

Single width Bulk Loader Validating Head Rejection Path option

Operation and Service Manual

Part 1. Operation Manual

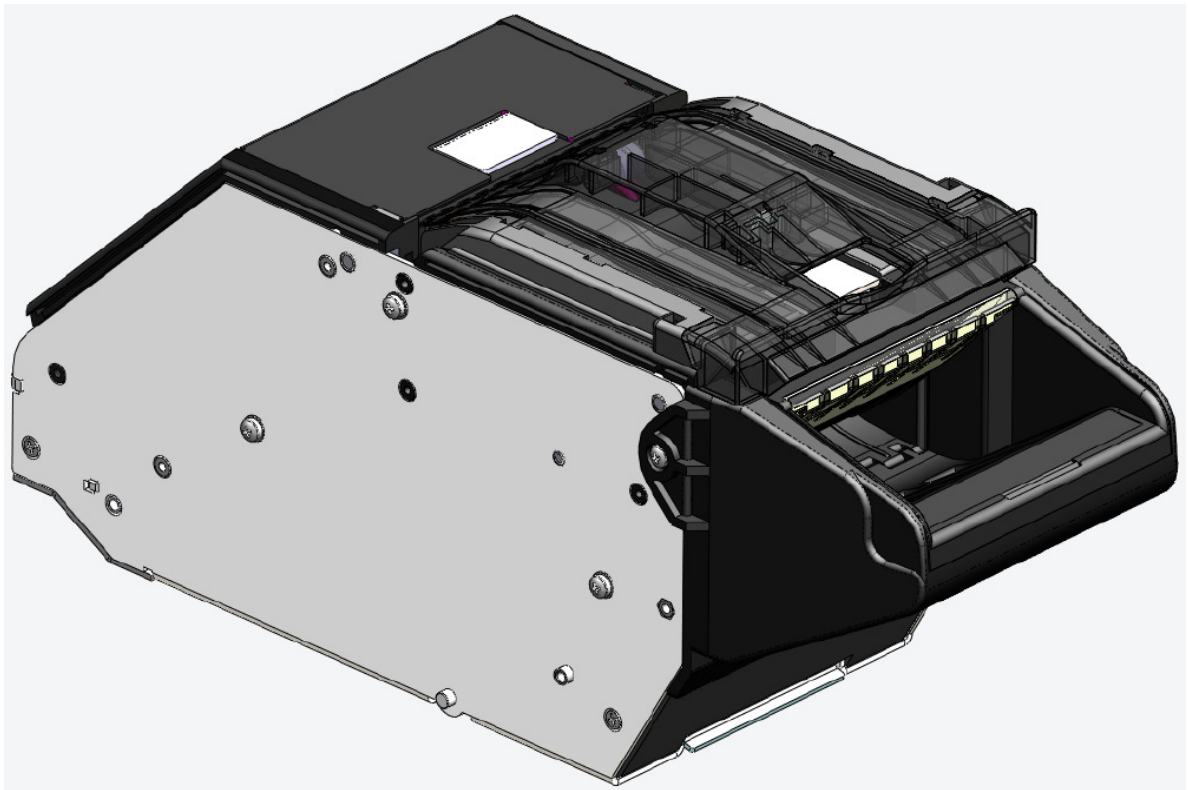


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INTRODUCTION

The scope of this document is to provide full and clear information about the Single width Bulk Loader Validating Head with Rejection Path hereinafter referred to as LVH.

The target audiences for the manual are those involved with:

- Integrating LVH into new equipment;
- Ordering LVH in different configurations;
- Installation of the LVH;
- LVH maintenance, service and repair;

The Manual consists of two parts: part 1 - Operation and Service Manual, and part 2 - Repair Manual.

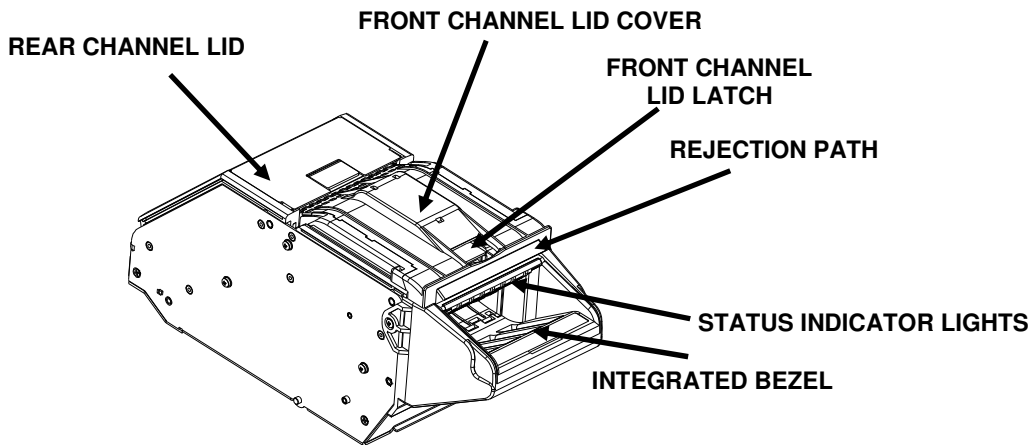
GENERAL DESCRIPTION

LVH accepts a bundle of up to 25 bills at a time. It uses CashCode's advanced bill validating technology.

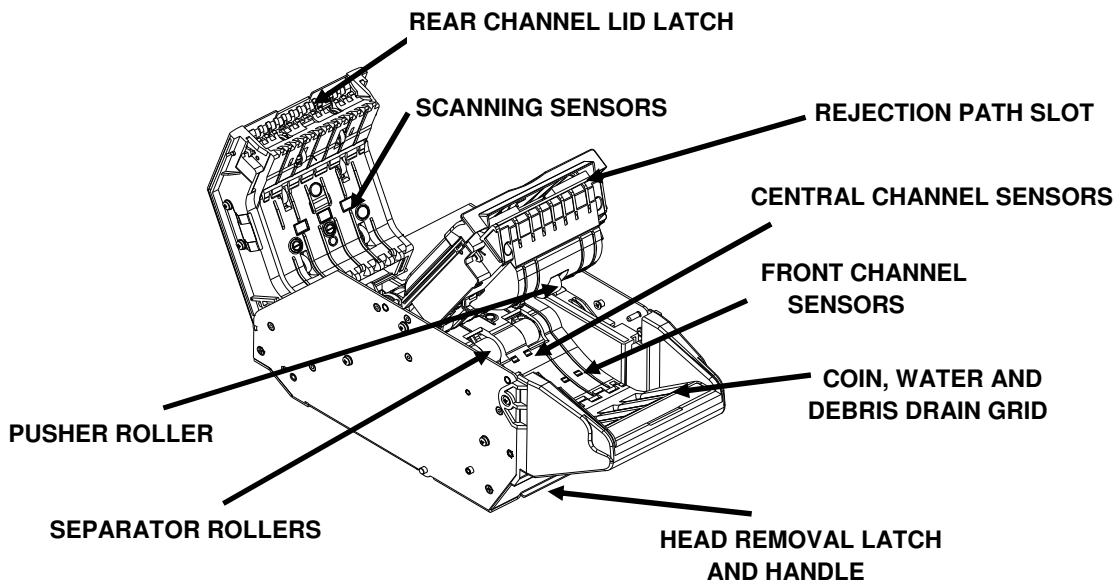
The device has a built-in rejection path on top of front channel lid. Invalidated bills are directed into the path one by one. Until a rejected bill is removed, the device operation is blocked.

LVH coupled with mounting bracket is primarily used in cash deposit systems with drop bag.

LVH coupled with FL housing can be used wherever a regular front-load bill validator is used.



The Loader Validating Head*



The Loader Validating Head detailed view*

* - minor features are omitted for clarity

The LVH is not self-sufficient and is also inconvenient in mounting. To overcome the issue a mounting bracket was designed. The bracket provides convenient mounting holes and built-in power interface.

Two versions of the bracket were developed:

- regular bracket, LV02.00.000;
- “hanging bill” bracket

LVH is a single-width validator. To accommodate different currencies there are ordering configurations, with different channel width. Available widths are 67, 71, 77 and 78 mm.

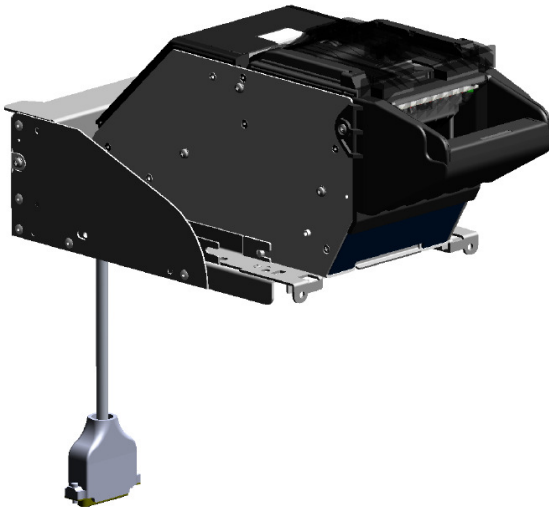
Part number patterns for different configurations are defined as:

Part Number Pattern	Description
SLB-1XXX	Bracketed configuration
SLF-2XXX	FL housing configuration

“X” is substituted with a digit to form a real part number.

A part number defines both channel width and bracket variant (if applicable). Part numbers are assigned in linear fashion. It is not possible to decompose a part number into a configuration without consulting a user guide.

SLB-1XXX



SLF-2XXX



GENERAL SPECIFICATIONS

Note capability and performance

Note processing	1.2 sec max, 96% acceptance on first insertion
Note acceptance	4-way
Stack size	25 notes
Note sizes	67mm x 158 mm; 71mm x 158 mm; 78mm x 158mm
Rejection Path	For rejected notes
Escrow	Single bill
Bar-coded coupons acceptance	Two ways, face up
MTBF	1,500,000
Roller service frequency	Every 500,000 notes

Environment

Operation	Indoor only, 0 to +60C
Storage	-30C to +60C
Humidity	30-90%RH non-condensing

Sensors - scanning

3-color optical trans-reflective	6
Dielectric sensor	1 differential
Magnetic contact-less	2 max out of 3 available positions
Barcode sensors (2 of 5)	1
UV trans-reflective	1

Sensors – channel control

Anti-stringing sensor	1
Past-escrow exit sensor	2
Front channel	2
Door sensing	1
Double take	1 speckle sensor

Interface

Connector	DB25 male
Protocol	CCNET only

Power

Voltage	12 VDC
Current	5A peak, 2.5A operating average

Physical

Weight	2.7 Kg without box
Dimensions	127 mm (H) x 113 mm (W) x 306 mm (D)

Bezels and indication

Indicators/lights	Steady red/green runway LEDs
Bezels	Integrated LV bezel only

Controls

DIP switches	12 positions
Memory card slot	Compatible with standard CC cards including NDE/NDEG

Firmware updates

Card controlled
Interface controlled

With “manufacture” and “single update” cards
Via CCNET with NDE/NDEG card installed

Regulation compliance

Safety
Emissions/immunity
Environment

cULus 756
FCC class B compatible (no marking)
RoHS

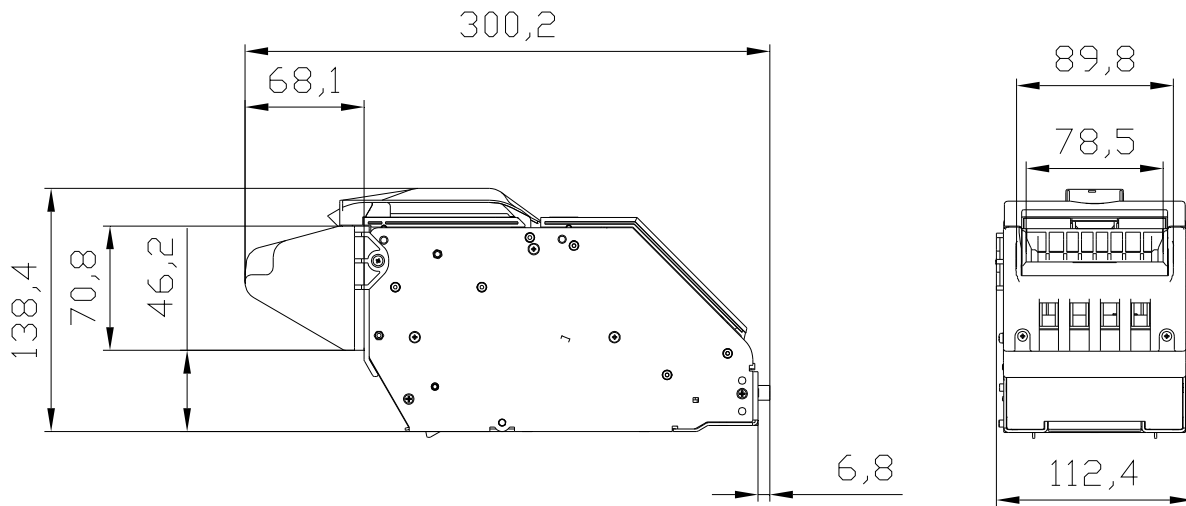
Miscellaneous

CashManager feature
Operational configuration

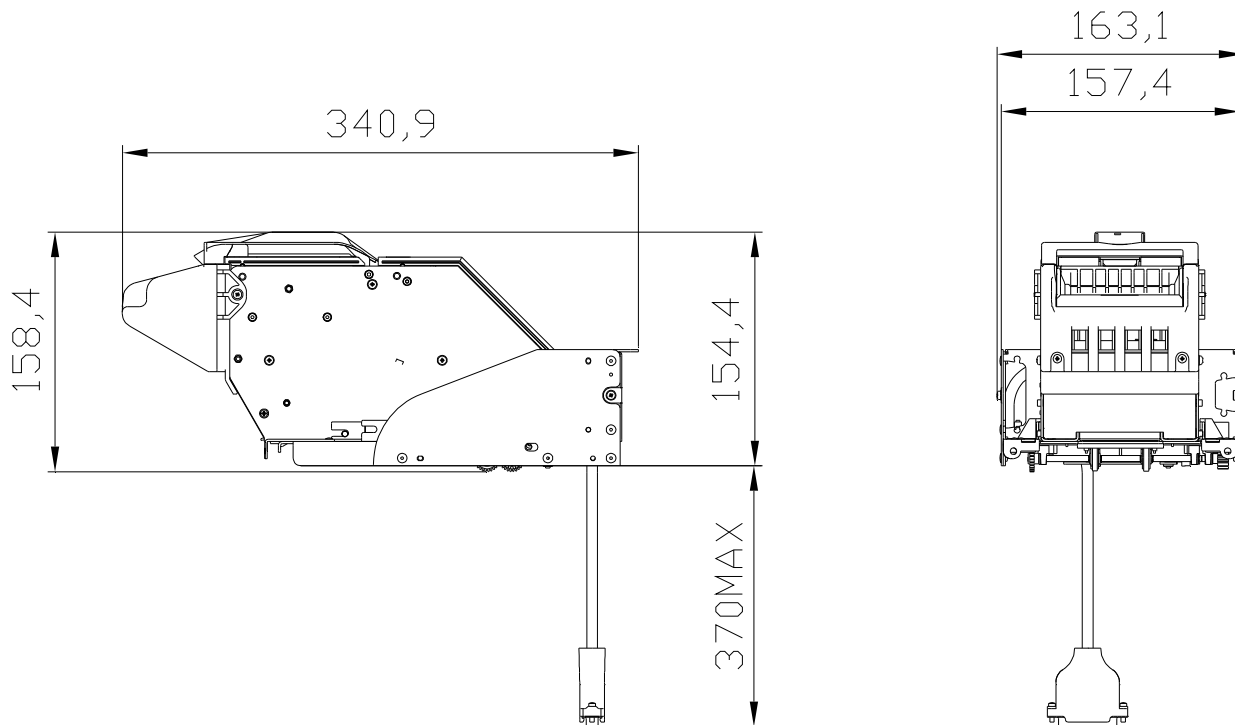
Optional
With:
a) BB, b) bracket and adapter, c) frame of front load
validator

OUTLINE DRAWINGS

Loader Validating Head

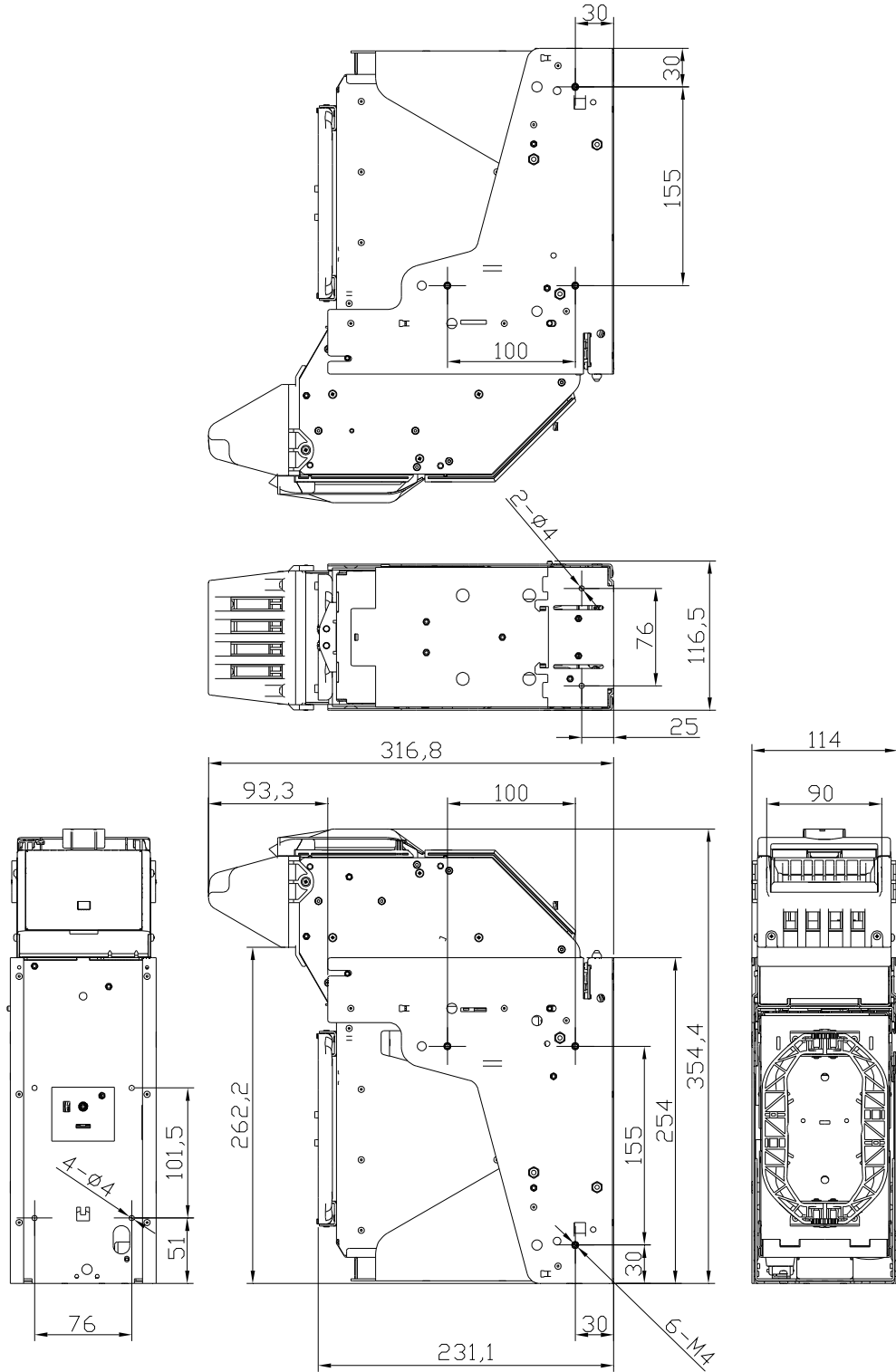


Single Width Bulk Loading Validator with Mounting Bracket and Adapter SLB-1XXX



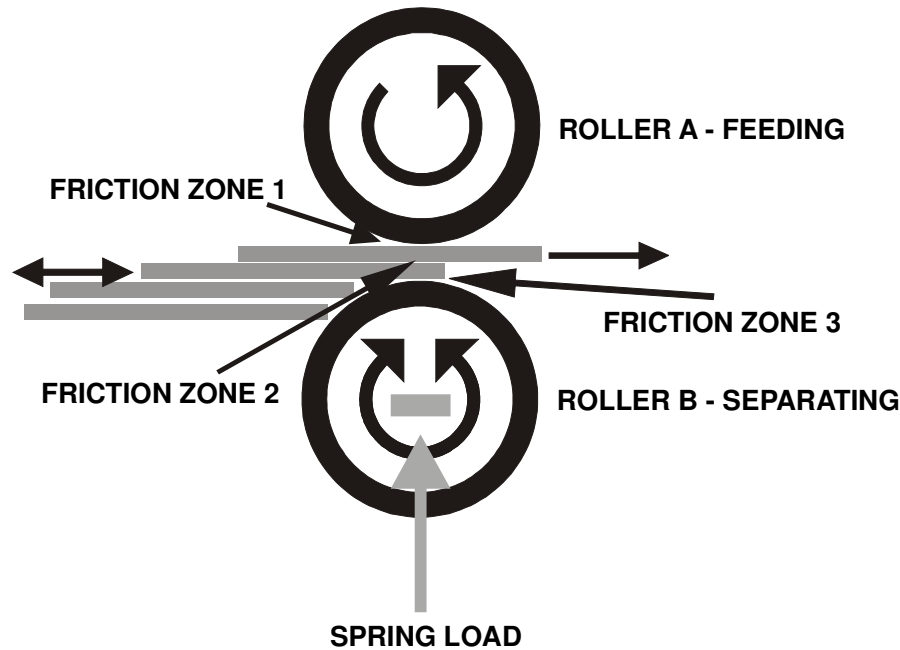
Single Width Bulk Loading Validator with frame

SLF-2XXX



DEVICE OPERATION - GENERAL PRINCIPLE

The **Loader Validating Head** is intended to provide performance gains compared to standard bill validating heads when processing multi-bill transactions.
Separation of bills from stack is based on friction difference.



The separation principle

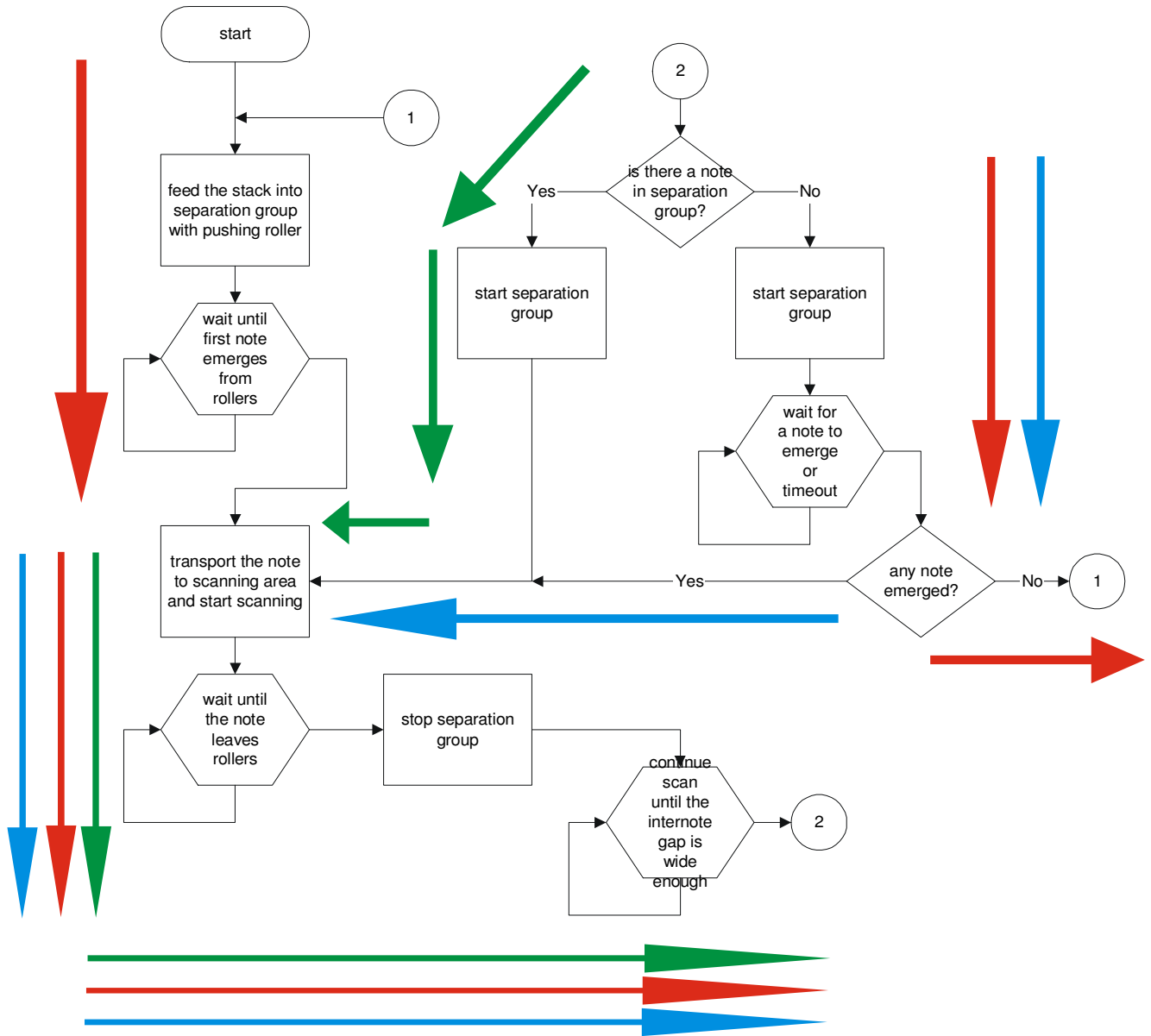
The stack of notes is fed into the separation group of rollers A and B. The A rollers are always rotating in one direction, with the torque staying relatively the same. The friction in zone 1 (roller A and a note) is selected to be greater than friction in zone 2 (between notes). This is guaranteed by roller A material choice. The friction in zone 3 is also greater than friction in zone 2, but normally less than friction in zone 1. Under ideal conditions, the whole system is maintained in quasi-equilibrium with roller B stalled, allowing only one note to propagate through the separation group. In real world, many factors add and the separation may become unreliable. To compensate for that, two approaches are utilized:

- roller B torque control;
- sensors to detect multiple notes exiting the separation group.

Roller B torque is not only controlled at time of separation, but also calibrated periodically, e.g. at system startup, to compensate for dirt accumulation, roller wear and material degradation. Calibration is achieved with roller A rotating with constant speed and torque, while roller B torque is gradually increased. When the torque becomes strong enough to disrupt even rotation of the roller B by roller A, the torque value is saved.

The saved value is later used in conjunction with the double-note sensor output. If the sensor indicates a double take, torque is increased, and vice versa.

Device operation – STACK HANDLING



There's no try limit shown in the flowchart, but it is present in a real system and is normally set to 3 full attempts.

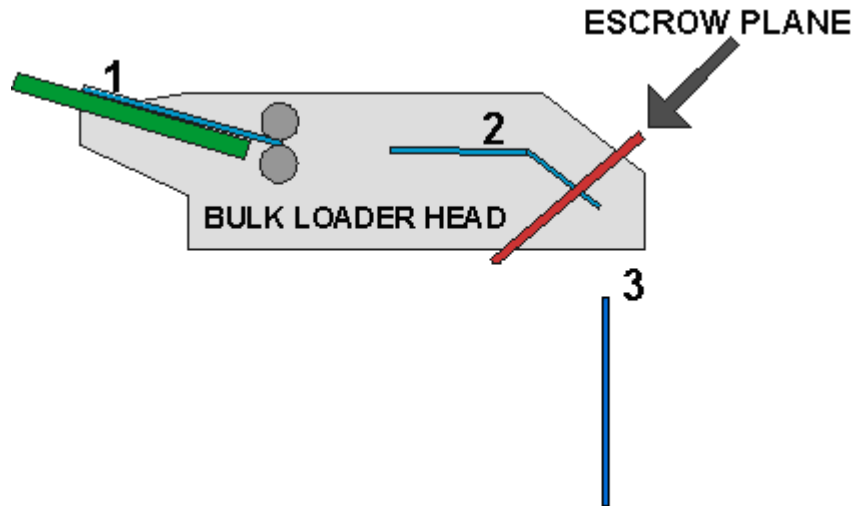
The arrows illustrate 3 distinct routes the stack processing can take:

GREEN route – the fast flow, can only occur after the first note is taken; for currencies with significant difference between the longest and shortest notes this route is only available for short notes;

BLUE route – the partial take, can only occur after the first note is taken, take in case a following note failed to enter the rollers;

RED route – the full take, occurs on a first note in a stack and also in case the partial take has failed.

Device operation – THE NOTE FLOW



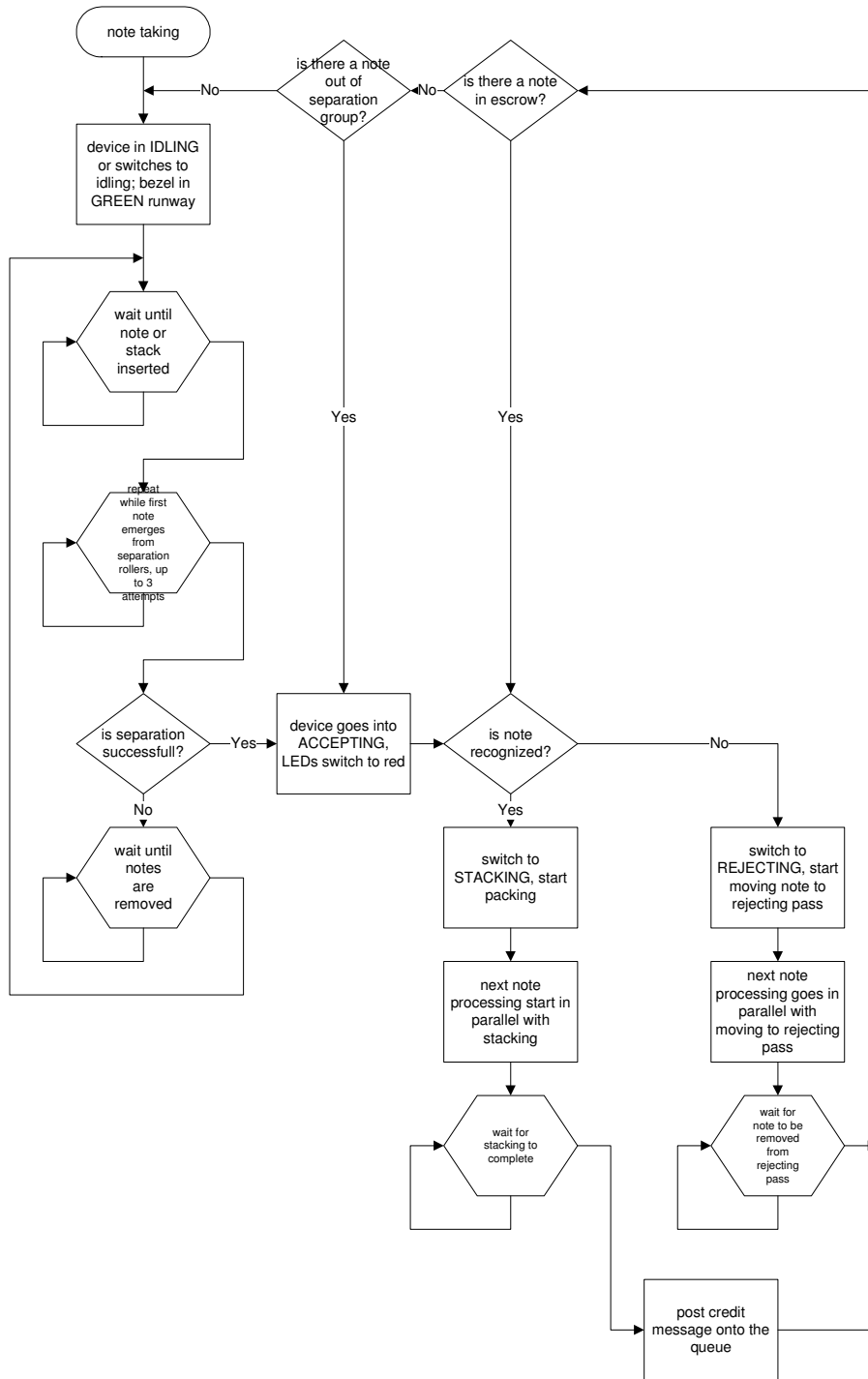
In case of fast flow, there is more than one note traveling the bill path at the same time. This is a substantial difference from the standard validating head.

The notes, shown in blue, all share the same path. While note 1 is separated from the stack note 2 is scanned and note 3 has left the unit. The whole flow stops when note 2 trailing edge reaches the **escrow plane**. To prevent jams, note 3 trailing edge must leave validating head at this point. In case of a fast flow, the note 1 leading edge will be entering the **scanning area** at the same time.

If the fast flow conditions are not met, the gap between notes 1 and 2 increases, bringing down the device performance. In most cases this happens with poorly aligned stack or poor note condition.

Device operation – The state machine flowchart

While processing notes, the **Bulk Loader Head** is running a state machine.

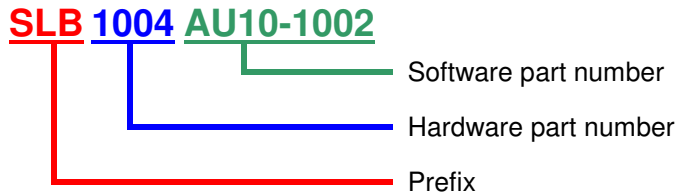


The device state names in figure are internal states and may or may not correspond to the states reported over the communication protocol.

NUMBERING SYSTEM

Depending on currency, available features users can choose the Bulk Loader Head that best matches their needs.

Complete part numbers for the SL consist of two parts: a hardware part number and a software part number. The part number looks like this:



The **prefix** defines the device class. In this instance, SLB is Bulk Loader Validating Head with Rejecting Path, bracket and adapter.

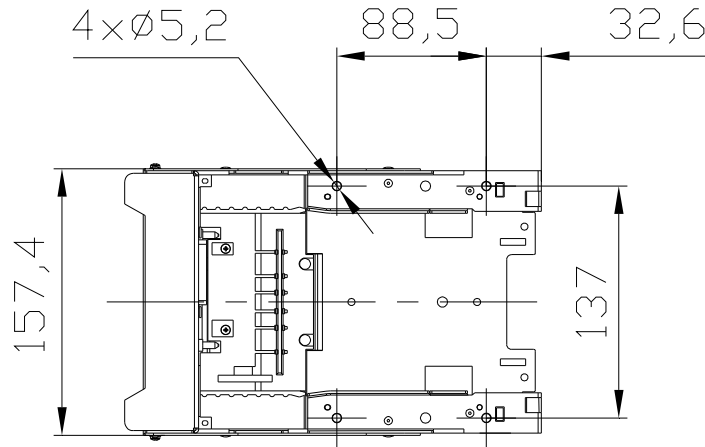
The **hardware part number** reflects the hardware features. In this instance bill wide – 66mm, security mechanism.

The **software part number** reflects the country (currency), software version.

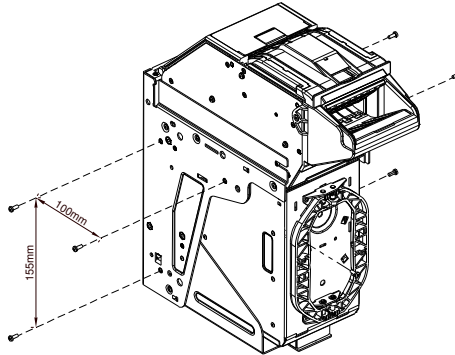
INSTALLATION

Mechanical installation

The Loader Validating Head with bracket SLB-1000 (1003, 1004) is installed by using 4 holes in bracket.



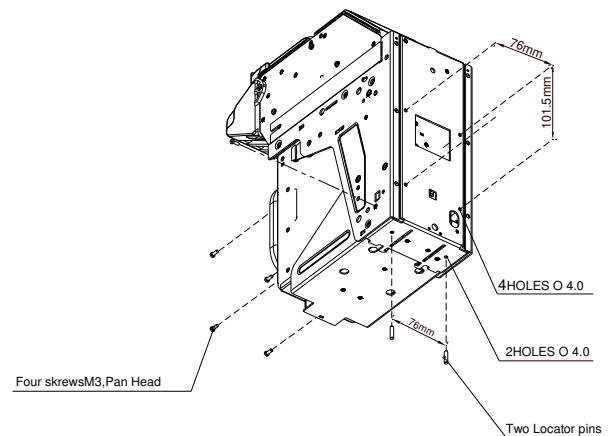
The SLF-2002 is installed by using three M4 screws on each side of the Front Load frame. The length of these screws should not be longer than required, otherwise they may protrude through the inside of the frame.



If the position of the mounting screws is different than the position of the mounting holes provided in the target equipment, then additional frame mounting components may be required.

The validator can also be secured through the holes in the rear wall of the Housing. In this case, M3 screws and locator pins can be used.

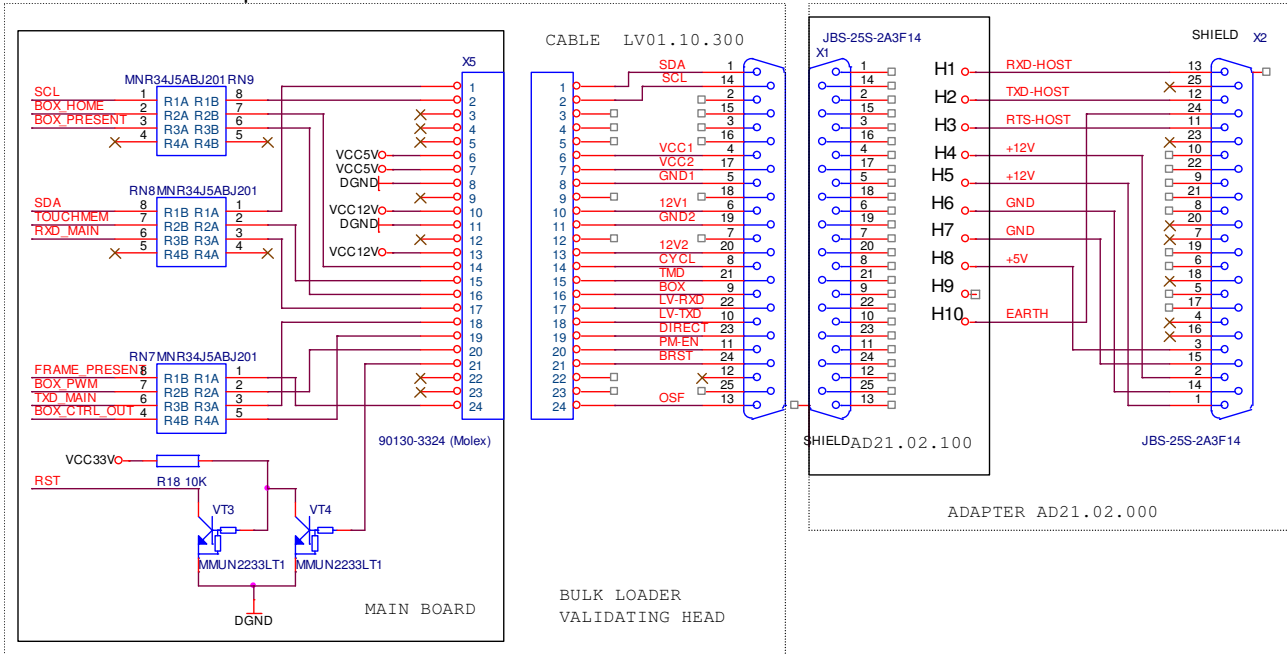
For dimensions of the mounting holes, please refer to the dimensional drawings (page 9).



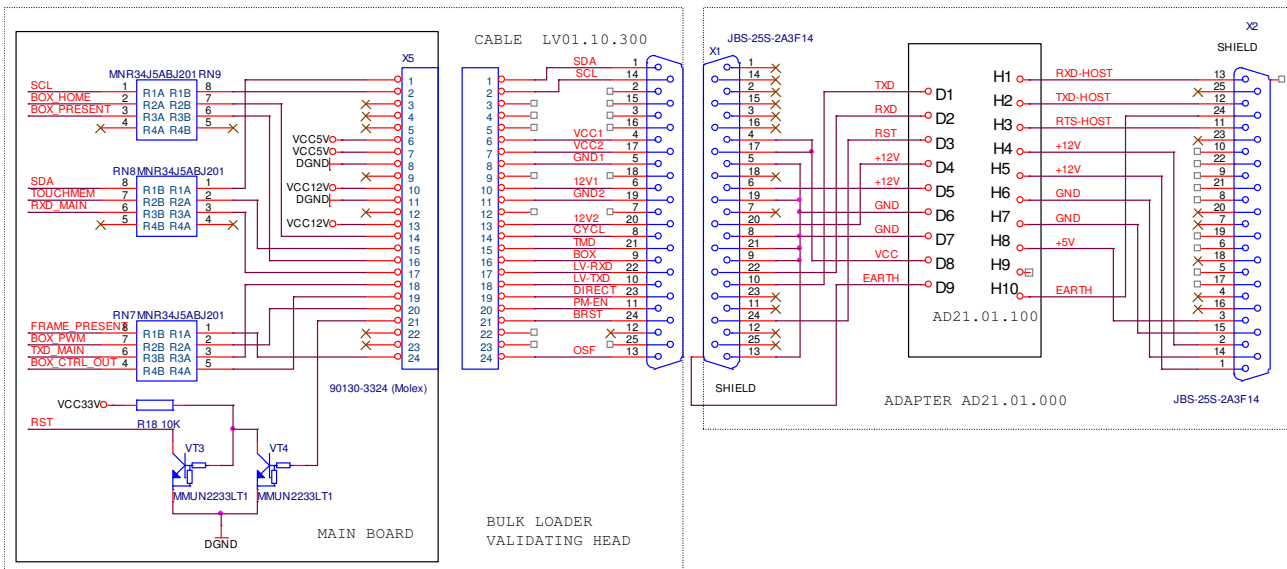
INPUT/OUTPUT CIRCUITS

SLB-1XXX

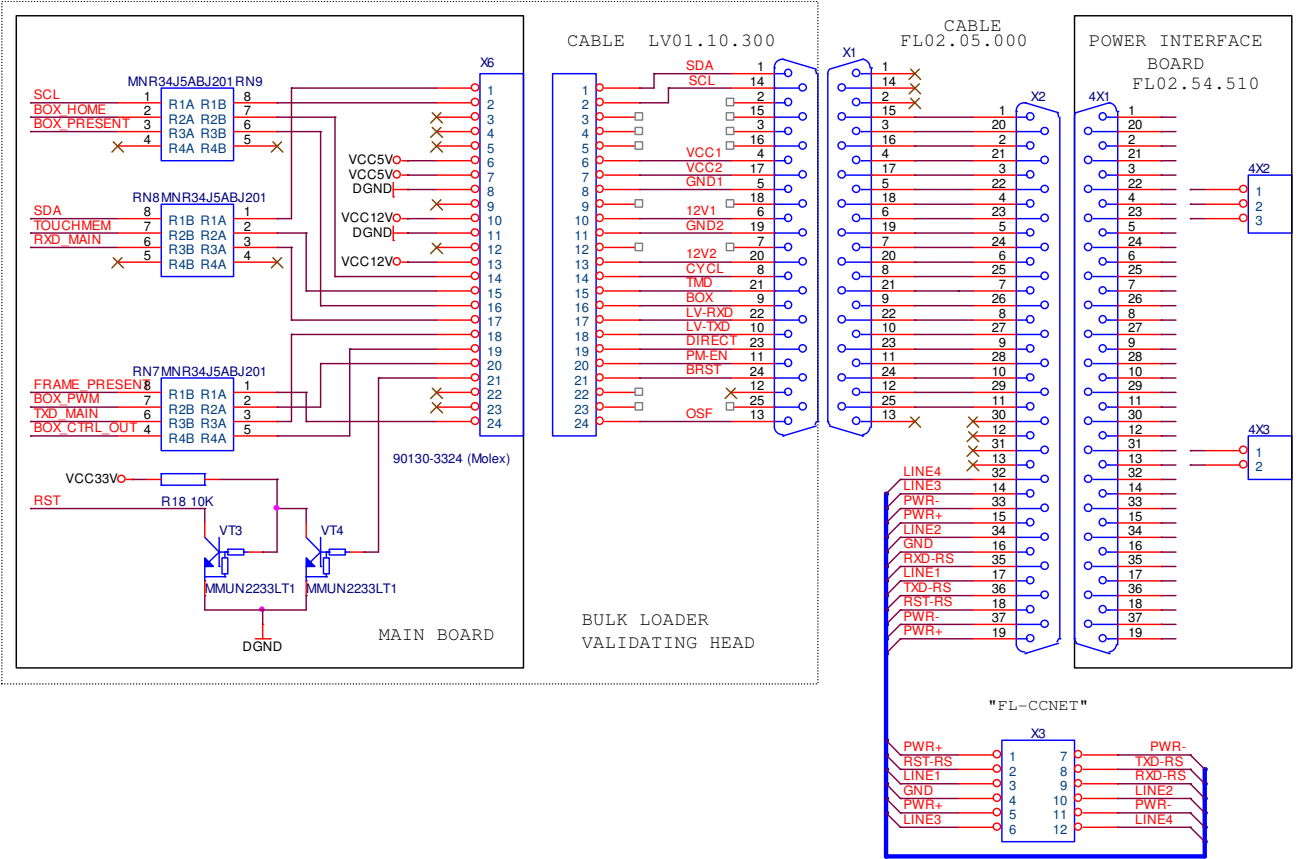
For version with adapter AD21.02.000



For version with adapter AD21.01.000



SLF-2XXX



INPUT/OUTPUT CIRCUITS

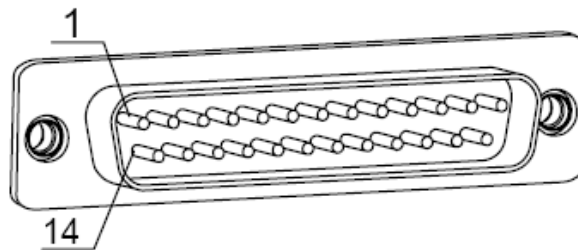
INTERFACE CONNECTION

Interface description

The Loader Validating Head interface operates with RS232 levels and under CCNET protocol. Host Controller may reset Validator by holding line M-RES “active” for 1 mS. This informs Bill Validator to abort any activity and return to its power-on reset state. A detailed description of the CCNET protocol can be found in the “CashCode NET Interface Manual”. The manual may be downloaded from the CashCode website at www.cashcode.com .

SLB-1XXX Power and Interface cables specification

Mating Connector:
DB25 generic male connector

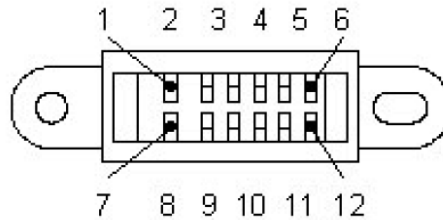


The Adapter has the following external connections:

TERMINAL	SIGNAL	FUNCTION
1	+12V	POWER
2	+12V	POWER
3	+5V	POWER (not required for AD21.02)
4	NC	NOT CONNECTED
5	NC	NOT CONNECTED
6	NC	NOT CONNECTED
7	NC	NOT CONNECTED
8	NC	NOT CONNECTED
9	NC	NOT CONNECTED
10	NC	NOT CONNECTED
11	Reset	Bus Reset
12	TXD	Host Tx output
13	RXD	Host Rx input
14	GND	Power ground
15	GND	Power ground
16	NC	NOT CONNECTED
17	NC	NOT CONNECTED
18	NC	NOT CONNECTED
19	NC	NOT CONNECTED
20	NC	NOT CONNECTED
21	NC	NOT CONNECTED
22	NC	NOT CONNECTED
23	NC	NOT CONNECTED
24	GND	Signal ground
25	NC	NOT CONNECTED

SLF-2XXX Power and Interface cables specification

Pin Assignment (cable connector):



Socket **DR1-12-2SC-FO (JAE)**
Contact **DR-SC20-1-7000 (JAE)**

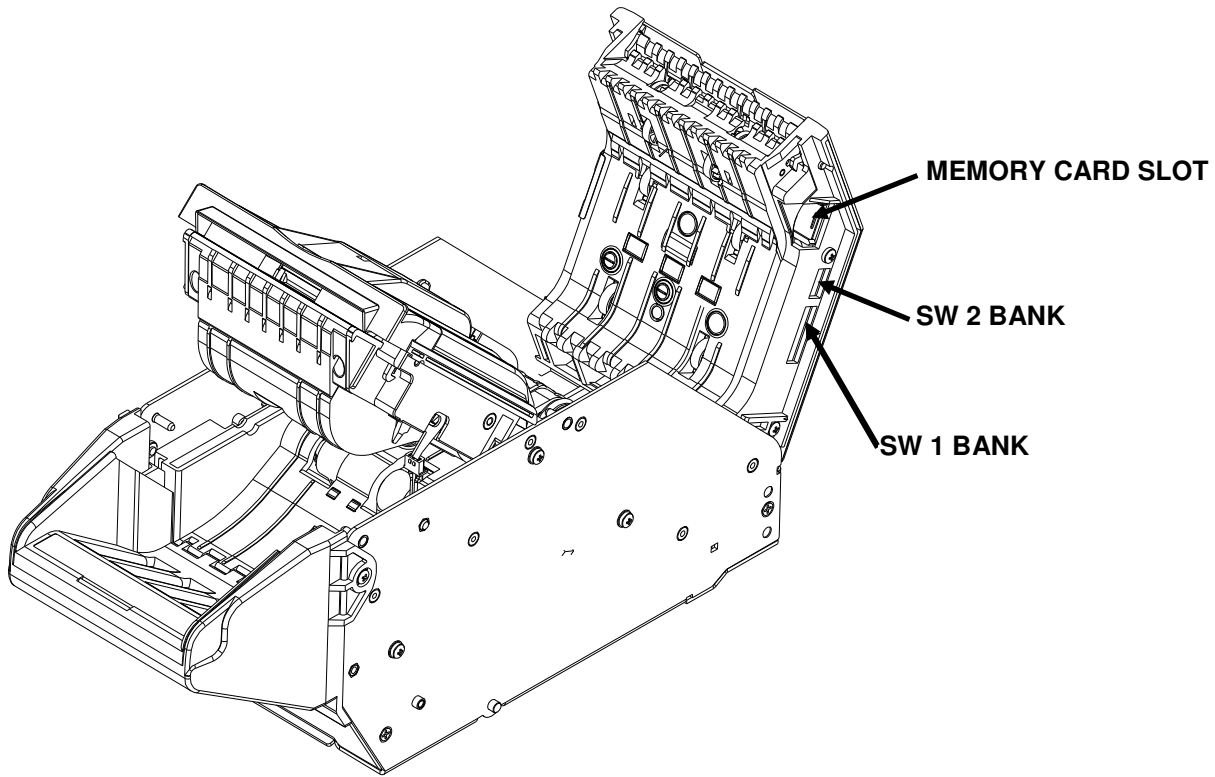
Signal descriptions:

TERMINAL	SIGNAL	FUNCTION
1	+12V	POWER
2	M-RES	MASTER RESET
3	NC	NOT CONNECTED
4	GND	INTERFACE GROUND
5	+12V	POWER
6	NC	NOT CONNECTED
7	GND	POWER GROUND
8	TXD	TRNSMITTED DATA
9	RXD	RECEIVED DATA
10	NC	NOT CONNECTED
11	GND	POWER GROUND
12	NC	NOT CONNECTED

OPERATING CONTROL

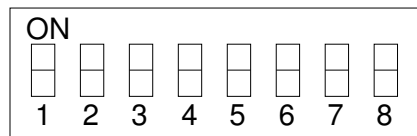
Switch settings

Device configuration is implemented with array of DIP switches, divided into SW1 and SW2 banks.

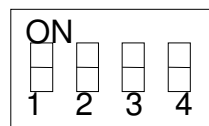


DIP switch array and Memory Card slot

Every DIP switch bank is a piano-type switch component on the main control board with switches accessible through the compartment windows. Every bank, if viewed through the window will look similar to what is shown below. The default setting for all switches is “OFF” position.



SW1 bank simplified view



SW2 bank simplified view

The DIP switch banks SW1 and SW2 functions are summarized in the tables below:

Switch #	ON	OFF
SW1.1	Bill type 0 acceptance disabled	Bill type 0 acceptance controlled by host
SW1.2	Bill type 1 acceptance disabled	Bill type 1 acceptance controlled by host
SW1.3	Bill type 2 acceptance disabled	Bill type 2 acceptance controlled by host
SW1.4	Bill type 3 acceptance disabled	Bill type 3 acceptance controlled by host
SW1.5	Bill type 4 acceptance disabled	Bill type 4 acceptance controlled by host
SW1.6	Bill type 5 acceptance disabled	Bill type 5 acceptance controlled by host
SW1.7	Bill type 6 acceptance disabled	Bill type 6 acceptance controlled by host
SW1.8	Bill type 7 acceptance disabled	Bill type 7 acceptance controlled by host

SW1 DIP switch bank functions*

The DIP switch bank SW1 is always assigned for bill acceptance control. If the bill table for a particular firmware release is shorter than 8 entries, only the relevant switches can be used; other switches from SW1 bank are not used and their setting has no effect. *NOTE: If switch setting disables a bill it cannot be enabled over CCNET. If a bill is enabled by switch setting then CCNET has full control of that bill enabled status.*

Switch #	ON	OFF
SW2.1	Acceptance one way face up only	Four way acceptance
SW2.2	High security mode enabled	High security mode disabled
SW2.3	CCNET 19200 bps data rate	CCNET 9600 bps data rate
SW2.4	TBD	TBD

SW2 DIP switch bank functions*

NOTE: CCNET security control is disabled if a switch disables High security mode – setting security bits from CCNET will have no effect in this case. High security mode must be enabled to allow security level control from CCNET.

* - TBD – to be defined;

ERRORS AND TROUBLESHOOTING

Any error a device encounters is reported, both over the communication protocol and visually with colored flashes on the indicator lights. Under normal operation when a device is ready to accept notes, the indicator lights are in green “runway” mode. Any error will drive the lights either into red or into a series of red or green flashes either on dark or red background

The application level flashing codes are generated in red on black background. They are summarized in the following table:

Status of diagnostic light	Error description	Corrective action
1 red flashes on black background	Box is removed or Box sensor failure*	<ul style="list-style-type: none"> – verify the Drop Box is fully inserted; – if the error persists the Power Interface module may need replacement;
2 red flashes on black background	Boot operation error	<ul style="list-style-type: none"> – verify the card is in secured in place; – take the card out and clean the contact pads with soft cloth; reinstall the card;
3 red flashes on black background	Box is full or Box pusher plated drive is too tight, but not stuck*	<ul style="list-style-type: none"> – check the Drop Box if it is full and empty it if needed; – if error persists the Drop Box may need replacement;
4 red flashes on black background	Box pusher plate is stuck or sensor error*	<ul style="list-style-type: none"> – verify the Drop Box is fully inserted; – if error persists, the Drop Box and/or Power Interface module may need replacement;
6 red flashes on black background	Optical sensor failures of any nature	<ul style="list-style-type: none"> – if error persists the Bulk Loader Head may need service;
7 red flashes on black background	Magnetic sensors cannot be tuned into resonance frequency	<ul style="list-style-type: none"> – wait 30 seconds; – if error persists or reappears frequently the Bulk Loader Head may need service;
9 red flashes on black background	Critical failure	<ul style="list-style-type: none"> – reset or (better) re-power the validator; – if error persists or reappears frequently the Bulk Loader Head may need service;
11 red flashes on black background	Bills in channel or channel sensors failure	<ul style="list-style-type: none"> – verify there're no bills or bill fragments in the channel; – if error persists the Bulk Loader Head may need service;
14 red flashes on black background	Verification Software (VS) integrity problem	<ul style="list-style-type: none"> – the VS update was not performed – update the VS firmware to a correct version; – the main firmware or was upgraded and it is no longer compatible by interface with VS – update the VS firmware to a correct version; – if error persists the Bulk Loader Head may need service;

* - SLF only;

Apart from the blink codes, there are many errors reported over the communication protocol.

SOFTWARE UPDATES

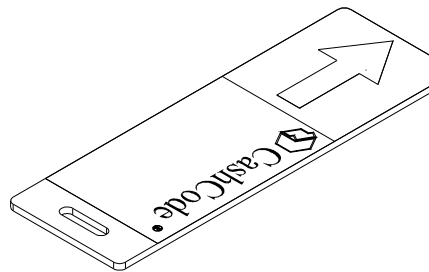
The LVH is supplied with pre-installed software, according to a User's order. A "dummy card" is normally placed in the slot indicating the software version. Software updates are recommended whenever new currency is issued, or whenever counterfeit bills appear on the market.

Software updates are offered in three options:

1) New software can be ordered with a single-download memory card. The software from the new memory card is downloaded as soon as it is inserted into the slot, and the validating head is powered on. The memory card must be present at all times for the LVH to operate.

2) New software can be ordered with a multi-download memory card. The software supplied through the multi-download memory card allows the LVH to operate even after it is removed from the slot. The memory card can be used for updating the next LVH unit, depending on the number of licenses ordered. Typically a multi-download memory card is issued for a specified number of downloads, and therefore the number of downloads required must be defined in the User's order.

3) A special memory card can be ordered, which allows the download of new software through the interface connector. This memory card must be present in the validating head at all times. The download can be done via the host controller (and local network). Downloads can also be accomplished with any personal computer. The LVH must be temporarily disconnected from the host controller for this purpose.



Download Procedure for a Single-download Memory Card:

Step 1. Turn Power OFF.

Step 2. Lift up the latch under the validating head; and remove the validating head from the housing.

Step 3. Remove the card from the slot.

Step 4. Insert the new memory card. contact pads facing up and away from user.

Step 5. Turn power ON and wait until the download process is completed. During the download, the status indicator will flash RED-GREEN. Once the download is completed, the unit will initialize and the status light will turn green. If there were no communication with the controller the light would stay RED.

Download Procedure for the Multi-download Memory Card:

Please follow the instructions for the single-download memory card. Follow steps 1 through 6. After the successful completion of step 5, remove the card from the slot. (Follow steps 1,2,3 and 4).

Turn power ON. The LVH will initialize and the status light will turn GREEN. If there is no communication with the controller the light would stay RED.

The memory card can be used to download other LVH units, until the number of preordered downloads is reached.

Download Procedure via Interface Connector:

In order to properly complete an interface download, a network download memory card must be present in the slot at all times—before and during the download.

1. The software download can be accomplished via the host controller (please refer to CCNET protocol description).
2. For a direct download via the interface connector, please follow the instructions below:

Step 1. Turn power OFF.

Step 2. Disconnect the interface connector from the LVH.

Step 3. Connect the personal computer to the LVH.

Step 4. Perform update.

Step 5. Disconnect the computer.

Step 6. Connect the interface connector to the LVH.

Step 7. Turn power ON.

Software Update Diagnostics

Normally, the download process will be accompanied by a blinking red-green status light lasting for less than 3 minutes (worst case). If the download has completed successfully the device will self-reset. In case of errors they are indicated by green flashes on red background (boot level flashes).

The following table lists possible errors that may take place during a download:

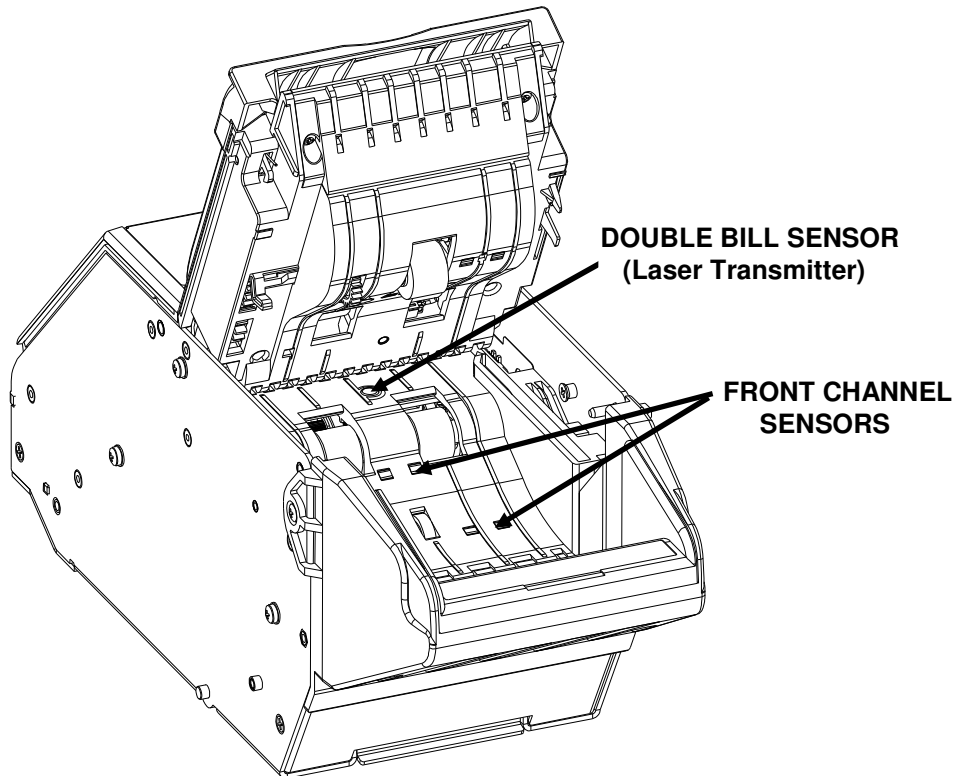
Status of diagnostic light	Error description	Corrective action
1 green flashes on red bkgrd	Write error	<ul style="list-style-type: none"> – Check the card and it’s contact pads – clean if necessary. – Repeat procedure.
2 green flashes on red bkgrd	A firmware component is missing	<ul style="list-style-type: none"> – Please install a component missing– either a slave boot or main firmware or both.
3 green flashes on red bkgrd	A required card is missing	<ul style="list-style-type: none"> – Please insert the required card and reset/repower the device. Ex.: no valid main firmware is detected and there is no card to update it from or the card does not contain a record with main firmware.
4 green flashes on red bkgrd	Update policy violation	<ul style="list-style-type: none"> – Please install the required card. If the firmware was upgraded with ONE UPDATE card, please make sure this card is present at reset. If the firmware was downloaded remotely with NDEG rights, please make sure the NDEG card with your client code is present at reset.
5 green flashes on red bkgrd	Generic error	<ul style="list-style-type: none"> – A boot-originated error which is not user-fixable.

MAINTENANCE & SERVICE

Front Channel' Optical Sensors Cleaning

Open the Front Channel Door;
Clean the Channel Surface in Sensors' Areas.

Clean this Sensors' Surfaces after every 20 000 Bills Accepted. The laser transmitter is the sensor that requires the best possible cleaning.



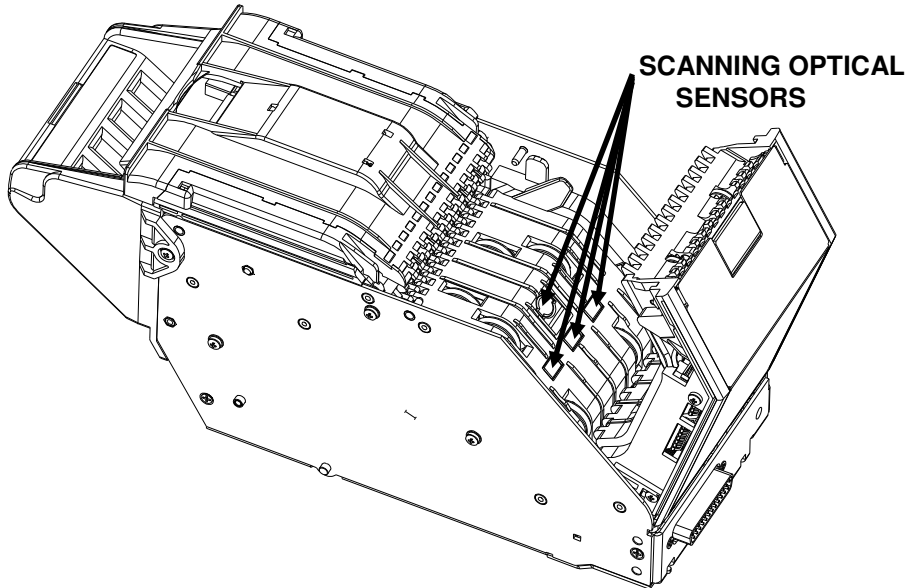
Optical Sensors in Front Channel

NOTE: despite the sensors are located on the bottom of the channel only, loopback light guides matching the sensors on the channel lid should be cleaned too.

Scanning Section' Optical Sensors Cleaning

Open the Scanning Section Door;
Clean the Channel Surface in Sensors' Areas.

Clean this Sensors' Surfaces after the Acceptance of every 60 000 Bills.



Optical Sensors in Scanning Section

NOTE: Both the channel bottom and the channel lid sensors should be cleaned.

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APPROVAL OF CHANGES

Revision	Description	Approval	Date