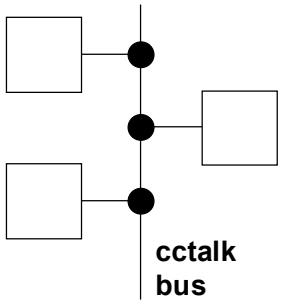

SR5 Serial Protocol
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Issue 1.6

Revision History

Issue	Date	Comments
1.0	23-01-01	First Issue
1.1	20-02-01	Request address mode returns 84 hex = 132 dec
1.2	21-06-01	ACK now returned for headers 219 & 218 (PIN no.) on software revision SR5-V2.00 and later
1.3	24-06-01	Clarification of credit poll watchdog
1.4	15-04-03	Added TSP number Amended Headers and Footers
1.5	30-06-04	Amended footer
1.6	26-01-04	Added Error, Fault & Teach & Run Codes

Contents

Introduction

The SR5 coin acceptor can operate entirely in serial mode with all conventional control and status functions implemented in the serial protocol.

The serial protocol is **cctalk**, now a standard for the money transaction industry.

Full details of the protocol can be found in the following document, available from the customer services department of Money Controls…

'cctalk Serial Communication Protocol - Generic Specification - Issue 4.0'

The generic specification explains the history and design philosophy of the protocol, the message structure and a complete list of commands covering different types of money transaction peripherals.

Listed below are the command headers available to SR5 and any product-specific features which you need to know about.

Implementation on SR5

The protocol conforms to cctalk b96.p0.v12.a5.d0.c5.m0.x8.e0.i0.r4

In other words…

- 9600 baud
- open-collector
- +12V nominal supply
- +5V data pull-up
- supply sink
- connector type 5
- slave device
- 8-bit addition checksum
- no encryption
- cctalk minor release 0
- cctalk major release 4

To operate in serial mode, ensure that **pin 9 of the 10-way serial connector is tied low** and the mech powers up in this state. Although some serial commands appear to operate correctly in parallel mode, the product will not function entirely as described below.

Device Address

All SR5's leave the factory with **address 2**.

The address is stored in EEPROM and can be subsequently changed with serial commands. Unless you have an application requiring more than one coin acceptor on the serial bus, it is strongly recommended you leave the address alone. The default

addresses for hoppers and bill validators have been made different and will not clash with the coin acceptor.

If the address has been changed to an unknown value then you will either have to search all through the entire address space (2 to 255) with the 'Simple poll' command until an ACK is returned or send the 'Address poll' command with the broadcast address.

Electrical Connections

Only 3 wires are required for the interface between a SR5 and the host machine.

```
(1) /DATA
(7) +12V
(8) 0V

(9) /SERIAL MODE
```

Pin 9 should be tied to 0V on the connector (pins 2 or 4 can be used) to operate the SR5 in serial mode.

The bi-directional data line operates at 9600 baud, 1 start bit, 1 stop bit and no parity bits. There is no option to select a different baud rate.

The data pin on SR5 is pulled up to +5V via a **10K resistor** and should be driven with an open-collector transistor.

Pin 5 is a hardware /RESET line but no connection needs to be made. A software reset command is provided for this purpose.

Inhibits and Overrides

SR5 can accept **16 different coins** including a special token selected from a bank of 12 if in 'token mode'.

There are 16 inhibit bits used in the 'Modify inhibit status' command allowing any combination of coins to be accepted or rejected.

There is support for 8-way routing with a 7-way override.

There are 7 override bits used in the 'Modify sorter override status' command allowing complex routing patterns to be achieved.

Each coin can have **4 paths** programmed into EEPROM. If the first path has an active override, then the coin will be routed down the second path. This continues until all the assigned paths have overrides when the coin will be sent down the default path.

The default path can be changed with the 'Modify default sorter path' command.

SR5 has a new command called 'Modify inhibit and override registers' which allows *current* and *next* coin values to be sent. This allows accurate coin-by-coin acceptance and routing, overcoming the inherent latency in serial operation.

At power-up or reset, all coins are inhibited and all sorter overrides are removed.

Coins cannot be accepted until a non-zero inhibit mask is sent to the mech.

Credit polling

Coin credits are obtained by polling the coin acceptor at regular intervals using the 'Read buffered credit or error codes' command. Up to 5 credits or errors are stacked in the return buffer.

The return data is 11 bytes in length.

[event counter]
[result 1A] [result 1B]
[result 2A] [result 2B]
[result 3A] [result 3B]
[result 4A] [result 4B]
[result 5A] [result 5B]

A & B are formatted as [credit code] [sorter path] or [0] [error code] depending on the logged event. See Table 2 in the generic specification for a list of error codes.

Note that the event counter wraps from 255 to 1, not 0.

A suitable polling interval is anywhere between **100ms and 900ms**. If other cctalk peripherals are on the bus then these may have to be polled as well.

SR5 has a ***credit poll watchdog*** feature whereby if the mech is not polled for 1s or longer then the device auto-inhibits and does not accept any more coins. When polling resumes, the auto-inhibit is lifted. This feature prevents coin swallowing in the event the host machine serial link goes down. Note that insertion of coins during a credit poll auto-inhibit increments the insertion and reject counters but does not generate an event in the event buffer (cctalk header 229). Also, the individual and master inhibit settings are not altered.

Sorter Operation

To ensure that the cctalk serial commands 'Modify sorter paths' and 'Request sorter paths' operate as expected, the coin acceptor must be in **EEPROM routing mode**. Please state this is the option you require when ordering product from the factory.

SR5 can operate without a sorter, or in 4-way and 8-way routing configurations.

This table shows how the different modes relate to each other.

cctalk Route Code	cctalk Override Bit Position	8-way Route Number	4-way Route Letter	8-way Manifold Active ?	Parallel Routing Plug Pin	Parallel Override Pin
1	0	1	D	Yes	7 (D)	9
2	1	2	C	Yes	13 (C)	8
3	2	3	B	Yes	15 (B)	7
4	3	4	A	Yes	-	6
5	4	5	a	No	-	5
6	5	6	b	No	-	4
7	6	7	c	No	-	3
8	-	8	d	No	-	-

The route numbers and letters refer to physical exit positions. Looking down from the front of the product (accept gate side), the sorter exits appear as…

C B

D A

(4-way)

or

8 7 6 5

1 2 3 4

(8-way)

Serial Teach

Coins and tokens can be taught using the ‘Teach mode control’ and ‘Request teach status’ commands. This method involves the insertion of a small sample of coins (typically 8) but the process can be controlled entirely over serial.

If a token is taught then after the teach process send a ‘Reset device’ command to force the new token to be used (alternatively, cycle the power). The rotary switch should always be on position ‘C’ for the teach token.

Calibration

SR5 implements 'calibration' which is the Money Control's system for remote coin programming. Using this method, a new coin set can be programmed into SR5 without inserting any of the coins themselves.

Remote coin programming uses the 'Upload window data' and 'Download calibration info' commands.

Further details of calibration are not given in this document. If you are interested in remote coin programming then contact Money Controls for the latest policy and support equipment.

Command List

The following table shows all the cctalk commands available for customer use on SR5. More details can be found in the generic specification.

Any [data bytes] are shown in decimal.

DCE = Dual Coin Entry rundown. This is a 'Y' chute with optos in the coin and token entry slots.

MDCES = Multi-Drop Command Extension Set. These commands are only used when peripheral addresses are unknown.

Header numbers are shown in descending order.

*** SR5 has 66 serial commands ***

Header	Function	Returned Data and Comments
254	Simple poll	ACK returned. All cctalk peripherals should reply to a simple poll - use this command for testing the comms link.
253	Address poll	MDCES support
252	Address clash	MDCES support
251	Address change	MDCES support
250	Address random	MDCES support
249	Request polling priority	[1] [200] = 200 ms
248	Request status	[0] = 'OK' [1] = 'Flight deck open'
247	Request variable set	Nothing of interest
246	Request manufacturer id	'Money Controls'
245	Request equipment category id	'Coin Acceptor'
244	Request product code	'SR5'
243	Request database version	[0] if no calibration support, otherwise new coin sets can be remotely programmed.
242	Request serial number	Supported. Range 0 to 16,777,215. This is an internal electronic serial number and may be different to the batch serial number on the label. The serial number is unique on SR5 and may not be modified by conventional means.
241	Request software revision	'SR5-V1.50' or a subsequent revision.
240	Test solenoids	Bit 0 = Accept gate Bit 1 = Lower sorter flap Bit 2 = Upper sorter flap Bit 3 = 8-way Manifold flap (if used) Pulsed for 500ms
238	Test output lines	Bit 0 = A1 parallel output Bit 1 = A2 Bit 2 = A3 Bit 3 = A4 (strobe) Bit 4 = A5 Bit 5 = A6 (ident) Bit 6 = Tri-colour LED to Green Bit 7 = Tri-colour LED to Red Pulsed for 500ms

237	Read input lines	For low level diagnostics only. 12 bytes returned… [Byte 1] Bits 3:0 = rotary switch Bit 4 = push button (0 = pressed) Bits 7:5 = zero [Byte 2] Bit 0 = bank select 1 Bit 1 = bank select 2 Bit 2 = diagnostic link pin 1 (lower) Bit 3 =diagnostic link pin 2 (upper) Bits 7:4 = zero [Byte 3] Bit 0 = credit select line (0 = binary / BACTA mode) Bit 1 = override 1 (0 = override active) Bit 2 = override 2 Bit 3 = override 3 Bit 4 = override 4 Bit 5 = override 5 Bit 6 = override 6 Bit 7 = override 7 [Byte 4] Bits 7:0 = parallel inhibits (0 = enable coin) [Byte 5] Bits 6:0 = routing plug value with no drive signal Bit 7 = one [Byte 6] Bits 6:0 = routing plug value for coin 1 Bit 7 = zero (bit 0 = route 1 … bit 6 = route 7) [Byte 7] Bits 6:0 = routing plug value for coin 2 Bit 7 = zero [Byte 8] Bits 6:0 = routing plug value for coin 3 Bit 7 = zero [Byte 9] Bits 6:0 = routing plug value for coin 4 Bit 7 = zero [Byte 10] Bits 6:0 = routing plug value for coin 5 Bit 7 = zero [Byte 11] Bits 6:0 = routing plug value for coin 6 Bit 7 = zero [Byte 12] Bits 6:0 = routing plug value for coin 7 Bit 7 = zero
236	Read opto states	Bit 0 = DCE Coin opto (1 = blocked / not fitted) Bit 1 = DCE Token opto Bit 2 = Sorter optos Sorter optos cannot be tested individually - they are combined in series.

233	Latch output lines	Bit 0 = A1 parallel output Bit 1 = A2 Bit 2 = A3 Bit 3 = A4 (strobe) Bit 4 = A5 Bit 5 = A6 (ident) Bit 6 = Tri-colour LED to Green Bit 7 = Tri-colour LED to Red (0 = latch off, 1 = latch on)
232	Perform self-check	Supported. Refer to table 3 in the generic specification.
231	Modify inhibit status	[inhibit 1] [inhibit 2] Support for 16 coins. 0 = inhibited, 1 = enabled Inhibits are stored in RAM and are lost at power-down or reset. The power-up state is 'all coins inhibited'.
230	Request inhibit status	Supported.
229	Read buffered credit or error codes	Supported. 5 event buffer. This is the only command which can be used to obtain coin credit information.
228	Modify master inhibit status	Supported 0 = inhibited, 1 = enabled The master inhibit flag is stored in EEPROM. The master inhibit flag is not normally used and all SR5's which leave the factory are 'enabled'.
227	Request master inhibit status	Supported
226	Request insertion counter	Supported The counter is stored in RAM and is cleared at power-down or reset.
225	Request accept counter	Supported The counter is stored in RAM and is cleared at power-down or reset.
222	Modify sorter override status	Bit 0 = override route 1 (0 = override) Bit 1 = override route 2 Bit 2 = override route 3 Bit 3 = override route 4 Bit 4 = override route 5 Bit 5 = override route 6 Bit 6 = override route 7 Bit 7 = { not used) Overrides are stored in RAM and are lost at power-down or reset. The power-up state is 'no overrides'.
221	Request sorter override status	Supported
219	Enter new PIN number	ACK returned but PIN number mechanism not used.

218	Enter PIN number	ACK returned but PIN number mechanism not used.
216	Request data storage availability	[2] [2] [8] [2] [8] EEPROM storage is available for customer use… 2 blocks of 8 bytes for reading 2 blocks of 8 bytes for writing A number of security features could be implemented with this 16 byte memory such as logging machine ident numbers during installation.
215	Read data block	Supported
214	Write data block	Supported
213	Request option flags	Bit 0 = credit code format (0 = position)
212	Request coin position	Supported Returns position of coins with specified parallel (i.e. 1 of 6) credit code.
210	Modify sorter paths	[coin position] [path 1] [path 2] [path 3] [path 4] coin position : coin 1 to 16 path : route 1 to 8 route 1 ⇔ D (4-way…) route 2 ⇔ C route 3 ⇔ B route 4 ⇔ A route 5 ⇔ a (8-way…) route 6 ⇔ b route 7 ⇔ c route 8 ⇔ d Sorter paths are stored in EEPROM.
209	Request sorter paths	4 paths returned
202	Teach mode control	[coin position] Specify 1 to 16 for a coin or 17 for token position ‘C’. The rotary switch must be on ‘C’ for the teach token to be accepted. If the teach mechanism has been disabled for security reasons then the ‘teach error’ code is returned.
201	Request teach status	Supported
199	Configuration to EEPROM	Stores the current inhibit & override settings into EEPROM so that they are then used at the next power-up. Use with caution as this modifies the factory default settings !
197	Calculate ROM checksum	4 byte ROM checksum returned SR5-V1.50 = [106] [132] [48] [0]
196	Request creation date	Supported
195	Request last modification date	Supported

194	Request reject counter	Supported The counter is stored in RAM and is cleared at power-down or reset.
193	Request fraud counter	Supported The counter is stored in RAM and is cleared at power-down or reset. Note : Fraud coins can only be counted if they are factory pre-programmed into the coin acceptor and marked as 'bad'
192	Request build code	8 character ASCII string representing major build options. May contain spaces.
189	Modify default sorter path	[default path] Specified as 1 to 8. This is the path the coin is routed to after all the override paths have been used. The default path is stored in EEPROM and is used at the next power-up. The default path for 4-way routing is A. The default path for 8-way routing is 8.
188	Request default sorter path	Supported
185	Modify coin id	Supported 6 x ASCII characters e.g. GB100A It is not recommended that factory settings are changed unless a new coin set is being programmed.
184	Request coin id	Supported 6 x ASCII characters e.g. GB100A
183	Upload window data	Supported Various security options limit the scope of this command.
182	Download calibration info	Supported No customer parameters.
181	Modify security setting	Supported Security settings are stored in RAM and are cleared at power-down or reset. 0 = factory default setting Each coin can have a different security setting.
180	Request security setting	Supported
179	Modify bank select	[bank no.] 0 = default (both banks enabled) 1 = bank 1 only enabled (coins 1 to 8) 2 = bank 2 only enabled (coins 9 to 16) The action of this command is the same as using the 'Modify inhibit status' command.

177	Handheld function	Low level engineering functions… mode = 0 : function = 0 read rotary switch mode = 0 : function = 1, [token] select token to be used mode = 0 : function = 2, [coin] read route value for given coin (routing plug mode) mode = 0 : function = 5 fix EEPROM checksum
176	Request alarm counter	[alarm count] The alarm counter is stored in RAM and is cleared at power-down or reset. Additionally, it is cleared **after each request** and so should be used cumulatively. Alarm conditions… a) blocked sorter exit optos b) blocked credit sensor c) coin going backwards detection
173	Request thermistor reading	Supported
170	Request base year	'2000'
169	Request address mode	[132] Address is stored in EEPROM and may be changed serially (non-volatile).
162	Modify inhibit and override registers	Supported
4	Request comms revision	[1] [4] [0] cctalk level = 1 specification = 4.0
3	Clear comms status variables	Supported
2	Request comms status variables	Supported The rx buffer can store complete messages up to 176 bytes in length.
1	Reset device	Supported This command performs a 'software reset'.

Error Codes

Reject Coin	1	Coin Going Backwards	17	Coin 6 Inhibited	133
Coin Inhibited	2	Accept Sensor Under Timeout	18	Coin 7 Inhibited	134
Multiple Window Error	3	Accept Sensor Over Timeout	19	Coin 8 Inhibited	135
Validation Timeout	5	Dce Opto Timeout	21	Coin 9 Inhibited	136
Coin Accept Over Timeout	6	Dce Opto Error	22	Coin 10 Inhibited	137
Sorter Opto Timeout	7	Coin Accept Under Timeout	23	Coin 11 Inhibited	138
Second Close Coin	8	Reject Coin Repeat	24	Coin 12 Inhibited	139
Accept Gate Not Ready	9	Reject Slug	25	Coin 13 Inhibited	140
Credit Sensor Not Ready	10	Coin 1 Inhibited	128	Coin 14 Inhibited	141
Sorter Not Ready	11	Coin 2 Inhibited	129	Coin 15 Inhibited	142
Reject Coin Not Cleared	12	Coin 3 Inhibited	130	Coin 16 Inhibited	143
Credit Sensor Blocked	14	Coin 4 Inhibited	131	Flight Deck Open	254
Sorter Opto Blocked	15	Coin 5 Inhibited	132		

Fault Codes

No Fault Found	0	Piezo Sensor Faulty	4	Rim Sensor Faulty	21
Eeprom Checksum Error	1	Sorter Exits Faulty	8	Thermister Faulty	22
Inductive Coils Faulty	2	Rej Flap Sensor Faulty	19	Dce Faulty	35
Credit Sensor Faulty	3				

Teach & Run Codes

Teach Abort	252
Teach Error	253
Teach In_Progress	254
Teach Completed	255