C120S Technical Manual

Money Controls

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1. Diary Of Changes

Issue 1.0 ..... February 2004
- 1st Issue

Issue 1.1 ..... June 2004
- Changed footer

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2. Introduction

2.1. Scope

This document specifies a coin validator, C120S, for use in payphone applications. The power to operate the payphone is derived from the telephone line, requiring the C120S to consume the minimum power possible.

The C120S is capable of accepting up to 16 different coin types of any denomination. The coin set data is remotely downloadable via the payphone controller interface.

The C120S operates over the environmental conditions specified in Section 5.

2.2. General

A coin reject mechanism is provided, which will open the C120S to allow coin jams or foreign debris to be cleared and fall into the reject chute.

The C120S operates to specification when fitted in an appropriate channel within 3 degrees to the vertical in any plane.

While the C120S is inactive, it enters a low power mode. A coin entered into the system or a message sent over the serial interface causes the C120S to power up, validate the coin or process the message, then return to the low power mode.

If no power is applied to the C120S, any coins inserted are returned to the user via a reject chute.

Accepted coins are directed to a coin store or cashbox using a solenoid driven gate and rejected coins to a reject chute.

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3. Electrical Specification

Table 1: Power Supply

Regulated Supply:	5V DC +/- 5%
Supply rise time:	< 100ms to spec
Supply fall time:	< 1 second to 400mV or less
Reset Active	At all times when supply is out of spec

Table 2: Current Consumption

Note: Idle current is that state where the power is applied, but prior to a coin being detected at the wakeup sensor. This is the condition when the phone is off hook, or where the telephone has activated the message line.

Idle:	< 750μA
Peak:	< 80mA
Energy:	36mJ max @ 5.0v

Note:- for some coins, this energy budget may be exceeded. The specified figure will be achieved for 90% of the coins capable of qualification on this product.

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3.1. Electrical interface:

External connection is by means of a 10 way (dual row 2x5 way) header on a 0.1" pitch. Connector recess is polarised for use with industry standard IDC headers and ribbon cable:-

Figure 1: C120S Parallel Connector



Table 3: C120S Parallel Interface

PIN	FUNCTION	ACTIVE
1	ccTalk	ccTalk data line
2	RxD1 *	Receive flash data 5V TTL/CMOS.
3	Ready	Active low.
4	TxD1 *	Transmit flash data 5V TTL/CMOS.
5	Reset	Active low when supply is outside spec.
6	CNVSS *	Active low for flash program mode.
7	Inhibit ALL	Low
8	GND	0V
9	Supply	+5V
10	GND P	Solenoid 0V supply return (order option)

*** Flash programming pins – Do not connect to these pins during normal unit operation.**

There is provision to operate with two grounds, one for the low power validation circuits [pin 8] and one for the separate solenoid return utilising reserved pin 10 [GND P].

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Ready signal

The Ready Signal is bi-directional. It is used to indicate to the Host controller that there is a message waiting from the C120S. The C120S will stay powered up until the Host controller polls and acknowledges the message or a time out occurs. It is also used to wake up the C120S when the Host controller wishes to send a message to the coin mech.

Inhibit signal

Inhibit all can be used to slow down coin acceptance 'on the fly' giving the Host controller time to deal with the preceding coin. The inhibit line status is read immediately prior to operation of the accept gate solenoid. The decision to accept a true coin is made at this point. A subsequent change in the inhibit line has no effect on the coin just accepted, which will continue through the defined accept process. Following coins detected by the C120S while the inhibit status is active will be rejected.

Signal Logic Levels

The logic levels between the C120S and the payphone controller is standard CMOS level, that is Logic 0 shall be less than 30% of +5V (supply) and Logic 1 shall be greater than 70% of +5V (supply).

The INHIBIT line is pulled up to +5V (supply) via a 1M-ohm resistor. The READY and RESET lines are pulled up to +5V (supply) via 100k-ohm resistors. The DATA line is pulled up to +5V (supply) via a 68k-ohm resistor.

3.2. 'Reset' timing & process

Reset is an active low signal which forces the processor into a reset state for as long as the reset line is active. Minimum pulse width is 10ms.

Applying power to the coin acceptor triggers an internal power-on-reset (POR) condition which provides the necessary reset timing without the need for any external signal conditions. Note that for the POR circuit to function correctly, reset must be connected to the supply voltage or left unconnected.

The reset line is diode protected and is internally pulled up to the +5V (supply) via a 100k-ohm resistor.

Note that due to settling time required for the internal sensor oscillators to stabilise, the coin acceptor requires a minimum period of 400ms to stabilise after the supply voltage has been applied before it will accept coins.

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4. Mechanical Specification

4.1. External Dimensions / Mechanical Interfaces

The space envelope, coin entry and exit positions, together with the mounting details are detailed in Figure 2.

4.2. Orientation:-

The C120S may be orientated at ±3^{o} in any plane from nominal without affecting coin accept rates.

4.3. Acceptance Rates

The C120S is capable of accepting coins at a rate of two coins per second on “normal” round coins. Coins entered at faster rates may be rejected due to 2nd close coin errors, which may jeopardise the 88% coin acceptance rate. Coin acceptance is inhibited following a successful validation until the Host controller has acknowledged the previous acceptance message, or a timeout condition has occurred. The timeout is nominally 50ms. A timer will be available to slow the accept rate further if the system [payphone] demands it. Coins inserted quickly should be able to be cleared quickly, without a coin jam arising.

In addition to the standard security windows, other window types may be generated which provide higher security over both standard and extended temperature ranges.

The actual acceptance rates shall be determined on development of each coin set and shall be defined in the individual coin set specification. The C120S accepts up to 16 different coin types and the parameters for these are stored within the mech. in a non-volatile memory. It is possible to download new or amended data from the Host controller or alternative programming equipment, via the serial link.

4.4. Accept gate

The coin accept gate is operated by a low powered solenoid to minimise energy use. The default coin path with the solenoid de-energised is to reject the coin.

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4.5. Coin Sizes

The C120S accepts the following range of coin or token dimensions which is believed to cover at least 95% of the world's coinage :

Table 4: Coin Sizes

Diameter:	15.0 - 33.0 mm
Thickness:	1.2 - 3.3 mm
Weight:	1.5 grams min.

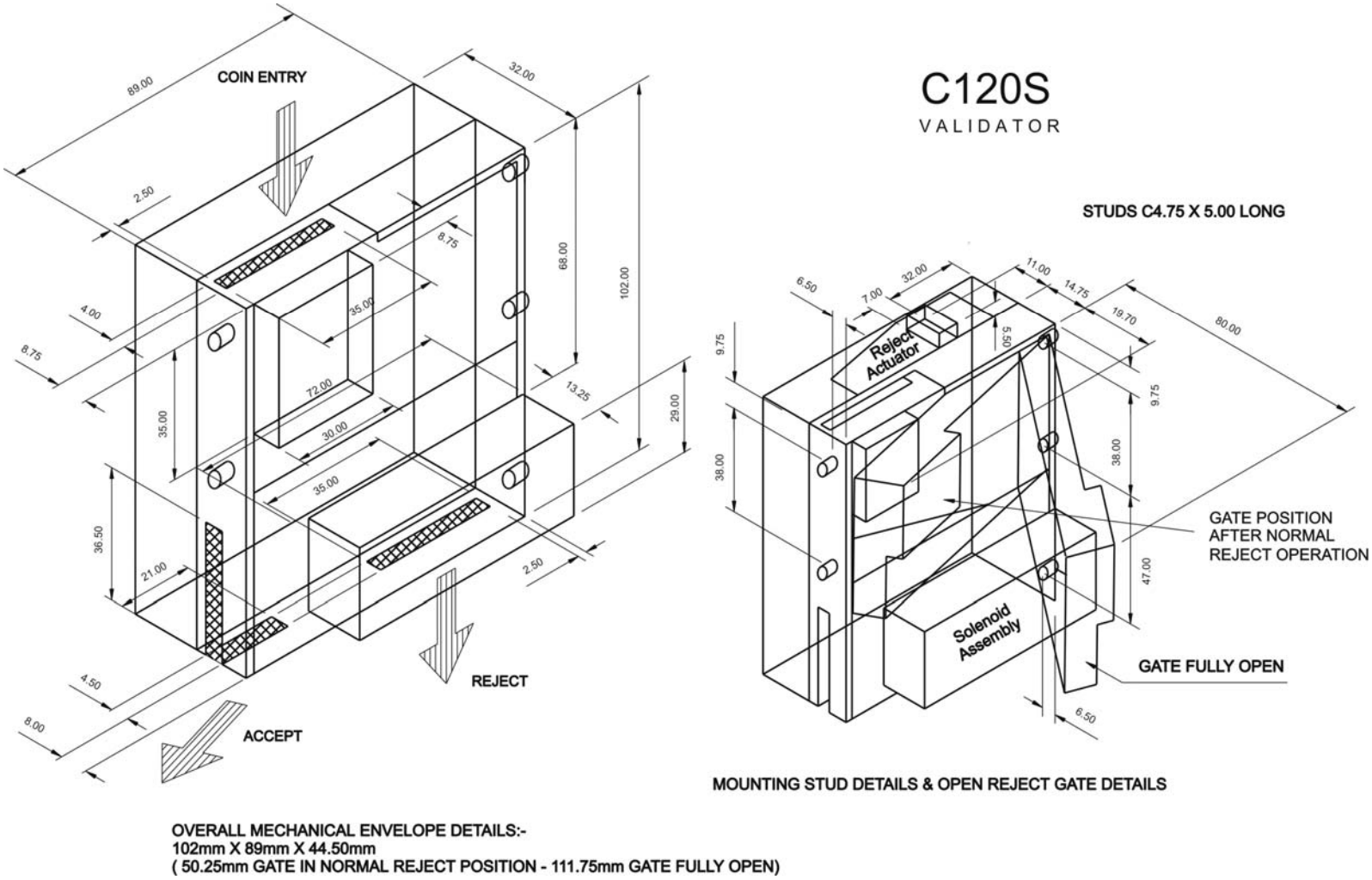
The coin or token material may be any of the normal alloys that are generally used to produce coins world wide. Coins may have holes or be non circular providing that they are capable of rolling uniformly down a ramp at an angle of 15° to the horizontal. Tokens may have identification grooves.

4.6. Wet Coin Handling

The C120S acceptance rates and coin throughput may be degraded where there is condensation on the rundown. Any coins, which may become stuck in the rundown due to moisture can be ejected by activating the coin reject mechanism. Furthermore, the rundown is profiled with grooves, which reduce the surface tension on the coin, ultimately reducing the sticking potential of individual wet coins.

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Figure 2: C120S External Dimensions



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5. Environmental Specification

Table 5: Environmental Ranges

Standard Operating temperature range:	0°C to 60°C 0% to 75% RH non-condensing
Extended Operating temperature range:	-25°C to 60°C 0% to 95% RH non-condensing
Storage temperature range:	-40°C to 70°C 0% to 95% RH non-condensing
Rate Of Change	< 40% per hour
(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.)	

5.1. Fluid Ingress

The design of the product is such that the passage of liquids entered through the coin entry port are routed via the reject path and away from sensitive hardware circuits.

The PCB is conformally coated to withstand the presence of moisture and limited fluid abuse.

5.2. EMC

Product complies with European generic standards EN50081-1 and EN50082-1.

5.3. Safety

Product meets the safety requirements of EN41003 and EN60950

5.4. Shock, Bump, Vibration & Impact

This product complies with:

Packaged vibration:-	BS2011: part 2.1 Fdb
Packaged shock:-	ISTA - Procedure 1A, Vibration test method A
Packaged drop:-	ISTA - Drop test procedure 1A
Packaged compression:-	ISTA - Static compression test, Method B
Installed vibration:-	IEC 68-2-6, Fc
Installed shock:-	IEC 68-2-27, Ea

5.5. Time

– No limited life components fitted

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6. Software Specification

6.1. ccTalk spec & additional commands

This protocol is a level shifted RS232 asynchronous Non Return to Zero (NRZ) serial communication protocol, format 4800 baud, no parity bits, 8 data bits and one start and one stop bit.

The idle state is +5V DC, the active state is 0V DC

6.2. ccTalk structure and commands:

Refer to latest ccTalk manual.

New ccTalk commands for re-programming coins.

Header 96

Sub-header 255: Begin packet upload
Sub-header 254: Upload packet data
Sub-header 253: End packet upload & program
Sub-header 245: Delete all coin windows

All the other C120P commands (SEE TSP068 for details) are supported apart from header 200 (Upload coin data).

6.3. Initialisation

Whenever the Host controller is powered up (e.g. customer starting call) a handshaking procedure is conducted to determine that the C120S is functioning correctly and that it has not changed since last operation.

A typical sequence would be:

- Power applied to coin acceptor
- Host Controller activates /READY to wake up coin acceptor
- Host Controller requests serial number
- Coin acceptor replies with serial number
- Host Controller deactivates /READY
- Coin acceptor enters IDLE mode

The Host controller may instigate a data transfer if certain data has changed e.g. the C120S has been replaced which will comprise a series of messages as below:

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6.4. Messages

The sequence to be followed when the Host Controller wishes to send a message to the coin acceptor is as follows:

- /READY signal activated by Host Controller
- Coin acceptor changes from IDLE to RUN state
- Host Controller sends message
- Coin acceptor replies with completion message
- /READY signal released by Host Controller
- Coin acceptor adopts IDLE state

Note: The coin acceptor cannot power down while the /READY signal is pulled low.

6.5. Validation

The sequence to be followed when a coin is inserted into the coin acceptor is as follows:

- Coin detected in coin acceptor
- Coin acceptor changes from IDLE to RUN state
- Coin validated and result calculated (true / reject / error)
- /READY signal activated by coin acceptor
- Host Controller requests result code (or coin acceptor time-out)
- Coin acceptor replies with result code
- /READY signal released by coin acceptor
- Coin acceptor adopts IDLE state

Note: In the event of a checksum error, the Host Controller can request the result code again within the ‘credit timer’ period.

6.6. The coin download process

Involves the use of a database. The relevant data for the selected coin or coins is sent by the Host Controller, which may be PC based. This information includes data necessary for the coin prediction, along with credit code, window position etc.

6.7. Field re-programming

Field reprogramming (Flash) via ccTools (when available)

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7. User Interface Specification(s)

7.1. Electrical

External connection is by means of a 10 way (dual row 2x5 way) header on a 0.1" pitch. Connector recess is polarised for use with industry standard IDC headers and ribbon cable.

7.2. Mechanical

Refer to Figure 2.

8. Life & Reliability

8.1. Security

The 120S is resistant to known fraud attempts, including 'coin on a string' or other common methods of coin manipulation, consistent with achieving very low power operation.

8.2. Self Test and Diagnostics

A self test can be invoked by command from the Host controller.

8.3. Reliability

Life expectancy – service life of 10 years or 1 million coins whichever is the sooner.

8.4. MCBF

Reliability target for a hard fault requiring a service visit exceeds 450,000 coins between failures. This figure does not include faults caused by abuse or operation outside of the specification.

9. Servicing

The C120S mountings are such that it may be exchanged or installed rapidly without the need for adjustment or the use of special tools.

The only routine maintenance required is the cleaning of dirt etc. from the coin pathways. The C120S opens easily for cleaning without the use of special tools.

Jammed coins or debris stuffed into the unit through the coin entry can be easily cleared.

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