Bulk Coin Recycler Technical Manual

Money Controls

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1 Diary of Changes

Issue 1.0 ..... 16th April 2008
- First Issue

Issue 1.1 ..... 17th July 2008
- Updated the pictures
- Changed the active manifold details
- Added Safety note to SR5i section

Issue 1.2 ..... 22nd July 2008
- Corrected Table 12 SR5i LED Status

Issue 1.3.....14th Jan 2011
- Inserted new PCB cover instructions
- Updated images and general update

2 SERIAL COMPACT HOPPER

2.1 Introduction

The Serial Compact Hopper Mk2 or SCH2 is a serially controlled Compact Hopper manufactured by Money Controls. The serial interface is **ccTalk**, firmly established as a leading, low-speed device control protocol in the money-transaction industry. A key feature of **ccTalk** is its optimal balance between simplicity and security.

2.2 Safety Note

To meet the requirements for EN 60950 the equipment must be installed according to the following requirements:-

- The equipment must be protected by a 3A fuse.
- The equipment must be supplied from a SELV limited power source.
- The equipment must be installed in an enclosure but positioned so that it is external to any fire enclosure area within the main enclosure.

2.2.1 INSTALLATION AND REMOVAL

Warning: Ensure that the power has been disconnected from the Hopper before removal or servicing.

2.2.2 HAZARDOUS MOVING PARTS

Warning: There are hazardous moving parts, keep fingers and other body parts away. Consideration to this hazard must be assessed in the end use application.

2.2.3 HEALTH AND SAFETY

Warning: Due to the potential respiratory hazards, it is highly recommended that a facemask be worn to prevent the inhalation of dust particles dislodged during the maintenance or cleaning process or the clearing of jammed coins.

2.3 Mechanical Description

Each disc contains a number of holes in which the coins are held. The disc is driven via a gear train, by the motor. As the disc rotates, the coin at the bottom of one of the stacks will make contact with the ejector fingers. The fingers will move back and, at the same time, the coin will start to move outwards to the exit slot.

Once the coin reaches the exit slot, the spring loaded ejector fingers will be able to return to their original position and, in doing so, will push the coin out of the hopper.

An optical coin detector is created by infrared transmitters and photo detectors situated on the PCB. The infrared light beam is routed across the exit slot via a light guide. When a coin passes through the exit, the light beam will be broken and a coin output signal will be generated.

There are a range of discs, ejector fingers and adjuster plates available to provide optimum performance for coins within the specified range.

2.4 Mechanical Features

2.4.1 HOPPER DIMENSIONS

The hoppers overall dimensions, mounting arrangement, coin entry and exit points are detailed in Figure 1. Note that, when used in the side exit mode, the rear of the motor protrudes from the rear of the casing, within the overall dimensions of the hopper envelope.

2.4.2 HOPPER WEIGHT

570 Grams

2.4.3 COIN SIZE RANGE

Hoppers can be configured to pay out coins in the diameter range 16.25-31.0mm, and within the thickness range 1.25-3.20mm. However, each coin needs to be qualified on an individual coin basis.

For further information on qualification of coins, please contact Money Controls Technical Services Department.

2.4.4 COIN CAPACITY

The coin capacity of the hopper is between 200 and 700 depending on their physical size.

Table 1: Coin Capacities

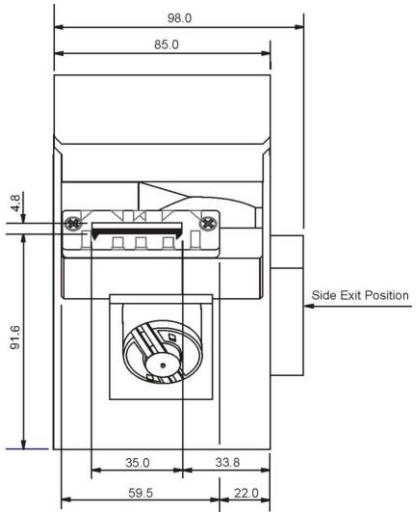
Coin	Diameter (mm)	Thickness (mm)	No Coin Capacity
£2	28.40	2.50	189
£1	22.50	3.10	235
50p new	27.30	1.80	282
20p	21.40	1.80	459
10p	24.50	1.83	349
5p	18.00	1.73	679
2p	25.90	1.80	316
1p	20.25	1.43	652

Note: these capacities are subject to a +/- 10% error.

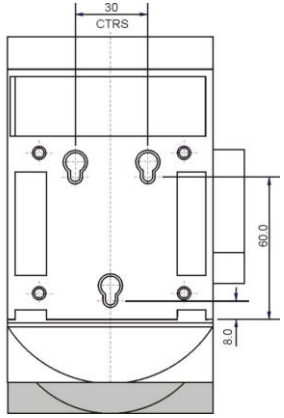
2.5 Overall Dimensions

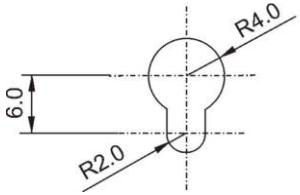
Figure 1: Hopper Dimensions

Rear Exit View



Bottom View





Key Hole Details

2.6 Installation and Removal

Warning: Ensure that the power has been disconnected from the hopper before removal.

2.6.1 DISMANTLING THE HOPPER

- Gently pull out the securing clips on the back of the base.
- Tilt the bowl forward until it is clear of the clips.
- Slide the bowl forward until the locating lugs are clear of the slots in the base.
- Remove the motor assembly from the base and disconnect the cable.

2.6.2 HOPPER ASSEMBLY

- Connect the cable to the motor assembly.
- Lower the motor assembly into the base, ensuring the coin exit is in the desired position.
- Locate the lugs at the front of the bowl into the slots at the front of the base.
- Gently press down on the top of the bowl until the securing clips (on the base) click into the slots on the bowl.

2.7 Why Serial?

Coin hoppers traditionally have a simple parallel interface. Common methods for paying out coins include 'logic motor control' whereby a low voltage control signal can be used to turn the motor on and off, and 'pulse counting' whereby a stream of pulses is used to dispense the coins (one coin per pulse). In the 'logic motor control' method it is up to the host software to monitor and count coins travelling past the payout optos.

A benefit of 'multi-drop' serial is the ability to connect several coin hoppers to the same wiring harness or 'bus'. This greatly simplifies the cabling within a machine as multiple hoppers can be daisy-chained together rather than having to branch out from a central star point. The number of control signals is usually much less with serial than with parallel. The only control signal in the **ccTalk** protocol is a single bi-directional 'data' line. It is also possible with serial to connect in other money transaction peripherals such as coin acceptors, bill validators and card readers.

The inherent 'expandability' of serial allows for a much better level of diagnostics and error reporting than is available on parallel, if it is available at all. Rather than a general alarm condition, the difference between a coin jam and a deliberate attempt to fraud the hopper can be reported externally.

2.8 Product Features

SCH2 represents to date the most sophisticated serial coin hopper in the world.

The following features are available on SCH2…

- Payout modes. The hopper defaults to multi-coin payout mode which pays up to 255 coins in a single dispense command.

- Opto security. During idling (no coins being paid out), the exit optos are randomly pulsed. If a blockage is seen while driving the opto or a short-circuit seen while not driving the

opto then an alarm condition is generated. During pay out, if a short-circuit is seen while not driving the opto then an alarm is generated.

- Motor terminal protection. A heavy duty mechanical relay protects the motor terminals by shorting them out during idle.
- Anti-jam operation. If the hopper experiences a coin jam during a payout sequence it will automatically reverse in order to clear the jam.
- Software fuse. If an absolute maximum current threshold is exceeded (factory pre-set) then the hopper aborts payout with an error code.
- Polyswitch protection. The motor driver terminals are protected with a polyswitch for additional overload protection.
- Power fail protection. A non-volatile memory keeps track of coins paid out. If power is lost during a payout sequence then the residual number of coins to pay can be read back after the machine re-initialises.
- Unique serial number. Each hopper is manufactured with a unique 24-bit serial number which cannot be modified by external means.
- Coin counting. Two counters record the number of coins paid out of the hopper. One is reset-able by the user, the other is a life counter. Both are implemented in NV Memory.
- Data integrity. All coin counter values in NV Memory are stored with a 8-bit checksum to ensure data integrity.
- Level plate support. There is an option to fit high or low level plates and the status of these can be read by the host machine on serial.
- Remote configuration. Motor parameters such as reversing current and payout timeout can be changed with serial commands. No changes to electronic components are required.
- Multi-drop operation. A number of serial hoppers can be connected to the same serial bus. Device addresses can be changed in software to any 8-bit value.
- Extensive command set. Host software can implement a small or large fraction of the full command set available depending on the application. Commands are available for inhibiting the hopper, reading the state of the exit optos, checking the software revision etc.
- Diagnostic and error reporting. Full access to diagnostic and error codes are made available over serial.
- Code protection. The software is protected with an internal, independent, watchdog circuit. A ‘crash’ in the software will result in a clean reset of code.

2.9 ccTalk Design Parameters

Refer the ‘**ccTalk** Serial Communication Protocol / Generic Specification’ for an explanation of the protocol and its implementation on any platform. A copy can be downloaded from *www.cctalk.org*.

This product is configured as…
cctalk b96.p0.v24.a5.d0.c8.m0.x8.i1.r3

In other words…
9600 baud / open-collector interface / +24V supply / +5V data / supply sink / connector type 8 / slave device / 8-bit checksum / implementation level 1 / spec. issue 3

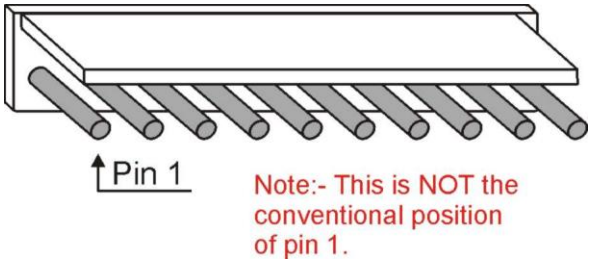
Note: The hopper can only operate at 9600 baud.

2.9.1 SERIAL CONNECTOR TYPE

PCB Connector
2.54mm (0.1inch) pitch 10 way with locking wall

Part No: Molex 22-27-2101 or equivalent

Figure 2: SCH2 Connector



2.9.1.1 Serial Connector Pinout

Pin	Function
1	Address select 3 - MSB
2	Address select 2
3	Address select 1 - LSB
4	+Vs
5	+Vs
6	0V
7	0V
8	/DATA (ccTalk)
9	N/C
10	N/C

Operation can be achieved with just 3 wires…

- +24V to pin 4
- GND to pin 6
- Bi-directional serial data line to pin 8

Pins 4 and 5, and pins 6 and 7, are linked internally. The provision of extra pins is to simplify the manufacture of a multi-drop cable using thicker wire for the power leads. There can be a 'power-in' and a 'power-out' pin, and the hoppers daisy-chained.

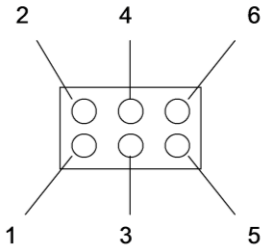
Note: The hopper can only operate at 9600 baud.

2.10 Auxiliary Connector Type

Figure 3: SCH2 Auxiliary Connector

PCB Connector
2.54mm (0.1inch) pitch

Part No. : AMP 87631-2



2.10.1 AUXILIARY CONNECTOR PINOUT

Pin	Function
1	High Level Plate
3	Low Level Plate
5	Plate Common
2	High Level Link
4	Low Level Link
6	Link Common

2.11 Operation

To notify the hopper software that level plate sensors are fitted, the link pins should be connected as follows…

Mode	Connections
High level plates only	pin 2 to pin 4
Low level plates only	pin 4 to pin 6
High & low level plates	pin 2 to pin 4 to pin 6

Otherwise, no connections should be made.

The level plates themselves should be connected through the corresponding plate pin (pin 1 for high level, pin 3 for low level) and the plate common (pin 5).

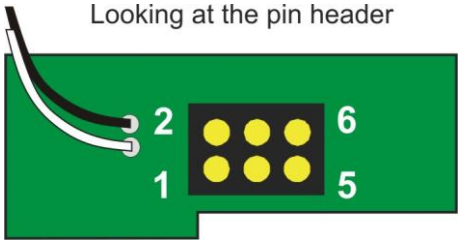
2.12 Address Selection

A number of mating connectors on a multi-drop bus cable may each be wired uniquely to allow operation of multiple hoppers. Since address selection is done externally, any Serial Compact Hopper may be plugged into any position on the bus and the host machine will know which one is paying out a particular coin.

Note: Addresses may be changed in software. Refer to the 'Address change' and 'Address random' serial commands. These values are lost at power-down or reset.

2.13 Level Sense Connector

Figure 4: Level Sense Connector



Pin	Function
1	High Level Plate
3	Low Level Plate
5	Plate Common
2	High Level Link
4	Low Level Link
6	Link Common

Operation

To notify the hopper software that level plate sensors are fitted, the link pins should be connected as follows…

Mode	Connections
High level plates only	pin 2 to pin 4
Low level plates only	pin 4 to pin 6
High & low level plates	pin 2 to pin 4 to pin 6

Otherwise, no connections should be made.

The level plates themselves should be connected through the corresponding plate pin (pin 1 for high level, pin 3 for low level) and the plate common (pin 5).

2.14 Power Fail Recovery

SCH2 contains a non-volatile memory (EEPROM) for the storage of coin counters. Therefore if power is removed in the middle of a payout sequence then the situation can be recovered and the residual coins paid out after power is restored. This behaviour is under control of the host software - the hopper does not automatically dispense coins when power is re-applied.

The following counters are saved…

- [Last payout : coins paid] x 1 byte
- [Last payout : coins unpaid] x 1 byte
- [Hopper dispense count] x 3 bytes
- [Hopper life dispense count] x 3 bytes

along with their corresponding checksums.

The [Last payout: coins paid] and [Last payout: coins unpaid] bytes can be read with the 'Request hopper status' command.

The [Hopper dispense count] can be read with the 'Request hopper dispense count' command.

The [Hopper life dispense count] can be read by looking at block 3 of the NV Memory using the 'Read data block' command. Refer to Appendix D for a memory map description.

After power-up initialisation, the host machine can read the [Last payout: coins unpaid] byte to determine if there are any remaining coins to be paid out after the last session. The decision to pay out any remaining coins is made by the host machine, not the hopper.

2.15 Power Fail in Detail

The sequence of saving the coin counters to NV Memory is triggered by the following conditions…

- Sudden loss of power with the motor running
- Receipt of an 'Emergency stop' command

If power is suddenly lost with the motor running then the hopper will stop the motor immediately and update the NV Memory while it has power to do so. SCH2 does not have a 'battery back-up' but uses a capacitor reservoir.

If power is lost after a payout sequence has completed (hopper in idle) then the [Last payout: coins unpaid] counter is cleared, regardless of the value it was holding. This is because it is assumed the host machine has dealt with the last payout sequence and has taken the appropriate action. It is not desirable to flag unpaid coins during the next power-up initialisation.

Note: This means a slow rise time or switch bounce on the power supply could inadvertently clear the unpaid counter.

If the host machine has early notification of a power fail it can send an 'Emergency stop' command to the hopper. This command stops the motor dead and returns the number of unpaid coins back to the host. This value **should be stored by the host machine** prior to power being lost.

Examples…

a) Power lost during payout sequence

Counter	Initial value	Pay 3 from 10 then lose power
Last payout : coins paid	0	3
Last payout : coins unpaid	0	→7←
Hopper dispense count	0	3
Hopper life dispense count	N	N + 3

Coins remaining = 7

b) 'Emergency stop' command issued during payout sequence

Counter	Initial value	Pay 3 from 10 then 'Emergency stop'	Cycle power off then on
'Emergency stop' return value	0	→7←	0
Last payout : coins paid	0	3	3
Last payout : coins unpaid	0	7	ZERO
Hopper dispense count	0	3	3
Hopper life dispense count	N	N + 3	N + 3

Coins remaining = 7

c) 'Emergency stop' command issued during payout sequence AND a coin is seen after the hopper replies with unpaid coins.

Counter	Initial value	Pay 3 from 10 then 'Emergency stop' + late coin exit	Cycle power off then on
'Emergency stop' return value	0	7 →6← on retry	0
Last payout : coins paid	0	4	4
Last payout : coins unpaid	0	→6←	**ZERO**
Hopper dispense count	0	4	4
Hopper life dispense count	N	N + 3	N + 4

Coins remaining = 6

In this more complicated example, the hopper dispense count and the hopper life dispense count end up with the correct values even though a coin was seen on the exit optos after the motor stopped. For the host machine to find the correct value of unpaid coins it would need to re-send the 'Emergency stop' command or use the 'Request hopper status' command **before** power was lost - otherwise it would think there were 7 unpaid coins rather than 6.

Therefore if you need to know the number of remaining coins during a power fail and wish to use the 'Emergency stop' command, please ensure that you have enough time to send this command and a 'Request hopper status' before power is lost. This gives the best possible accuracy. The host machine needs at least **100ms** of notice before the power supply dips below Vtrip (see Appendix B).

2.16 What happens…?

2.16.1 WHAT HAPPENS AFTER POWER UP?

The following is a guide to what happens when power is lost and re-applied.

Device Address
Defaults to the connector address

PIN Number
Retained but needs to be re-entered

Motor Variables
[current limit] = default value
[motor stop delay] = default value
[payout timeout] = default value
[maximum current measured] = ZERO

See Appendix A for default values.

Flags
Refer to the Flag Action Table within the 'Test hopper' command description.

Note that the 'Power-up' flag is set to indicate the power supply really was lost and the hopper defaults to multi-coin payout mode. The hopper also starts inhibited and needs to be enabled prior to coin dispensing.

Counter checksum flags are updated.

Counters
Hopper dispense count = last value
Hopper life dispense count = last value

Request hopper status
[event counter] = ZERO
[payout coins remaining] = ZERO
[last payout : coins paid] = last value
[last payout : coins unpaid] = ZERO or last value if power lost during payout

Request comms status variables
[rx timeouts] = ZERO
[rx bytes ignored] = ZERO
[rx bad checksums] = ZERO

2.16.2 WHAT HAPPENS AFTER A SOFTWARE RESET?

The following is a guide to what happens after a software reset. A software reset means sending the 'Reset device' command to the hopper.

Device Address
Defaults to the connector address

PIN Number
Retained but needs to be re-entered

Motor Variables
[current limit] = default value
[motor stop delay] = default value
[payout timeout] = default value
[maximum current measured] = ZERO

See Appendix A for default values.

Flags
Refer to the Flag Action Table within the 'Test hopper' command description.

Note that the 'Power-up' flag is cleared. The hopper also starts inhibited and needs to be enabled prior to coin dispensing.

Counter checksum flags are updated.

Counters
Hopper dispense count = last value
Hopper life dispense count = last value

Request hopper status
[event counter] = ZERO
[payout coins remaining] = ZERO
[last payout : coins paid] = last value
[last payout : coins unpaid] = last value

Request comms status variables
[rx timeouts] = ZERO
[rx bytes ignored] = ZERO
[rx bad checksums] = ZERO

2.17 Power Distribution on a Multi-Drop Bus

The multi-drop bus for Serial Compact Hoppers consists of a power, ground and serial data line. When more than one hopper is attached to the bus, all power is transferred along a single cable and significant ground potential rises can occur.

The following recommendations are made

- Only operate one serial hopper at a time. Never initiate a second payout sequence when one is already in progress.
- Consider the use of signal conditioning on the serial data line receiver. Perhaps a high-frequency filter and voltage comparitor input with a mid-rail (2.5V) threshold.
- Consider running separate power cables to the hoppers to alleviate the ground potential problem.
- If communication errors still occur, consider changing the topology of the multi-drop bus network. A star network will distribute power more evenly than a ring, tree or daisy-chain network.

2.18 Electrical Noise - Physical Measures

The **ccTalk** protocol is not designed for long distance transfer but for local hook-up of various peripherals within a machine cabinet. Typical cable lengths are likely to be of the order of a few metres.

Various measures can be taken to minimise the effects of radiated and conducted noise on the ccTalk bus.

- Use a good quality regulated power supply with mains filtering. The power rating should be sufficient to handle a Serial Compact Hopper at maximum surge current.
- Do not run the multi-drop bus cables directly next to noisy electrical components if at all possible. These are typically motors, relays, VDU's, fluorescent strip lights etc. If problems are experienced consider the use of screened cable.
- Keep cable runs as short as possible.
- Make sure the **ccTalk** data line has an appropriate load resistor at the host end (typically 1K to 10K pull-up to +5V).
- Do not place too many peripherals on the bus - consider the loading effects of each **ccTalk** interface circuit. The maximum number allowed will depend on the host transceiver circuit.

2.19 Electrical Specification

MCL recommend a 24V, 4A power supply.
24 volt motor version

Table 2: Electrical Specification

Electrical Specification	
Supply Voltage	+24V
Typical Operating Current/No Load	0.35A
Typical Operating Current/Max Load	0.9A
Surge Current/Start Up and Reverse	3.6A
Typical Payout Rate	8 to 10 coins per second

2.19.1 COIN PAYOUT:

Table 3: Coin Payout Rate

Mode	Rate
Multi coin payout	8 - 10 coins per second approx.
Single coin payout	2 coins per second approx.

2.19.2 PRODUCT COMPLIANCE

2.19.2.1 Emissions

This product is compliant with EMC test specification EN50081-1; 1992

2.19.2.2 Immunity

This product is compliant with EMC test specification EN50082-1; 1997

2.19.2.3 Safety

This product is compliant with EN60950; 1992 + Amdt A1 & A2: 1993 & A3: 1995 Safety

2.19.3 ENVIRONMENTAL:

Table 4: Environmental Ranges

Operating Temperature	0 to 60^0 C
Storage Temperature	-20 to 70^0 C
Operating Humidity	10 to 75% RH
Storage Humidity	10 to 95% RH non condensing

2.20 Maintenance Schedule

Table 5: Maintenance Schedule

Maintenance Schedule	
Every 50,000 to 100,000 depending on coin type.	Using a mild detergent on a damp cloth. No spray solvents should be used.
Every 500,000 coins.	Replace ejector fingers and spring
Every 1,000,000 coins.	Replace adjuster plate
Expected product lifetime:	3 million coins with routine maintenance

2.20.1 CLEARING A COIN JAM:

- Remove all coins from bowl.
- Remove motor assembly from base as described.
- Clear the jammed coin by either:
  i. Rotating the disk manually, first anti-clockwise then clockwise to free the coin OR
  ii. Push the coin back in using another coin.
- Remove any debris from the disk bed assembly.
- Clean the exit window opto with a clean dry cloth.
- Re-assemble, as described.
- Refill and test the hopper.

2.21 Fault Finding and Repair

Table 6: Fault Finding and Repair.

Problem:	Check:	Cure:
Coins fail to un-jam:	Ensure coin exit is clear.	Remove blockage from coin exit.
	Ensure correct coins in hopper.	Fill hopper with correct coins.
	Ensure no badly bent coins in hopper.	Remove bent coin/s.
Motor fails to run:	Supply fuse.	Replace fuse.
	Protection device tripped.	Wait 30 seconds with supply OFF.
	Hopper has detected an opto fault.	Check EEPROM flags.
Over payout of coins:	Check opto area/coin exit area for dirt.	Clean opto/coin exit area.
Under Payout Of Coins:	Check opto area/coin exit area for dirt.	Clean opto/coin exit area.
	Ensure hopper contains sufficient coins.	Refill hopper.

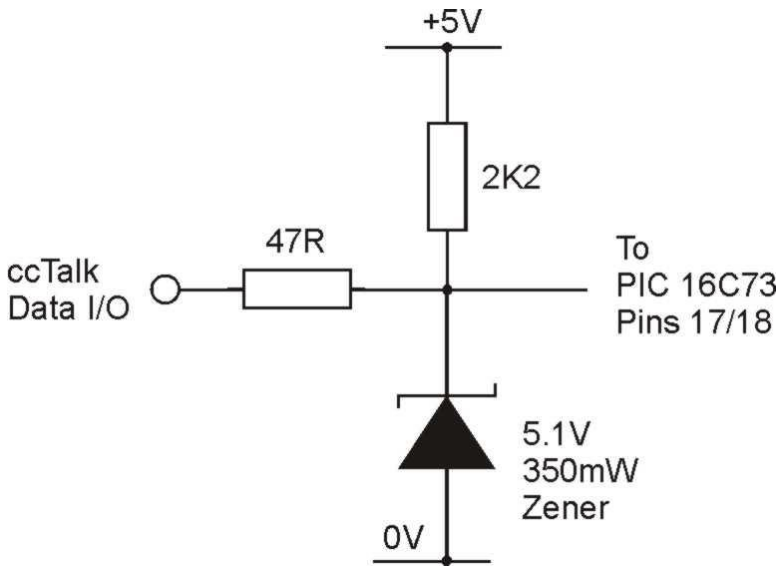
2.22 Appendix A

2.22.1 CCTALK INTERFACE CIRCUIT

This is the **ccTalk** electronic interface circuit on SCH2.

There are many options for the host interface circuit but we recommend an open-collector drive.

*Figure 5: **ccTalk** Interface Circuit:*



3 BCR SR5i

3.1 Introduction

Thanks to its intelligent expert system. AccepTelligence™ the **SR5i** offers an exceptional level of first-time acceptance and security levels resulting in exceptional fraud rejection.
Full remote capability allows new coin specifications and other coin programming to be downloaded via a connected host, while allowing diagnostics information to be transferred to the host for effective and secure machine management and control. The integration of an encrypted communications protocol further raises the integral product security to new levels.

3.2 Safety Note

To meet the requirements for EN 60950 the equipment must be installed according to the following requirements:-

- The equipment must be protected by a 3A fuse.
- The equipment must be supplied from a SELV limited power source.
- The equipment must be installed in an enclosure but positioned so that it is external to any fire enclosure area within the main enclosure.

3.2.1 INSTALLATION AND REMOVAL

Warning: Ensure that the power has been disconnected from the SR5i before removal or servicing.

3.2.2 HEALTH AND SAFETY

Warning: Due to the potential respiratory hazards, it is highly recommended that a facemask be worn to prevent the inhalation of dust particles dislodged during the maintenance or cleaning process or the clearing of jammed coins.

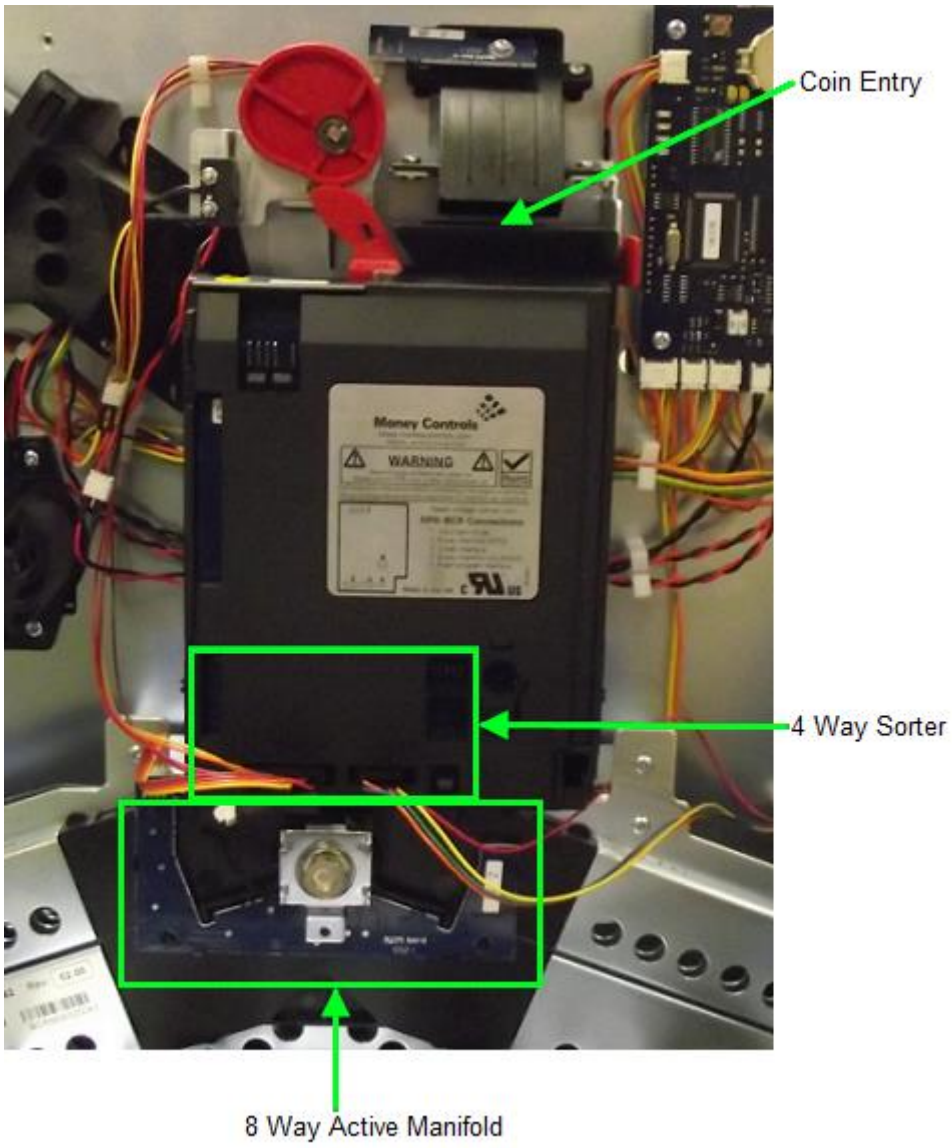
3.3 Operation

Coin discrimination parameters are factory programmed for optimum acceptance of up to 16 different coins or tokens and therefore no field adjustment is necessary beyond token select / **Teach and Run™**
However, the SR5i can now be programmed on site without the use of coins and for total flexibility, if a new coin/token is required, the **Teach and Run™** function can be used to program all 16 coins.

Coins are inserted into a front or top entry acceptor and roll past a set of Series Resonant sensors. If the characteristics measured from the inserted coin match the stored window readings in all respects, then the coin is recognised as being true. The accept gate will then open and the coin will pass through the accept sensor. Once this happens the SR5i will send a predefined credit signal to the host machine which will correspond to the coin accepted. The coin is then diverted to one of 4 different paths and subsequently an additional 4 paths by the active manifold.

If, on comparing the inserted coins characteristics, to all the pre-programmed parameters, the coin readings do not match, this coin will be deemed invalid, the accept gate will remain closed and the coin will travel through to the reject via the reject path.

3.4 Mechanical Arrangement



3.5 Electrical Connections

Figure 6: SR5i BCR Connector Side

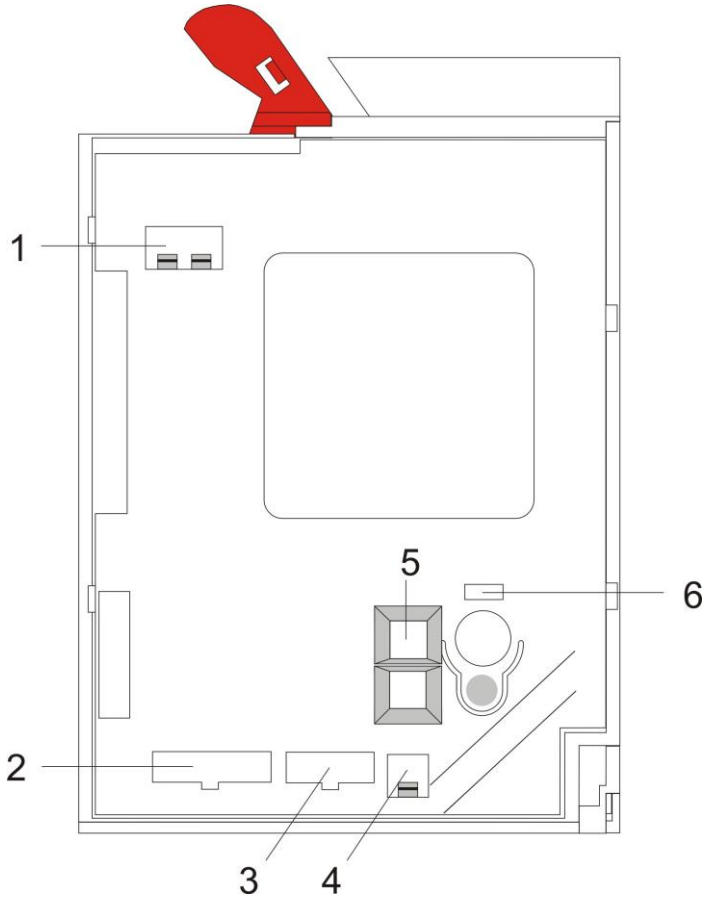


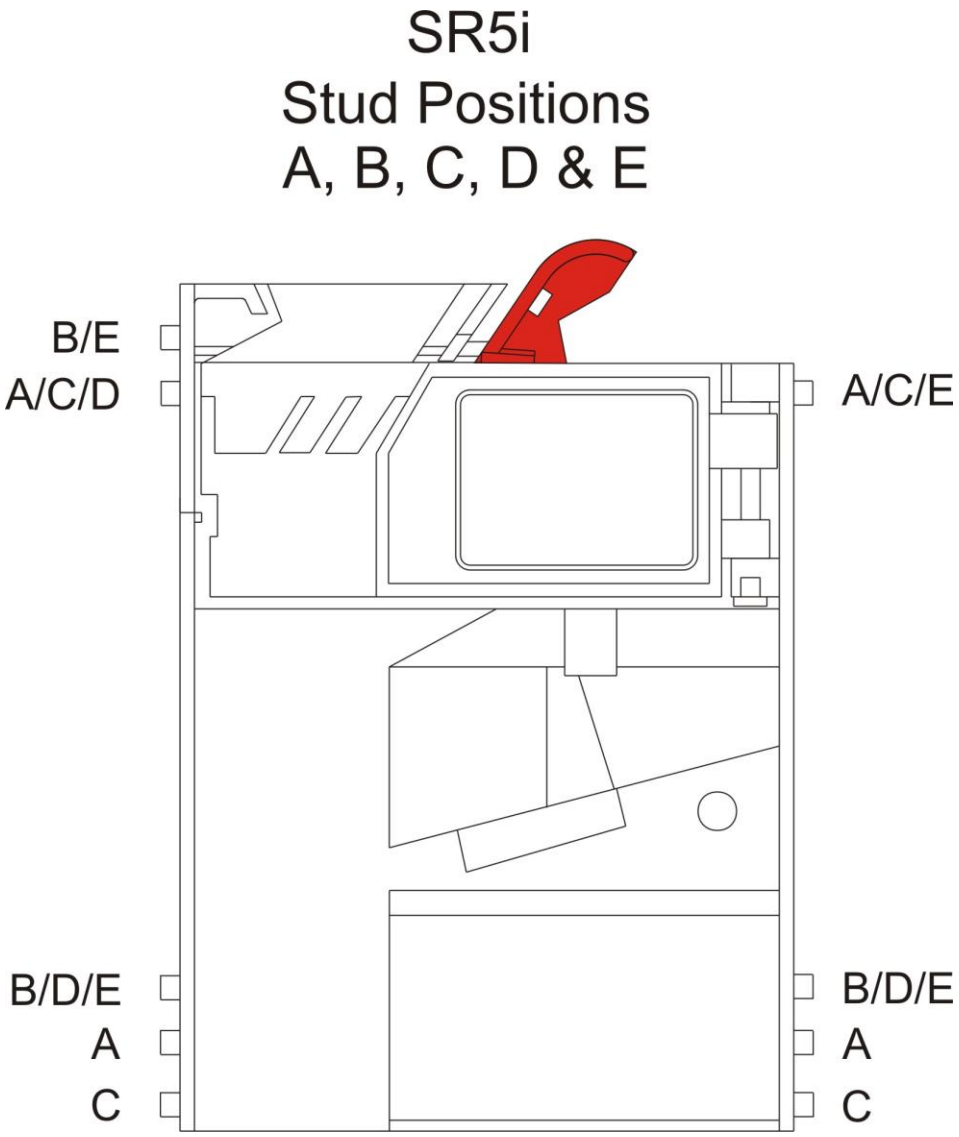
Table 7: SR5i BCR Rear Cover Details.

1	Not Used
2	8-Way Active Manifold Optics and Coin Arrival Sensor
3	Serial interface (**ccTalk**)
4	Not Used
5	Flash Programming
6	LED Indicator

3.6 Stud Positions

The stud positions shown below are factory fitted at MCL.
"A" represents Money Controls back channel compatible with a BCR

Figure 7: Stud Positions



3.7 Electrical Interface Requirements

Table 8: Power Supply

Voltage:	+12V to +24V DC +/- 10%
Absolute:	Min +10V Max +27V
Min / Max rise time:	5ms / 500ms (From 0V to within supply range)
Min / Max fall time:	5ms / 500ms (From within supply range to 0V)
Acceptor Power up time:	200 ms from the application of a valid voltage supply. A valid supply must be between the limits specified above.
Ripple voltage [< 120Hz]:	< 1 Volt
Ripple voltage [> 120Hz]:	< 100mV
Ripple voltage [> 1KHz]:	< 20mV

Table 9: Current Consumption

Typical:	70mA
Maximum:	2.0A with sorter. 3.0A with sorter and active manifold.

3.8 Power-up Diagnostics

When the SR5i powers up, it performs an EEPROM self-check. If there is a problem with the checksum, the LED will turn red and no coins will be accepted.

If diagnostic self check is **enabled**, the following are checked and if there is a problem then the accept lines show the alarm code, for as long as the fault is present.

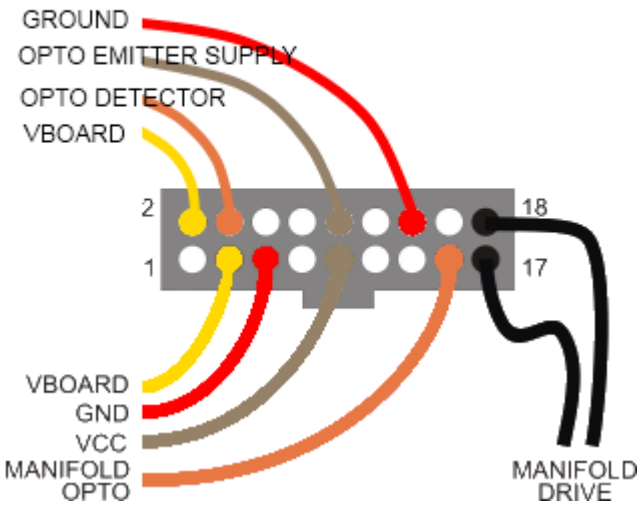
- Blockage in the sensor area / faulty sensor (AM, FM, Piezo & Credit sensors).
- The coin entry optics are checked for a blockage.
- The sorter optics are checked for a blockage.

Note: If the sorter has been removed, then the SR5i will think the sorter optics are blocked and therefore the alarm condition will be permanent. This can only be rectified by re-fitting a sorter.

When the blockage / fault is cleared, the alarm code will automatically be removed.

3.9 Main Connector

Figure 8: Main Connector Pin Outs



The main connector, connects power to the 8 way manifold, the opto circuit and also monitors the status of the manifold optics.

This connector is also used to provide information to the SR5i indicating when a coin is entered.

Normally, when there is no coin in the entry, the opto detectors are active as they are receiving infrared light from the corresponding emitter. This is the quiescent state.

When a coin is entered then the light path between the corresponding emitter and detector is broken and the detector becomes inactive.

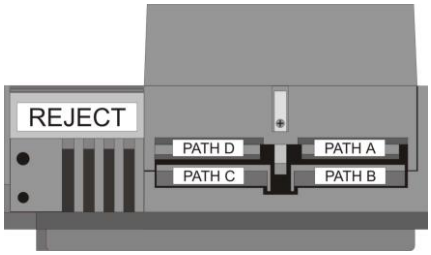
Once the coin has passed the optics, the system returns to its quiescent state.

3.10 Sorting Coins

3.10.1 4-WAY SORTER

Normally the SR5i will be used to sort coins to one of 4 paths.

Figure 9: 4-way sorter paths

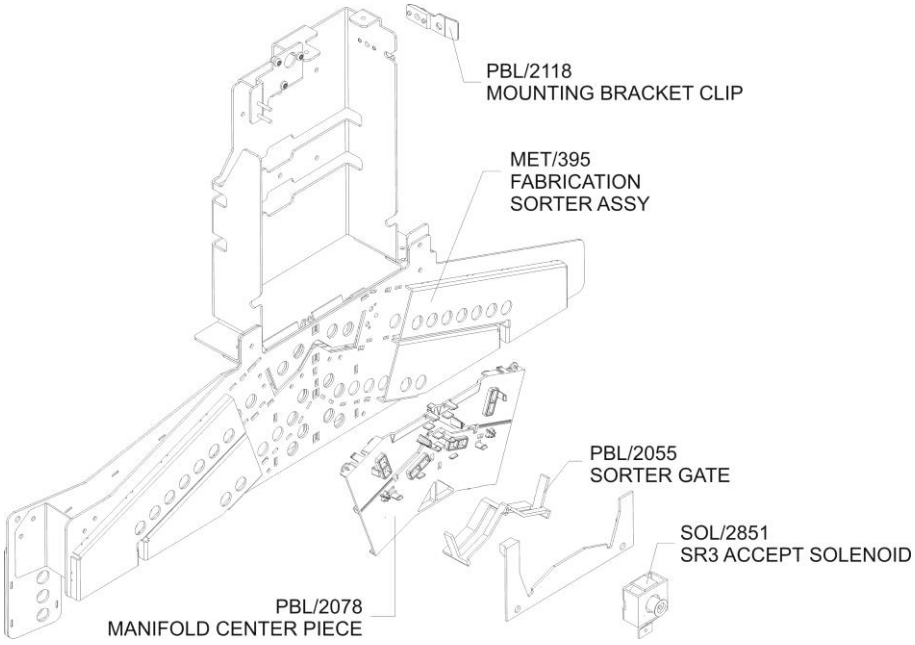


View from below sorter.

3.10.2 8-WAY SORTER (ACTIVE MANIFOLD)

Sorting up to 8 different paths is achieved using the active manifold in conjunction with the 4-way sorter.

Figure 10: 8-way Active Manifold exploded diagram



3.11 Flash Programming Interface

3.11.1 DETAILS OF PCB CONNECTOR:

5x2 way 2mm pitch straight pin header:

3.11.2 DETAILS OF MATING CONNECTOR PLUG:

Supplier – Harwin or equivalent:

Item 1 M22-3020500 5+5 DIL crimp housing
Item 2 M22-3050022 2mm crimp contact

Table 10: Flash Programming Interface – Signal Details

Pin	Signal Name	Function	Input (I) / Output(O) / Power(P)
1	Tx D1	Transmit Flash data – 5V TTL/CMOS	O
2	Gnd	Connection to SR5i board ground (0V)	P/O
3	Rx D1	Receive Flash data – 5V TTL/CMOS	I
4	Vcc	Connection to SR5i board +ve supply (+5V)	P/O
5	SCLK	Serial Clock – active Low	I
6	CNVSS	Programming voltage input – link to pin 4	I
7	Key	No connection. Used for polarising key	No connection
8	BUSY	Busy output – no connection required	O
9	CE	Chip Enable – active Low	I
10	HOLD/EPM	Hold/EPM – active Low	I

3.11.3 PLUG WIRING DETAILS FOR FLASH PROGRAMMING SR5I PROCESSOR

Table 11: Flash Programming – Connections Required

Pin	Signal	Connections for Flash Program mode
1	Tx D1	Transmit Flash data – 5V TTL/CMOS
2,5,9,10	0V / Gnd	External 0V / Ground connection
3	Rx D1	Receive Flash data – 5V TTL/CMOS
4.6		Link on header plug
7,8		No connection

3 external connections are required for on-board flash programming.

Programming of the on-board processor flash memory requires a cable link to a separate RS232 / 5V TTL/CMOS interface box connected to a PC COM port (COM1 or COM2).

Rotary switch must be set to Position 0.

Use Money Controls FlashProgrammer s/w utility to erase, download and verify the SR5i flash memory.

3.12 Led Indicator

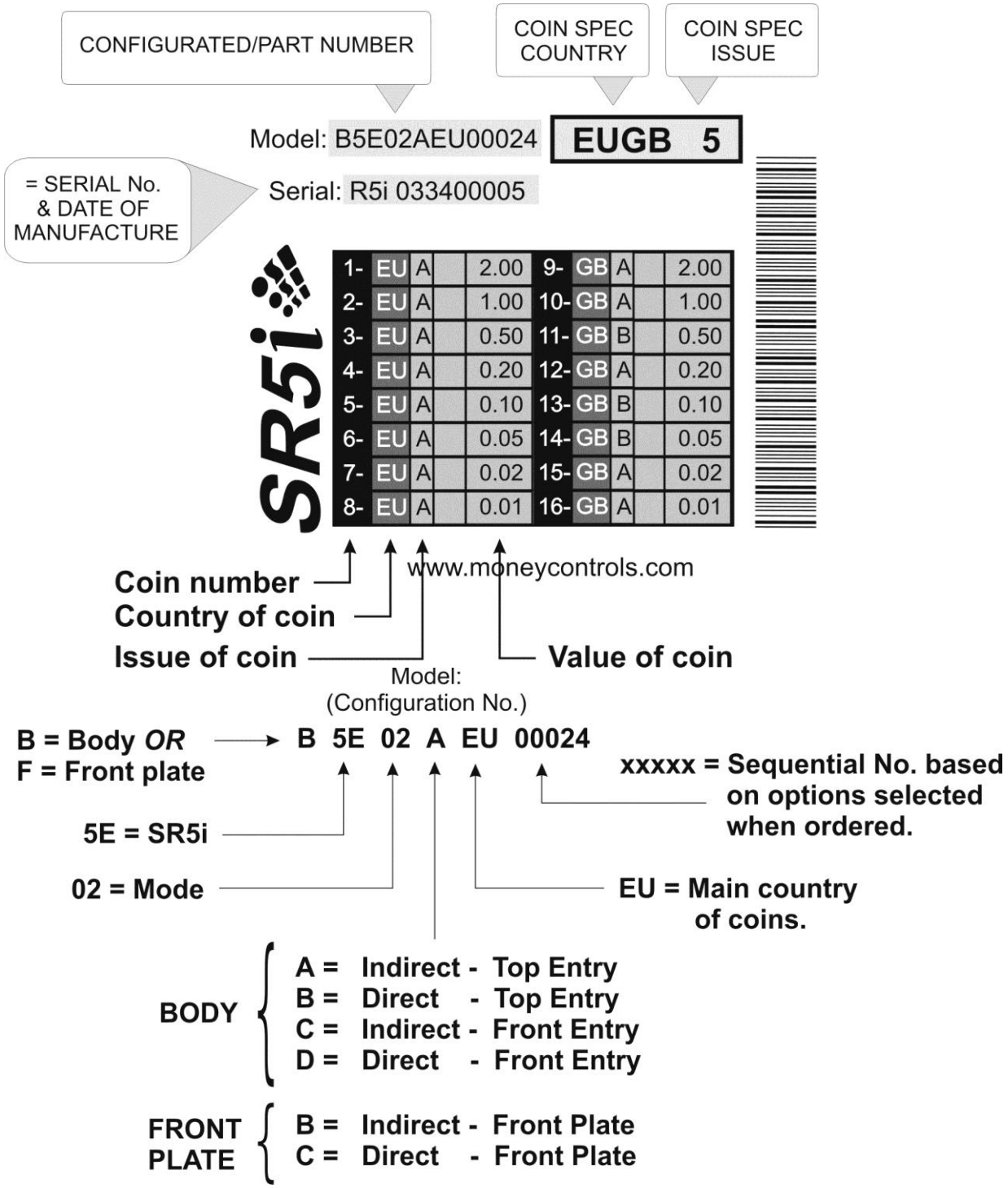
The following table shows the different LED states and the conditions which cause them.

Table 12: SR5i LED Status

Led status	Status description
Continuous **green**	SR5i OK – Coins Enabled
Continuous **red**	Coins Inhibited
Flashing **green / red**	Remote coin specification programming
Flashing **off / red**	Coin Jam or other fault
Flashing **off** / **green**	The 'intelligence' has been trigger (high security mode). The result will be reduced/no fraud coin acceptance. The SR5i will be reset by either 10 true coins or 5 minutes left in idle.

3.13 Label Details

Figure 11: SR5i Label Details



3.14 ccTalk Protocol

3.14.1 SERIAL INTERFACE

The serial interface is used to program coin data and customer options. It can also be used instead of the parallel interface to communicate with the machine.

Note: The serial and parallel interfaces cannot be used together in the machine.

Protocol: **ccTalk** BACTA compliant implementation.

For further details on this section please refer to the current **ccTalk** generic standard.

Connector type: 10 Way DIL (connector 5 on Figure 6).

Pin 1 - DATA
Pin 2 - 0V [Not used]
Pin 3 - Not used
Pin 4 - 0V [Not used]
Pin 5 - /RESET
Pin 6 - Not used
Pin 7 - +12 to +24 Volts [Power]
Pin 8 - 0 Volts [Power]
Pin 9 - /Serial Mode
Pin 10 - Reserved

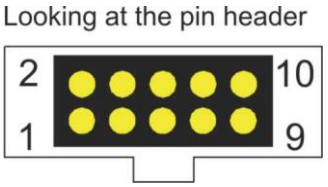


*Figure 12: **ccTalk** pin header*

Pin 9 is used to signal to the mech. that the serial interface is to be used rather than the parallel interface. For serial mode, pin 9 = Low **- at POWER-UP**.

Pin 5 is an optional hardware-reset line to the mech. and other peripherals on the bus.

Note: Pins 2 and 4 are connected to 0 Volts.

3.15 ccTalk Serial Messages

*Table 13: **ccTalk** Serial Commands*

Header	Function	Header	Function
254	Simple poll	214	Write data block
253	Address poll	213	Request option flags
252	Address clash	212	Request coin position
251	Address change	210	Modify sorter paths
250	Address random	209	Request sorter paths
249	Request polling priority	202	Teach mode control
248	Request status	201	Request teach status
247	Request variable set	199	Configuration to EEPROM
246	Request manufacturer id	197	Calculate ROM checksum
245	Request equipment category id	196	Request creation date
244	Request product code	195	Request last modification date
243	Request database version	194	Request reject counter

242	Request serial number	193	Request fraud counter
241	Request software revision	192	Request build code
240	Test solenoids	189	Modify default sorter path
238	Test output lines	188	Request default sorter path
237	Read input lines	185	Modify coin id
236	Read opto states	184	Request coin id
233	Latch output lines	183	Upload window data
232	Perform self-test	182	Download calibration information
231	Modify inhibit status	181	Modify security setting
230	Request inhibit status	180	Request security setting
229	Read buffered credit or error codes	179	Modify bank select
228	Modify master inhibit status	177	Handheld function
227	Request master inhibit status	176	Request alarm counter
226	Request insertion counter	173	Request thermistor reading
225	Request accept counter	170	Request base year
222	Modify sorter override status	169	Request address mode
221	Request sorter override status	162	Modify inhibit & override registers
220	One shot credit		
219	Enter new PIN number	4	Request comms revision
218	Enter PIN number	3	Clear comms status variables
216	Request data storage availability	2	Request comms status variables
215	Read data block	1	Reset device

For further details on this section please refer to the current **ccTalk** generic standard or contact Money Controls Technical Services Department.

3.15.1 CCTALK ERROR CODES

*Table 14: **ccTalk** Error Codes*

Code	Error
1	Reject coin
2	Inhibited coin
3	Multiple window (ambiguous coin type)
6	Accept sensor timeout
8	2nd close coin error (coin insertion rate too high)
14	Accept sensor blocked
15	Sorter opto blocked
17	Coin going backwards
23	Credit sensor reached too early
24	Reject coin (repeated sequential trip)
25	Reject slug
35	Number of coin meter pulses overloaded
36	Games overloaded
254	Coin return mechanism activated (flight deck open)

3.15.2 CCTALK FAULT CODES

Table 15: Fault Codes

Code	Fault
1	EEPROM checksum corrupted
2	Fault on inductive coils
3	Fault on credit sensor
4	Fault on piezo sensor
8	Fault on sorter exit sensors
22	Fault on thermistor
34	Temperature outside operating limits

3.15.3 CCTALK STATUS CODES

Table 16: Status Codes

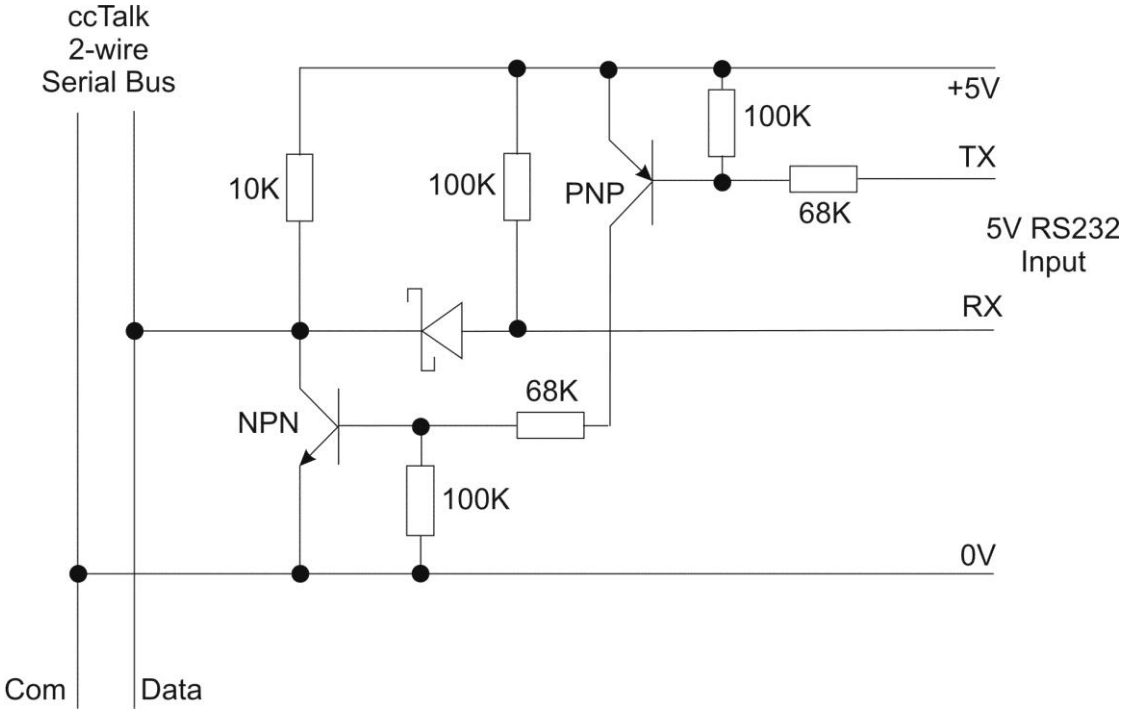
Code	Status
1	Coin return mechanism activated (flight deck open)

3.16 ccTalk Interface Circuits

3.16.1 CIRCUIT 1 – CCTALK STANDARD INTERFACE

This circuit uses an open-collector transistor to drive the data line and a diode protected straight-through receiver.

*Figure 13: Circuit 1, **ccTalk** Standard Interface*



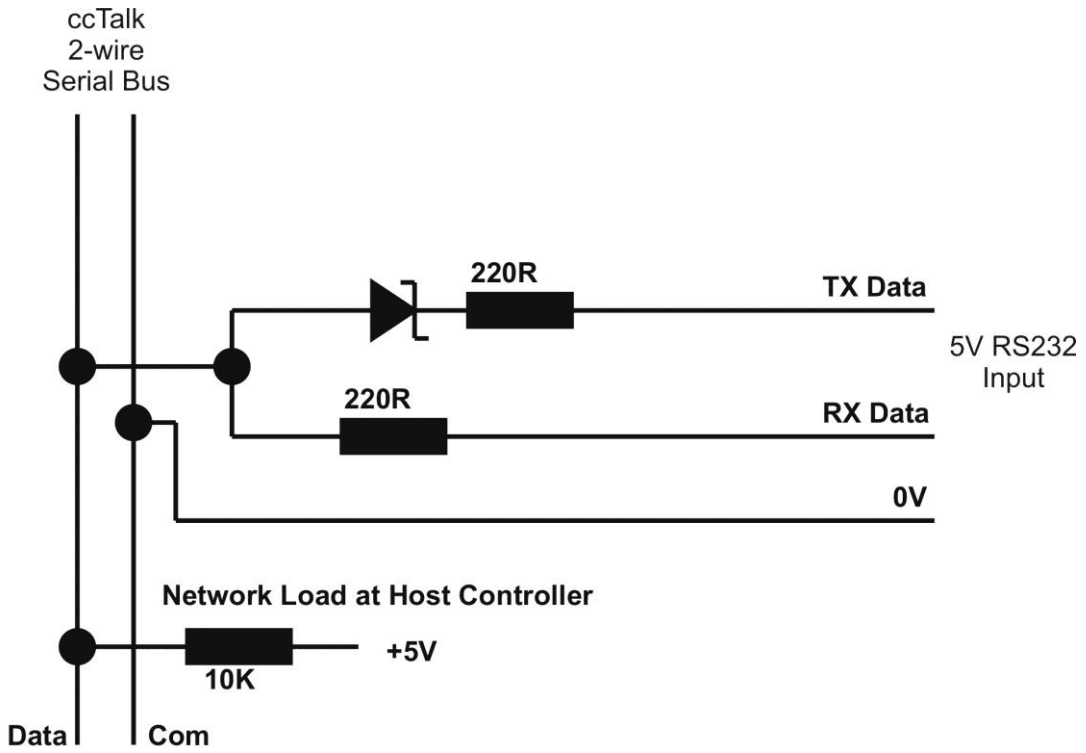
Typical Components

Diode	BAT54	Schottky Diode, low forward voltage drop.
NPN	BC846B	High gain, medium signal, NPN transistor.
PNP	BCW68	High gain, medium signal, PNP transistor.

3.16.2 CIRCUIT 2 – CCTALK LOW COST INTERFACE

Assuming that the transmitting device is capable of sinking a reasonable amount of current, a direct diode interface can be used rather than a full transistor interface. Although cheaper to implement, this circuit does not have the drive capability or the robustness of other designs.

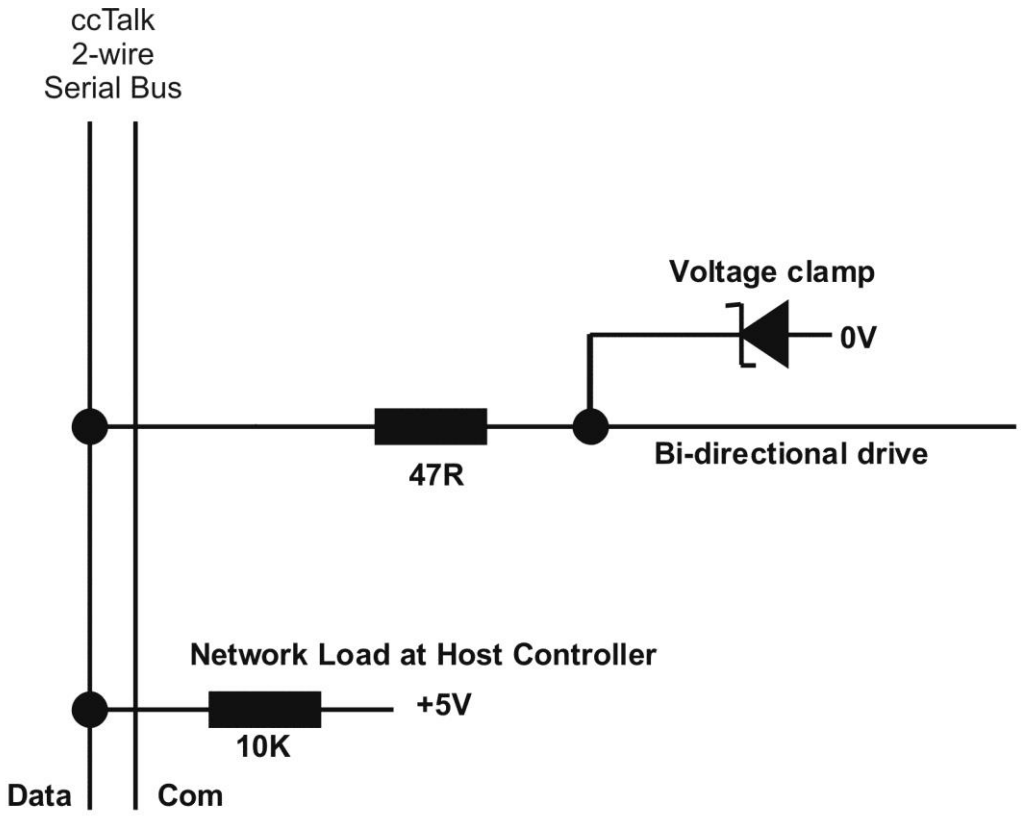
*Figure 14: Circuit 2, **ccTalk** Low Cost Interface*



3.16.3 CIRCUIT 3 – CCTALK DIRECT INTERFACE

A very low cost solution is to interface a single pin on a microcontroller directly onto the **ccTalk** data line. The pin can be switched between active-low for transmitting and high-impedance tri-state for receiving.

*Figure 15: Circuit 3, **ccTalk** Direct Interface*

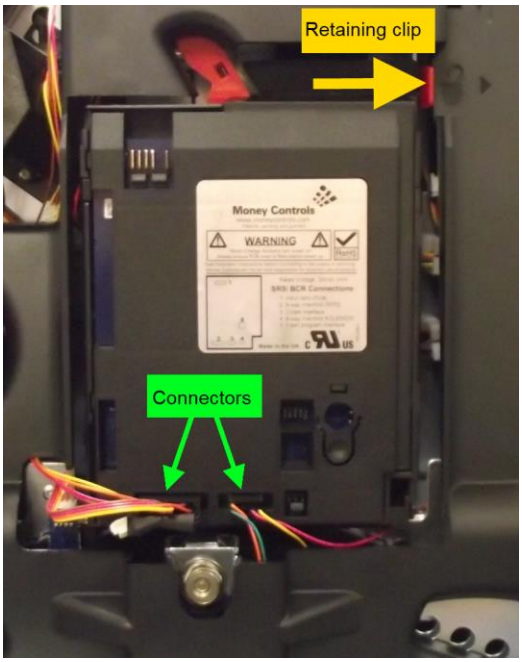


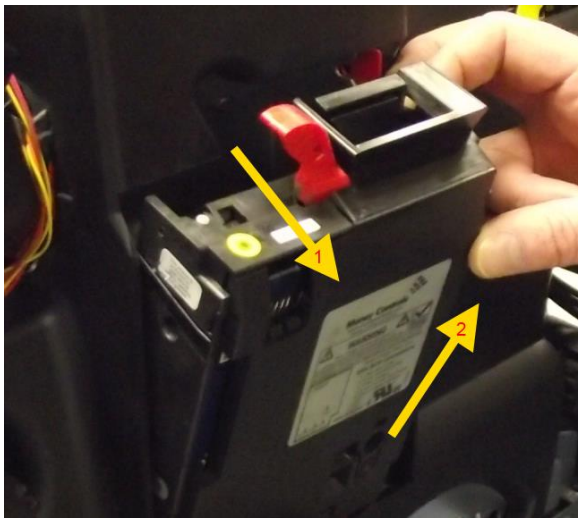
3.17 Servicing

3.17.1 TOP ENTRY - REMOVAL AND REFITTING

Release the locking catches and carefully lift out the acceptor from the back channel. Once the machines harness becomes accessible, remove all the interface connectors.

Refitting the acceptor is the reverse of removal.





3.17.2 CLEANING

The coin rundown area should be cleaned regularly to ensure accurate discrimination of coins and tokens. Only a damp cloth should be used.

Under NO circumstances should any solvent, abrasive or foam type cleaner be used.

Access to the coin rundown is gained by opening the reject gate.

3.17.3 ACCEPT GATE

Please refer to Figure 18.
To detach the accept gate, first undo screw (9) and remove the rundown cover. Carefully slide the gate spring (12) towards the rear of the SR5i and remove. Pull the gate forward and downward to remove.

Re-fitting is the reverse of removal.
Take extreme care when re-fitting the accept gate spring.

3.17.4 SORTER

Please refer to Figure 18.
Removal and Re-fitting.
Undo screw (9) and remove the rundown cover. The sorter can be unplugged and withdrawn.

When re-assembling, ensure the sorter flaps are correctly fitted and not trapped.

3.17.5 REAR COVER

No User serviceable parts.

Access to all switches is achievable without removing the cover. Therefore the cover should only be removed by approved service centres.

3.18 Fault Finding

The following information is presented for customers' guidance in rectifying a fault but does not cover all possible causes.
All acceptors with electronic faults should be returned to Money Controls Ltd. or to an approved service centre for repair.

Symptom	Investigate	Possible Cause
Acceptor does not work (all coins reject).	Connector.	Poor contact. Loose wire.
	Power supply.	Not switched on. Incorrect voltage. Inadequate current. Rise time too slow.
	Inhibit inputs.	Acceptor inhibited.
	Accept gate.	Gate not free or dislocated.
	Accept channel.	Obstructed.
	Reject gate.	Not fully closed.
	LED on rear cover is RED.	EEPROM checksum error[6]. SR Sensor faulty[7,8]. Credit sensor faulty[7,8]. Credit sensor blocked[7]. Sorter faulty[7,8]. Sorter blocked[7].
	LED on rear cover is YELLOW.	Remove the power and re-apply. LED should be green.

Poor acceptance of true coins.	Power supply	Voltage less than 10V. (NB voltage drops when solenoid/s are activated).
	Accept gate.	Gate not free or dislocated.
	Connector.	Loose.
	Coin rundown.	Dirty.
	Bank select switches.	Both switches are DOWN and both banks are programmed with the same coins.
Coins stick or jam in acceptor.	Rundown. Accept channel. Accept gate. Reject gate.	Dirty or mechanical damage.
One of the true coin types always rejects.	Interface.	Damaged interface cable.
	Inhibit status.	Coin inhibited.
	Label.	Coin not programmed.
Coins in wrong cash box.	Sorter.	Dirty, damaged or obstructed.
		Broken wire.
		Sorter flap dislocated.
	Main unit.	Incorrect sorter paths programmed.
		Faulty/wrong routing plug.
		No routing plug fitted.
		Wrong routing mode.
		Incorrect overrides selected.
No accept signal.	Connector.	Loose or broken wire.
	Accept channel.	Dirty or obstructed. (acceptor time-out)

[6] This condition requires the SR5i to be reprogrammed.
[7] These faults will only be seen if 'Power-up Diagnostics' is ON.
[8] These faults require to SR5i to be returned for repair.

3.19 Mechanical Specification

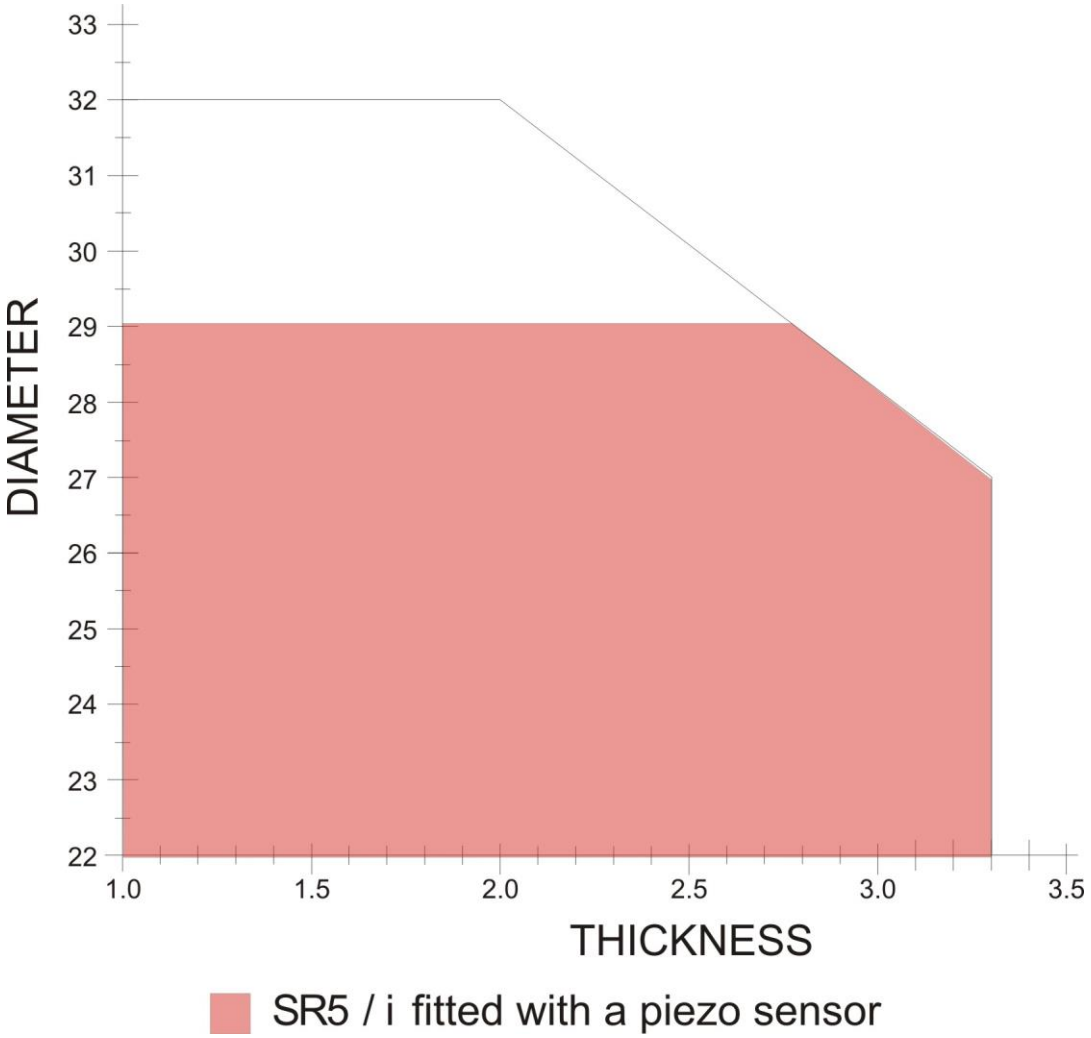
3.19.1 POSITION

The SR5i should be mounted within +/-2 degrees of the vertical in any plane. It is intended for use in stationary environments.

3.19.2 COIN/TOKEN SIZES

The accepted range of coin sizes are shown below:
This Graph is only intended as a guide. If a coin is required that is close to the limits shown, please check with Money Controls Technical Services department first.

Figure 16: SR5i Accepted Coin Dimensions Graph



3.19.3 SPECIFIED EMC PERFORMANCE

3.19.3.1 Emissions

This product is compliant with EMC test specification EN55022; 1998

3.19.3.2 Immunity

This product is compliant with EMC test specification EN55014-2; 1997

3.19.3.3 Shock / Vibration Immunity

This product is compliant with BS 2011 part 2.1. [IEC 68-2-27]

3.19.4 ENVIRONMENTAL SPECIFICATION

Table 17: Environmental Ranges

Operating temperature range:	0°C to 60°C 10% to 75% RH non-condensing
Storage temperature range:	-20°C to 70°C 5% to 95% RH non-condensing
(Recovery time by the acceptor after a temperature step change is 1 hour per 20°C. Maximum operating rate of change 20°C per hour.)	

3.19.5 MATERIAL FLAMMABILITY RATING

The major plastic part of the SR5i (the body) is rated as	UL94-V0
The other parts are rated as	UL94-HB
The 8-way manifold is rated as	UL94-HB

3.19.6 TOP ENTRY DIMENSIONS

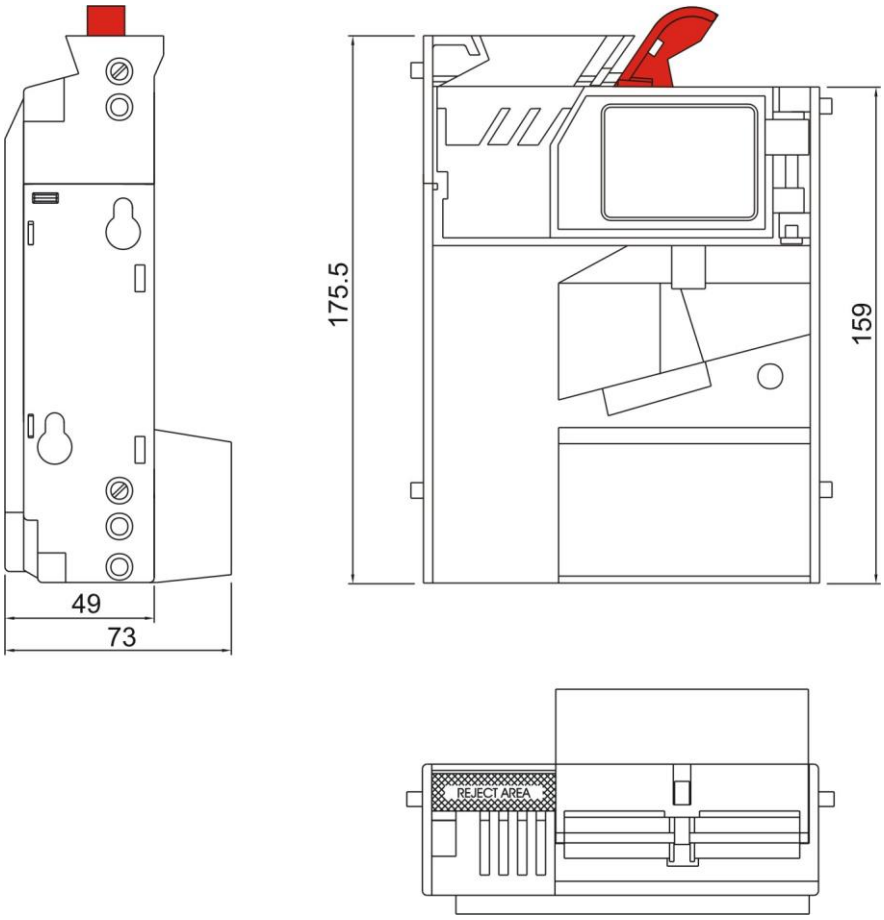
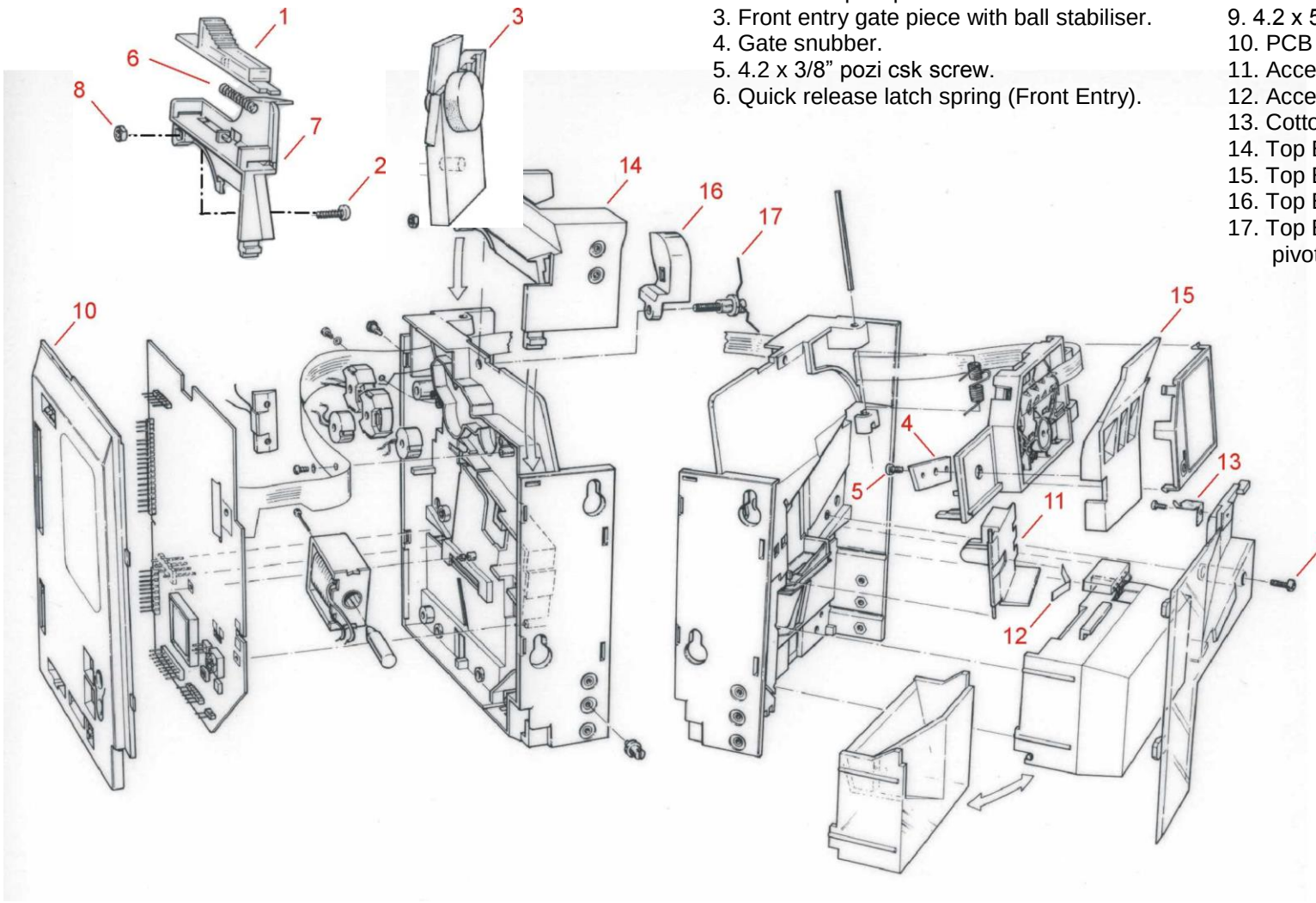


Figure 17: SR5i Top Entry with Sorter Dimensions

Figure 18: Top Entry / Front Entry Exploded View



1. Quick Release latch (Front Entry).
2. M4.0 x 16 pozi pan head screw.
3. Front entry gate piece with ball stabiliser.
4. Gate snubber.
5. 4.2 x 3/8” pozi csk screw.
6. Quick release latch spring (Front Entry).
7. Front Entry piece.
8. M4.0 full nut.
9. 4.2 x 5/16” pozi pan head.
10. PCB back cover.
11. Accept gate.
12. Accept gate spring.
13. Cotton catch.
14. Top Entry chute.
15. Top Entry gate piece.
16. Top Entry reject lever.
17. Top Entry reject lever pivot screw and spring

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