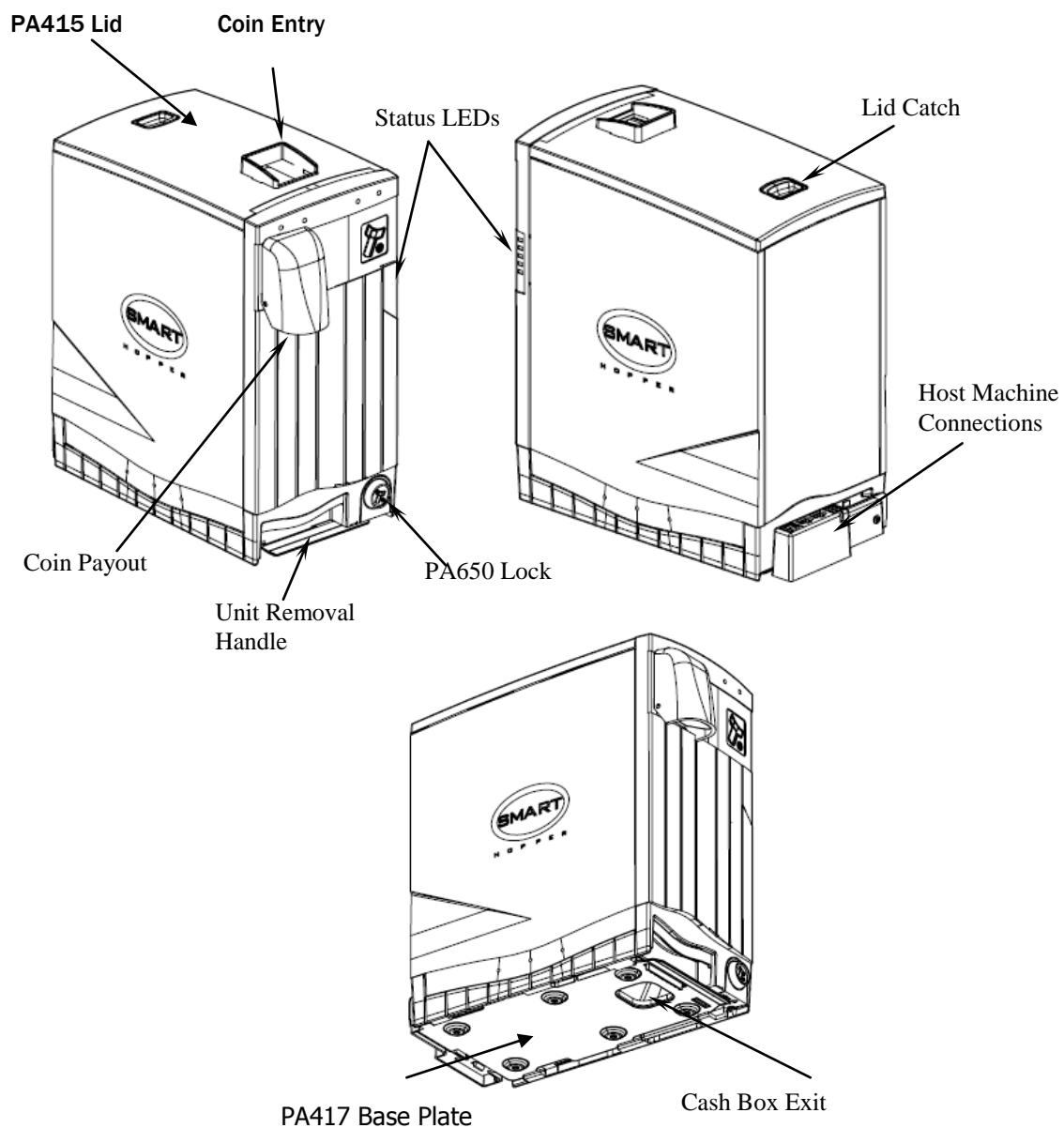| Item	Qty	Description	Supplier	Alternative
A	1	4 way 2.54mm pitch with key	Molex 3901-2165	Farnell 90142-0008
B	8	Tin plated female crimp	Molex 39-00-0038	Farnell 9733272

CN385 Connectivity

Connector	Pin	Gauge	Colour	Comments
CON1	1	24 AWG	Red	+12V DC
	2	24 AWG	Black	GND
	7	24 AWG	Orange	Date (CCT_TX)
	8	24 AWG	Brown	Not-Used (CCT_RX)

SMART Hopper

The user can obtain the following parts for the SMART Hopper:

ITL Part Number	Description
PA417	SMART Hopper Base plate
PA415	SMART Hopper Lid Assembly
PA650	Lock Assembly
MC211	Lock Cam
PA650	Lock Assembly

PA415 Lid   **Coin Entry**

Status LEDs

Lid Catch

Host Machine
Connections

Coin Payout

PA650 Lock

Unit Removal
Handle

PA417 Base Plate

Cash Box Exit

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4.9   Guidance Notes

Cleaning

⚠ **WARNING!**
Do not attempt disassembly

Do not attempt to disassemble the SMART Hopper module– trying to do this could cause personal injury and will damage the unit beyond repair.

The SMART Hopper module is effectively a 'sealed' unit; as such there are no parts to clean other than the external case and Hovering the inside.

Manual clearing a Jam

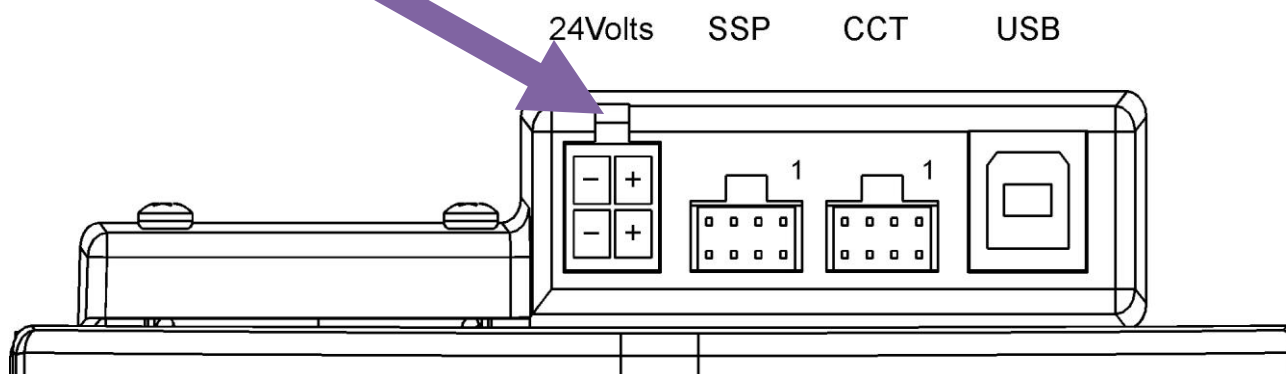On the unlikely event of a coin jamming within the SMART Hopper, follow the steps below
1. Power off the hopper

    Remove 24volt 4 way power cable.
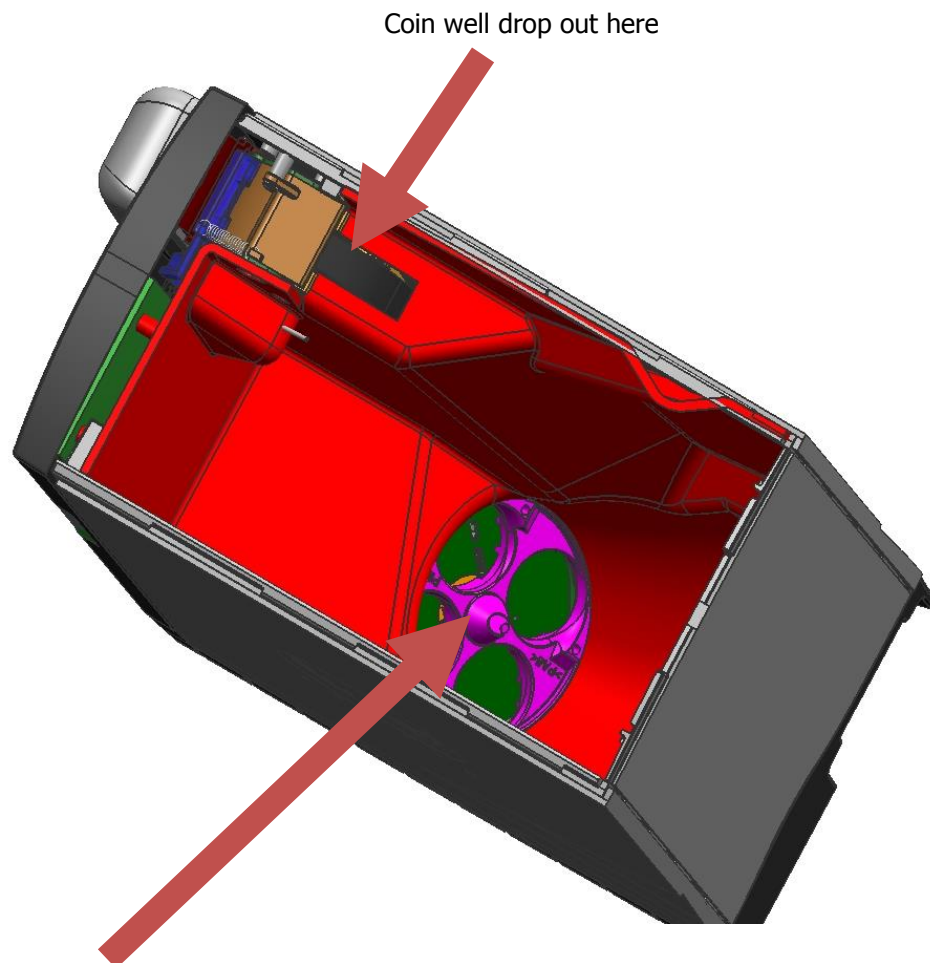
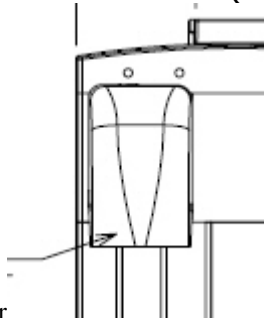| ⚠ **Caution!** |
|---|
| Power off Hopper before removing JAMS |

2. Remove the hopper from the mounting plate
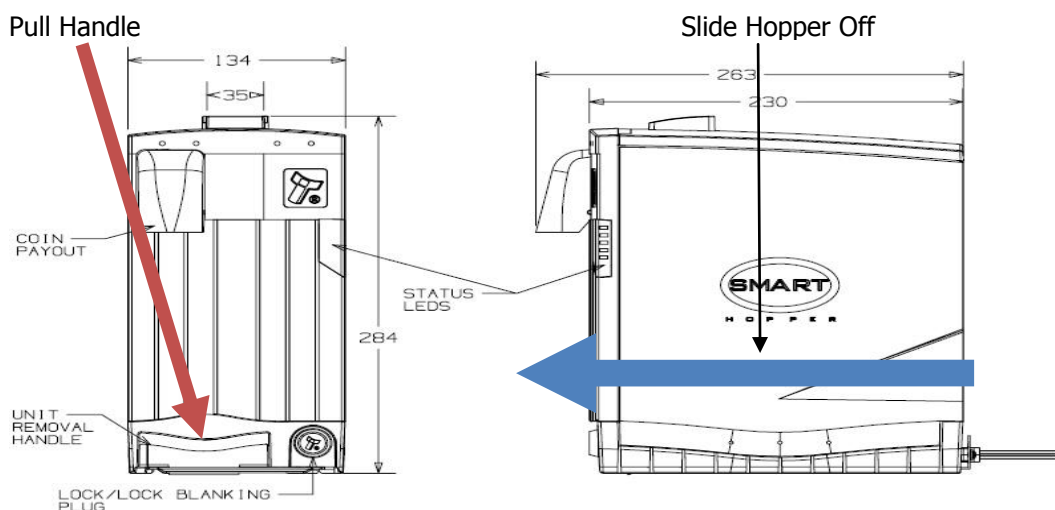
3. Empty all coins from the coin bowl

4. Clear the jammed coin from the disk
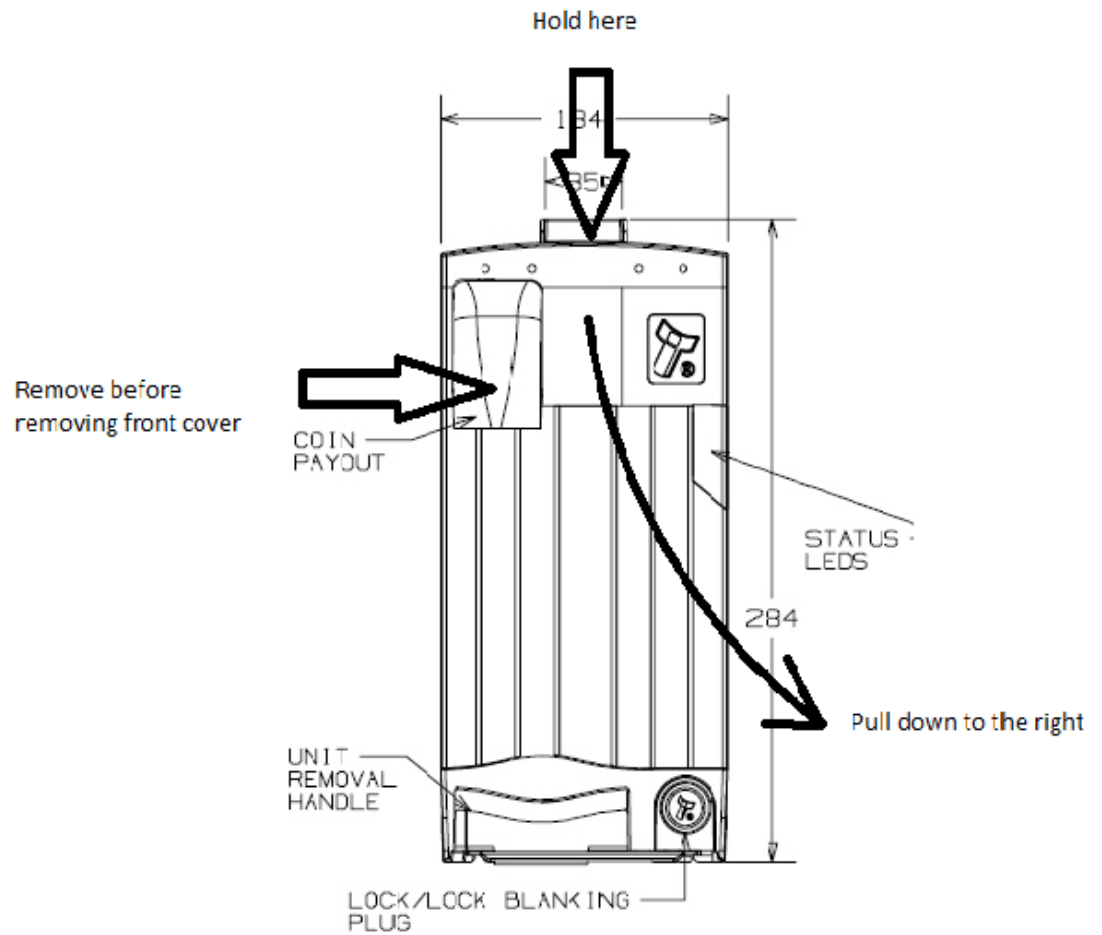
Coin well drop out here

Turn coil round anti-clockwise but be careful don't cut fingers inside.
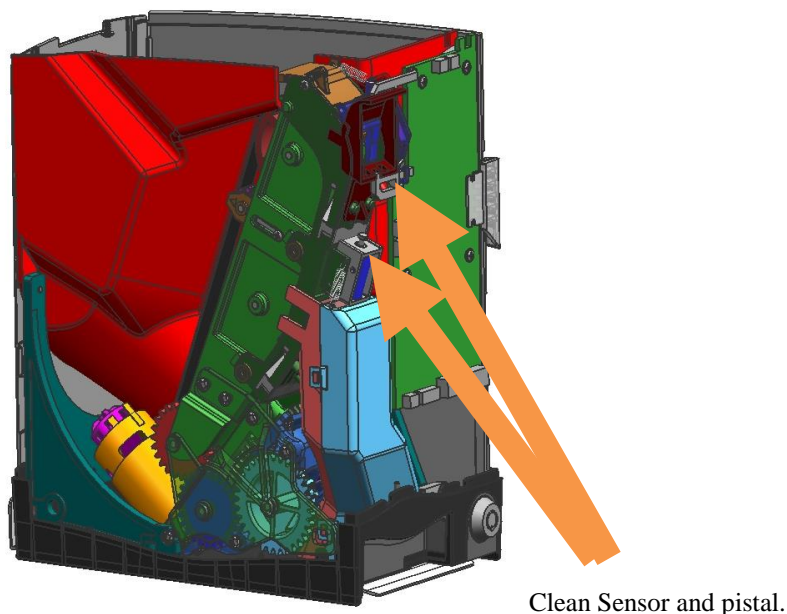
5. Take coin cover off (fraud cover)

Remove cover

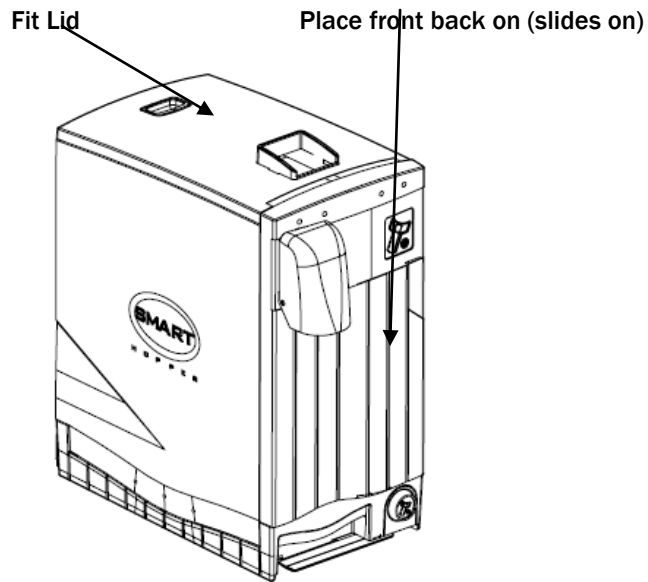6. Re-move the front panel, from the top pull right (twist) and down, clips off.

Hold here

134

35

Remove before
removing front cover

COIN
PAYOUT

STATUS
LEDS

284

Pull down to the right

UNIT
REMOVAL
HANDLE

LOCK/LOCK BLANKING
PLUG

7. Once cover off check the pistil is not sticking and sensor is clean, see picture

Clean Sensor and pistal.

8. Re-fit all parts

Fit Lid   Place front back on (slides on)

9. Re-fit the hopper to the mounting plate
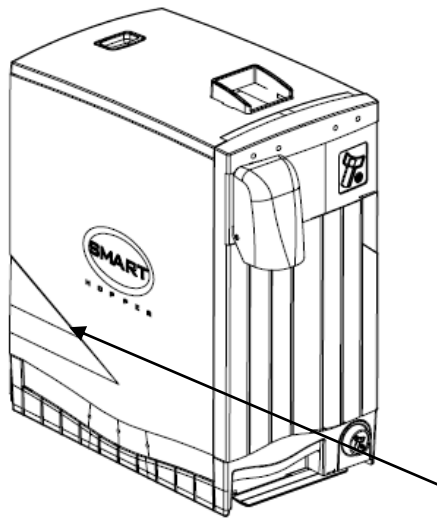
Slide on until clicks into place.

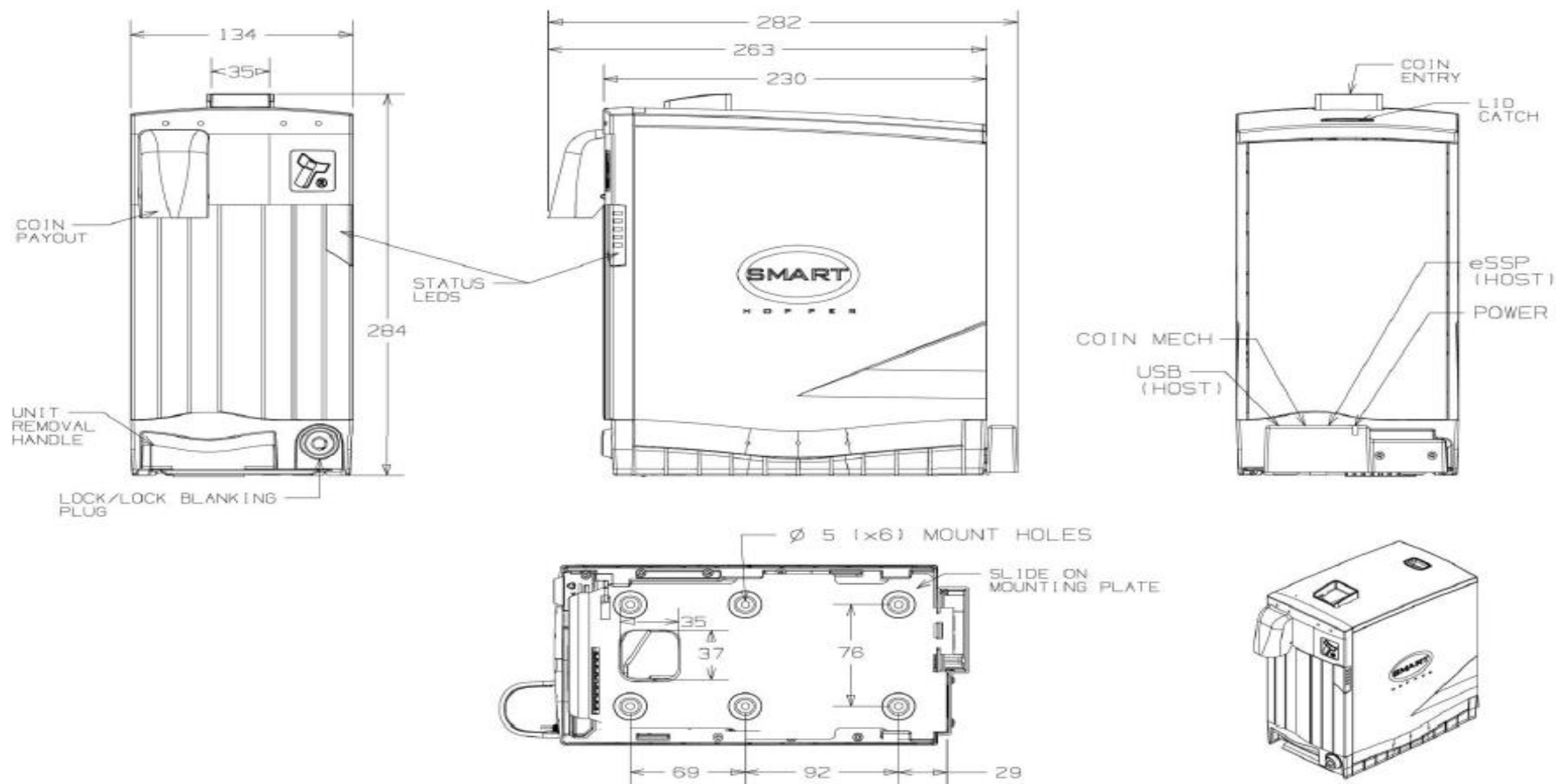10. Re-fill the hopper and apply levels to host.

11. Apply power

12. Test operation

4.10 Drawings and Schematics

NOTE: If required, IGES 3D models are available on request from ITL technical support.
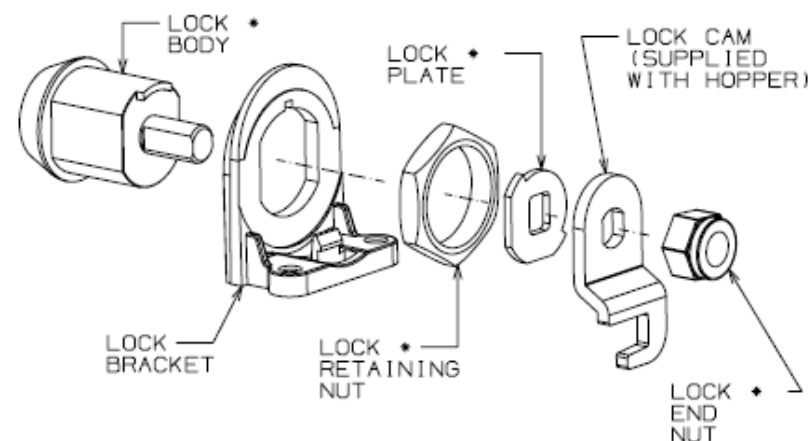
Smart Hopper:

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4.11   Lock Installation

The SMART Hopper has the option to add a lock that prevents the hopper being removed from the mounting plate. The hopper uses a standard lock PA650 which includes all the parts shown with an asterisk *. The lock cam can be ordered from Innovative Technology, part MC211.
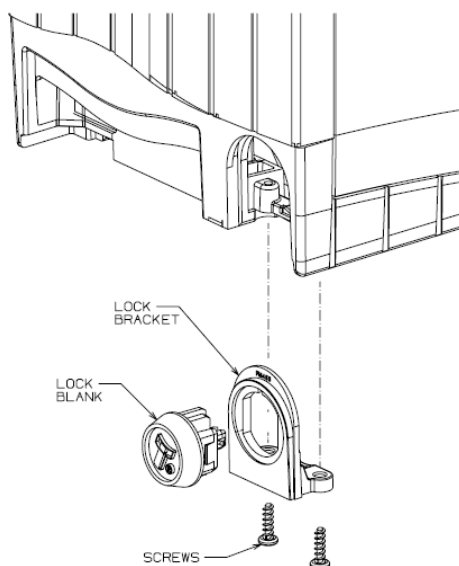
Remove the two screws from the base of the unit, and unclip the Lock Bracket as shown	Assemble the lock in the order shown paying close attention to the orientation of parts
Unclip the Lock Blank from the Lock Bracket	Place the Lock Bracket over the Lock Body and secure with the Retaining Nut
	Place the Lock Plate and Lock Cam over the shaft of the Lock Body and secure with the Lock End Nut
	Fit the assembly to the base of the hopper unit and secure with the two screws. (The Lock Blank is no longer required)

4.12 Frequently Asked Questions

a. What currencies does the SMART Hopper support?
- New currency dataset files are published on the ITL website as they are released. To find available datasets visit the Currency Download section within Support. Select the SMART Hopper and the currency you require to see all available dataset options. The blue i icon provides more details to assist selections.

b. I can't find the currency I need, how do I get it created?
- To create a new dataset, ITL requires 100 coins of each denomination. This process will take around 4 weeks to process and then coins can be returned and the dataset will be made available. Please email support@innovative-technology.co.uk for information.

c. Where can I get the software examples for the SMART Hopper?
- please email support@innovative-technology.co.uk for software example

d. What communication protocols does the SMART Hopper support?

- ENCRYPTED SSP (eSSP) is a secure serial interface specifically designed to address the problems experienced by cash systems in gaming machines. Problems such as acceptor swapping, reprogramming acceptors and line tapping are all addressed. The interface uses a master slave model, the host machine is the master and the peripherals (note acceptor, coin acceptor or coin hopper) are the slaves. Data transfer is over a multi-drop bus using clock asynchronous serial transmission with simple open collector drivers. The integrity of data transfers is ensured through the use of 16 bit CRC checksums on all packets. A Diffie-Hellman key exchange is used to allow the host machine and SMART hopper to jointly establish a shared secret key over an insecure communications channel. The encryption algorithm used is AES with a 128-bit key; this provides a very high level of security.

IMPORTANT: All transactions with the SMART Hopper must be encrypted to prevent dispense commands being recorded and replayed by an external device.
For detailed information and full protocol specification please refer to SSP Interface Specification (ITL Drawing GA138), this is available from the ITL website www.innovative-technology.co.uk.

e. Can I connect to the Host machine via USB?

- The direct USB port is for on the bench testing/Programming only. If a USB connection is desired, we recommend going through our IF17. The IF17 is a TTL to USB conversion box which filters out any noise and provides a smooth signal between the SMART Hopper and Host machine.

f. How fast does the SMART Hopper pay out?

- The SMART Hopper can pay out up to 12 Coins per second.

g. How many coins does the SMART Hopper hold?

- The capacity of the SMART Hopper depends on the size of coins. The table below shows approximate capacity for various coins and assumes all the coins within the hopper are the same coin type.

Type	Diameter	Thickness	Approximate Capacity
UK £1	22.5mm	3.15mm	1300
UK £2	28.4mm	2.5mm	800
Euro €1	23.25mm	2.33mm	1500

- SMART Hopper Weights

Coin Type	Coin Weight	Total Weight
Empty	-	2.60kg
UK £1	9.5g	Approximately 14.95Kg when full (1300)
UK £2	12.0g	Approximately 12.20Kg when full (800)
Euro €1	7.5g	Approximately 13.85Kg when full (1500)

MAIN HEADQUARTERS

Innovative Technology Ltd
Derker Street – Oldham – England - OL1 4EQ
Tel: +44 161 626 9999 Fax: +44 161 620 2090
E-mail: support@innovative-technology.co.uk
Web site: www.innovative-technology.co.uk

Innovative Technology
INTELLIGENCE IN VALIDATION

Bellis Technology
INTELLIGENCE IN VALIDATION

AUSTRALIA
support@innovative-technology.com.au

BRAZIL
suporte@bellis-technology.com.br

CHINA
support@innovative-technology.co.uk

GERMANY
supportDE@innovative-technology.eu

ITALY
supportIT@innovative-technology.eu

SPAIN
supportES@innovative-technology.eu

UNITED KINGDOM
support@innovative-technology.co.uk

REST OF THE WORLD
support@innovative-technology.co.uk