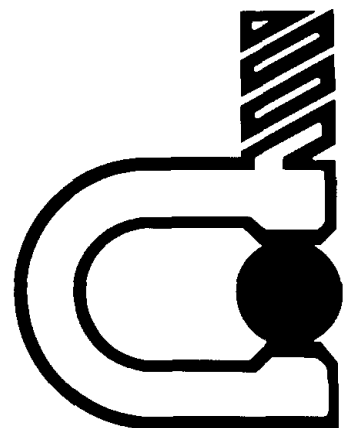


**SENTINEL
TECHNICAL
MANUAL**



COIN CONTROLS

CONTENTS AND INTRODUCTION

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1.0 General Description

The SENTINEL Coin Mechanism is the first of a new family of products based on Coin Control's new cash-handling concept of Flexible Cash Modules. It uses the latest in coin-handling technology offering a product with an unparalleled combination of performance, features and value-for-money.

The key feature of SENTINEL is flexibility. By selection from the carefully designed system of mechanical sub-modules, SENTINEL can be configured to suit almost any 5" sized coin mechanism application.

SENTINEL offers:-

- Standard 5" size
- up to 8-coin validation
- Field/User programmability of
 - Coin parameters
 - coin sorter routing
- both Parallel and Serial interfaces
- Flexible and fully programmable coin sorting (4 ways plus toggle within the height of the 5" body.)

1.1 Versions

At the time of going to press, the following versions and options were available. Please contact Coin Controls for the latest list.

Mechanical options:-

- Front Entry
- Top Entry
- Direct Reject
- Indirect Reject
- Single Accept Channel
- 4-way Plug-in Sorter

Electronic Versions:-

- UK AWP Standard with
 - 1/ 15- dc
 - "Universal" Parallel Interface
 - Compatible with all AWP'S
 - 4 and 8 coin capability
 - IIC Serial Interface

MECHANICAL DESCRIPTION

2.1 Coin Mechanism Assembly
The Sentinel Coin Mechanism is shown in exploded form at the back of this manual
A rundown is provided between the reject gate (no. 42) and the body (no. 7) along which are placed three coils of different shapes and sizes. The first coil (no. 18) is a large diameter round coil which is placed at the front of the rundown. Coil number two is a smaller round coil (no. 14) which is situated in the gate (no. 42) and the final coil is a wraparound (no. 20). If a coin having passed the three sensors is deemed true the accept gate (no. 40) is opened by energising a solenoid (no. 23A) and the coin passes through the accept coil (no. 28). Having cleared the accept coil, the accept gate is closed and a credit signal is generated. If the mechanism is fitted with a sorter, this is energised at the same time as the accept flap and is reset once the photo-cells (no. 47) have been obscured and cleared again.

2.2 Coin Entry and Exit Options

2.2.1 Option One-Front Entry

The front entry option is achieved by fixing to the basic assembly, parts numbered (6,8,9,12,13,15,16). In most cases this assembly will then be used in conjunction with the frontplate parts numbered (1,2,3,4,5,44). This option can be either direct or indirect reject and can also be fitted with either a single exit port or a four coin sorter.

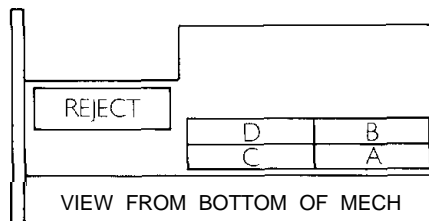
2.2.2 Option Two-Top Entry

This is achieved by adding to the basic assembly parts numbered (51, 52, 53, 54, 55). This unit can be fitted with either a single exit port or a four coin sorter.

2.3 Coin Sorter Module

When fitted to the assembly the sorter allows four-way sorting. This is achieved by two incorporated flaps (no. 27, 36) which are actively driven by solenoids (nos. 23 B & 23 C). The first flap (no. 36) is a metal construction, which diverts the coin to one of ports A or B at the back of the assembly when the solenoid (no. 23C) is not energised and to one of ports C or D near the centre of the mechanism when the solenoid (no. 23C) is energised. The long plastic divertor flap (no. 27) which runs the length of the sorter, is used to select between ports A and B or between ports C and D under the control of the solenoid (no. 23B).

Two sets of photo-cells (no. 47) are located at the bottom of the sorter which reset the solenoids and allow the assembly to accept further coins immediately after the coin has cleared the cells. This eliminates any timing complications.



The sorter is a plug in module and can be fitted and programmed on site with the aid of the Sentinel Tool Kit"or" Master Programmer"

2.4 Assembly and Disassembly

To remove the body from frontplate, first unplug connectors (parallel or serial Interface). Pull back catch (no. 6) and lift body upwards. When stop position is reached the body can be withdrawn. When reassembling, line up keyhole slots in body with retainers on frontplate. Push body forward and downwards. When in position, catch (no. 6) will click into appropriate slot.

To remove Sorter

Undo screw (no. 19c) and remove cover (no. 39). The sorter can be unplugged and withdrawn. When reassembling ensure snubber (no. 25) is in correct position.

Servicing the Sorter

When the three retaining screws (no. 30) are removed the sorter splits into two parts allowing the solenoids and flaps to be serviced. To remove flap (no. 27) the spring retaining screw (no. 35) must be removed first, followed by the spring (no. 32).

When reassembling the unit great care must be taken that neither springs (nos. 32, 37) are damaged.

Accept Gate

To detach accept gate first slide spring (no. 41) towards rear of mech and remove. Pull gate forward and downward. Care must be taken not to damage spring

Bulb

To replace the bulb it is necessary to remove bulb-holder. Place the blade of a screwdriver between bulb holder (16) and the parallel face affront entry (13). A slight twist will dislodge the small round pin on bulb holder from the slot in the front entry. The holder can now be removed. When the new bulb is in position the holder should first be located at the back of the entry and the round pin pressed to locate in the appropriate slot.

Reject Button

To replace reject button it is necessary to remove button assembly. This is achieved by removing screws (no. 45). When reassembling ensure cone spring is in correct position.

Direct Reject

By removing screws (no. 58) the reject cup and flap can be detached.

If the Reject Gate (no. 42) coils (nos. 14, 18, 20, 28) or circuit board need to be removed please contact Coin Controls

APPLICATION

3.0 This section is intended to help the user to get the most out of the SENTINEL coin mechanism. It discusses power supplies, interfacing and coin sorting. No applications section can ever be complete, however, and customers are always very welcome to contact Coin Controls direct to discuss the requirements of their particular coin handling applications and any other coin handling matters

3.1 power Supplies

Voltage: 11 to 15 Volts DC.
 Current: 220 mA continuous (nominal)
 0.7 Amps max. (no sorter fitted)
 2.0 Amps max. (sorter fitted)
 Rise Time: 200 msec max.

IMPORTANT NOTE: Operation of the coin mech outside of specification may cause malfunction or damage It is Important to ensure sufficient power-supply current capacity.

3.2 Using the Parallel Interface

The parallel interface provides open-collector output signals which will automatically pull up or pull-down to any voltage in the range +5V to +24v and 0V to -20V respectively. Figure 3 2 is a circuit diagram of the Accept output buffer in each of its three states.

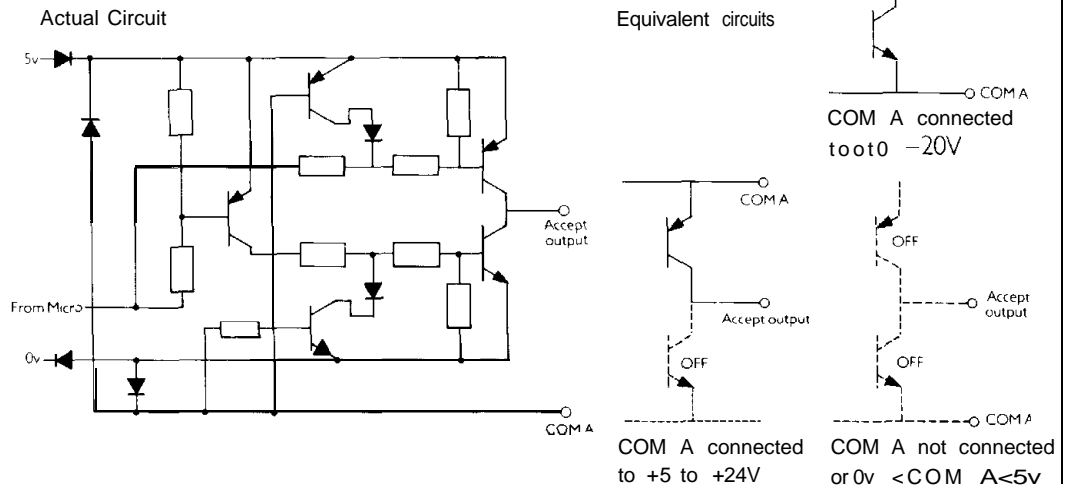
Two types of output coding are available dependent upon the state of the SELECT input on the parallel interface. The output coding types are: 1-Of-4 Coins and 8 Coin

These are described in detail later on. Full electrical specifications for the interface are given in Section 5 0

All parallel interface signals are routed via Connector I, the parallel interface connector. The following signals are available on this connector:

Pin No.	Signal Name	Signal Description
	COMA	Supply input for output pull-up/pull-down. Allowing this line to float disables all the accept outputs.
	A1	Accept Output 1. The Accept outputs are all normally open-circuit, pulling to within 1 Volt of the voltage on the COM A pin when true (logic "1")
3	n.c.	Polarising Position
4	A2	Accept Output 2
5	A3	Accept Output 3
6	SELECT	4-coin/8-coin Interface selection. This line is a passive pull-up, active pull-down signal. 1 Open circuit: 4-coin Interface. Tied to 0v : 8-coin interface.
7	A4	Accept Output 4
8	I4	Inhibit Coin Channel 4. The inhibit inputs are all passive pull-up, active pull-down. A coin channel is enabled when the inhibit input is pulled to 0v and disabled when it is left floating.
9	V (board)	Power supply input 11 15Vdc. 220mA nominal. 2.0 A peak
10	0V	
11	I3	Inhibit input for Coin Channel 3
12	I2	Inhibit input for Coin Channel 2.
13	I1	Inhibit Input for Coin Channel 1.
14	156	Inhibit Input for Coin Channels 5 and 6.
15	17,8	Inhibit Input for Coin Channels 7 and 8

FIGURE 3 2 Sentinel Accept output Buffer circuit diagram



Operation

1-of-4 Coins

With the SELECT line left open-circuit, the parallel Interface will operate as a 1-of-4 coins Interface. SENTINEL will provide validation of up to 4 different coin types.

Inhibits I5,6 and I7,8 MUST be left open circuit for correct operation of the validator.

When tied low, inhibit lines I1-I4 have the following meaning:

- enable acceptance of coin type 1
- 2 enable acceptance of coin type 2
- 3 enable acceptance of coin type 3
- 4 enable acceptance of coin type 4

signals A1-A4 then have the following meaning:

- A1 valid coin type 1 accepted
- A2 valid coin type 2 accepted
- A3 valid coin type 3 accepted
- A4 valid coin type 4 accepted

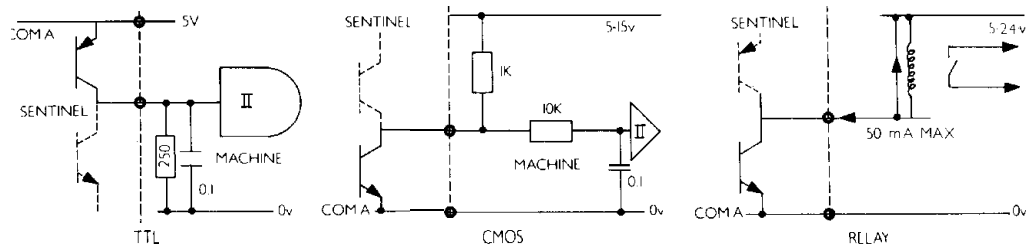
The accept signal will remain 'true' (i.e. pulling to within 1 volt of the COM A line) for 80ms +/-20%

Since it operates in an identical manner to the "coin-switch" outputs of many mechanical coin mechanisms, the 1-of-4 Interface can easily be connected to a wide range of existing coin operated equipment

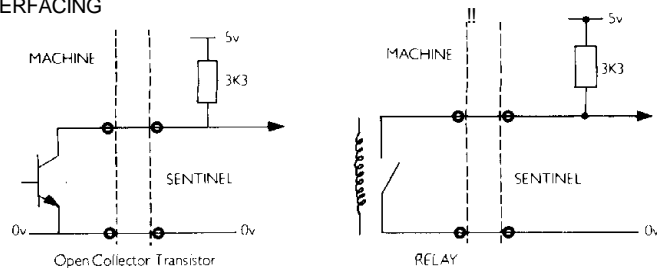
Note, however, that it is ESSENTIAL for signals to conform to the electrical specification of Section 5 to avoid damage or malfunction of the mechanism.

Below are some typical circuit configurations which are given as examples for guidance:-

ACCEPT OUTPUT INTERFACING



INHIBIT INPUT INTERFACING



8 Coin

With the SELECT input tied low to 0v, Sentinel becomes an 8-coin validator.

When tied low, the inhibit lines have the following meaning:

- I1 enable acceptance of coin type 1
- I2 enable acceptance of coin type 2
- I3 enable acceptance of coin type 3
- I4 enable acceptance of coin type 4
- I5,6 enable acceptance of coin type 5 and coin type 6
- I7,8 enable acceptance of coin type 7 and coin type 8

Upon detection of a valid coin, the accept outputs, A1-A4, form a binary pattern defining the valid coin type which has been detected. The outputs have the following meaning:

A4	A3	A2	A1	MEANING
0	0	0	0	coin validator inactive
0				coin present in validator
	0	0		valid coin type 1 accepted
	0		0	valid coin type 2 accepted
	0		0	valid coin type 3 accepted
	0		0	valid coin type 4 accepted
		0	0	valid coin type 5 accepted
		0		valid coin type 6 accepted
			0	valid coin type 7 accepted
				valid coin type 8 accepted

("0"=output open circuit. "1"=output short circuit to within 1 Volt of COM A.)

Normally, when idling, the outputs will display 'coin validator inactive' with all outputs open circuit.

When a coin is detected as having entered the validator, the outputs will show "coin present in validator". When a coin has been accepted, the corresponding 'coin accepted' signal is presented to the outputs. This signal remains present for 80ms +/-20%. The 'coin accepted' signal is then removed, and the Validator will continue to generate the "coin present in validator" output until the coin has successfully passed out of the mechanism.

In this manner it is possible to externally detect two possible fault conditions. The first is that a coin has been rejected. This is determined by the validator outputs changing from 'coin present in validator' to 'coin present in validator' and back to 'inactive' without generating any 'coin accepted' signal. The second is that a coin is being held within the validator. This is determined by the outputs sticking in the "coin present" state.

3.3 Using the Serial Interface

The SENTINEL serial interface allows the serial communication of both operating and programming information between SENTINEL and an external device. It is automatically selected in operating mode when the COM A input on the parallel interface is left unconnected.

The serial interface is designed to meet the standards for IIC serial interfaces. A full description of this standard is available from Coin Controls.

Although IIC performs its own synchronisation on a bit-by-bit basis, the bits of data are inherently grouped into byte-sized units, i.e. groups of 8 bits of data, and a complete message packet is therefore made up of an integral number of bytes.

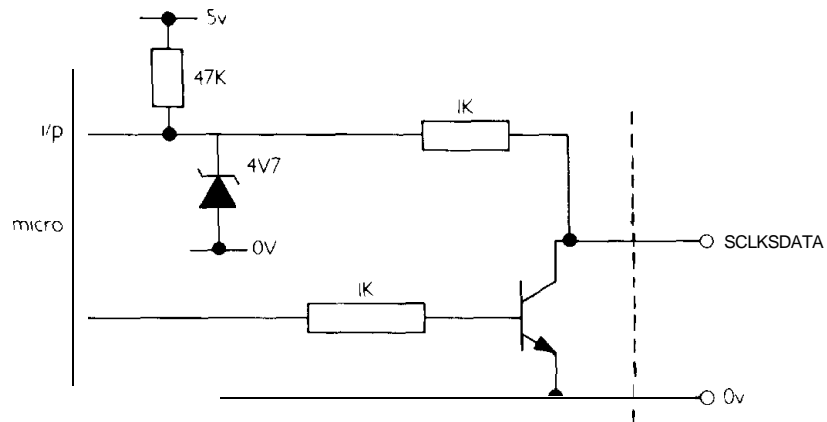
Messages are divided into two groups—those associated with normal operation via the IIC link and those associated with the programming mode.

As implemented in SENTINEL, the maximum recommended receive data rate (to SENTINEL) is 1500 baud. The transmit data rate (from SENTINEL) may be programmed to be either 'high' (1000 baud) or 'low' (500 baud).

The following signals are provided on the serial interface connector, CONNECTOR 2:

0V	(Pins 3 and 6)	Power supply and data 0V
V(board)	(Pin 2)	Power supply +ve rail
\$DATA	(Pin 5)	IIC serial data line
\$CLK	(pin 4)	IIC serial clock line

Circuit Diagram of SCLK/\$DATA I/O Pin



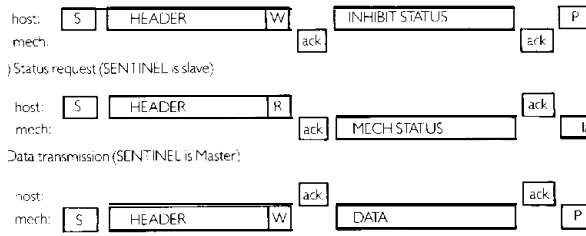
3.3.1 Normal Use

The IIC data transactions listed below are available when the serial interface is selected.

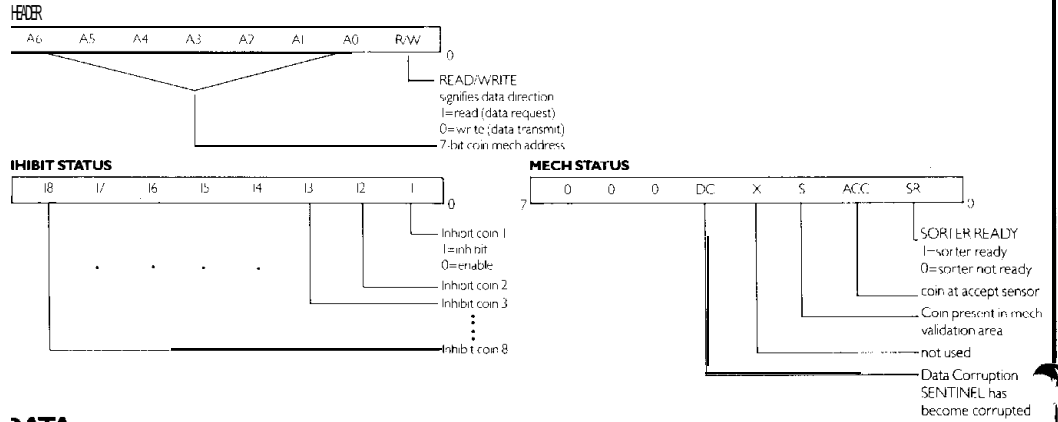
IIC is a 'multi-master' communications protocol. Communications during normal operation may therefore be split into two types, SENTINEL as slave, and SENTINEL as master.

- a) With SENTINEL as a slave, the following messages are available:
 - a.i) Set coin inhibits
 - a.ii) Status request
- b) With SENTINEL as master the following data byte transmissions are possible,
 - 3.1.) coin rejected
 - b.ii.) coin 1 accepted
 - b.iii.) coin 2 accepted
 - b.iv.) coin 3 accepted
 - b.v.) coin 4 accepted
 - b.vi.) coin 5 accepted
 - b.vii.) coin 6 accepted
 - b.viii.) coin 7 accepted
 - b.ix.) coin 8 accepted
 - b.x.) ERROR coin timed out in validation area
 - b.xi.) ERROR coin timed out between validation area and accept sensor
 - b.xii.) ERROR second closely following coin

Set coin inhibits (SENTINEL is slave)



The different bytes within the messages take the following format



DATA

The data within the data word has the following meaning:

b.i)	0 0 0 0	0 0 0 0	coin rejected
b.ii)	0 0 0 0	0 0 0 1	coin 1 accepted
b.iii)	0 0 0 0	0 0 1 0	coin 2 accepted
b.iv)	0 0 0 0	0 1 0 0	coin 3 accepted
b.v)	0 0 0 0	1 0 0 0	coin 4 accepted
b.vi)	0 0 0 1	0 0 0 0	coin 5 accepted
b.vii)	0 0 1 0	0 0 0 0	coin 6 accepted
b.viii)	0 1 0 0	0 0 0 0	coin 7 accepted
b.ix)	1 0 0 0	0 0 0 0	coin 8 accepted
b.x)	1	1 1 1 0	ERROR--coin timed out in validation area.
b.xi)	1 1 1	1 0 1	ERROR--corn timed out between validation area and accept sensor.
b.xii)	1	1 0 1 1	ERROR second closely following coin.

IMPORTANT NOTE: SENTINEL MUST successfully complete an IIC transaction in which it is master before it can revert to coin acceptance. SENTINEL will otherwise keep trying to transmit the credit/error message indefinitely. Thus, unlike the parallel Interface, unless the integrity of the Sentinel interface to the host machine is good, Sentinel will not accept coins.

3.3.2

Programming

An external device can configure the Serial Interface for programming operations. Coin Controls supply two units for programming SENTINEL

- the 'master programmer' for all programming functions
- the 'Tool Kit' field service aid

Further details may be obtained from Coin Controls Ltd.

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Coin Sorting

Coin Sorting is performed by the optional plug-in 4-way active sorter.

Coin Sorting is fully flexible (any coin any way) and is programmed by values stored in SENTINEL

There are six coin sorting functions which may each be programmed to any of the eight coin channels:

- coin always diverted down sorter path A (default path)
- coin always diverted down sorter path B
- coin always diverted down sorter path C
- coin always diverted down sorter path D
- coin toggles alternately between sorter paths A and B
- coin toggles alternately between sorter paths C and D

The last two sorter functions are intended for 'club' machines or any application where two payout devices for a given coin are required to be fed from a single coin mechanism.

Coin Sorting may be programmed by the user with either a Master Programmer or a 'Toolkit'. Additionally, some machines may have the ability to program coin sorting to the machines requirement facilitating SENTINEL'S universal application.

Cleaning

The plastic coin rundown should be cleaned periodically using a slightly moist cloth. Access to the rundown is gained by folding back the reject flap.

Cleaning of the sorter module may also be necessary from time to time on some sites.

Faulty Operation

Both Master Programmer and Toolkit enable functional testing of the coin mechanism and are of particular use in determining if a fault resides in the coin mech or the host machine. It is generally recommended that mechs with electronic faults be returned to Coin Controls Ltd for repair.

The following information is presented for customer guidance in determining a suspected fault and does not cover all possible causes.

<u>Symptom</u>	<u>Investigate</u>	<u>Possible Cause</u>
Mech does not work all coins reject)	Connector	Poor contact Bent Pins
	Power Supply	Not switched On Incorrect Voltage Inadequate Power. Power supply Rise- Time is too slow
	inhibit Inputs	Mech inhibited.
	Accept Gate	Gate not free or drsllocated
	Accept channel	Obstruction in channel
Mech takes first coin and then stops working (See Section 3.3 I)	Parallel Interface (If connected)	Parallel I/Face COM A pin not connected.
	Serial Interface (If connected)	Host Machine not responding
True coins reject too often	Power Supply	Voltage less than 11v (NB. voltage droop when solenoid activated).
	Accept Gate	Flap not free or drsllocated
	Connector	Loose.
Coins stick or jam in mech	Rundown	Dirty
	Rundown, accept channel, reject channel, accept gate, sorter (if fitted)	Dirt or Mechanical damage/obstruction
One of the True Coins always rejects	Mounting of mech Body and/or Sorter.	Improperly mounted.
	Parallel Interface (If connected)	Bent or broken Connection Pin, Wrong inhibit input voltage
false Coins in Cashbox	Accept Flap	Flap spring loose or flap drsllocated
Coins in wrong Cashbox	Sorter	Dirty, Mechanical damage or obstruction, Solenoid failure or wire broken
No Accept Signal	Connector	Connector Loose or broken
	Accept Channel	Dirty or obstructed (mech timeout)

Power Supply

11 to 15 volts dc. 220mA nominal standby consumption
 0.7 Amps Peak, 200 msec max. (no sorter)
 2.0 Amps Peak, 600 msec max. (with sorter)
 Rise Time=200 msec(max.)

Parallel Interface

COM A : +5 to +24 volts dc, 0 to -20 volts dc; 200mA max.

A1-A4 : 50mA sink or source, credit pulse 80msec (+/-20%) duration. (See Section 3.2)

II-17,8 3K3 pull-up to on-board 5vdc.

Open Circuit or greater than 3.6v-Coin Inhibited

Short to Ov or less than 12v ~ Coin enabled

Inhibit input

signal range : Ov (abs. minimum < Vin < 5v (abs. maximum)

Serial Interface

IIC Serial Interface Standard

Received Data Rate: 1500 baud (max.)

250 baud (mtn.)

Transmit Data Rate: programmable 1000 baud or 500 baud (+/-20%)

Sdata, Sclk: 47K pull-up to on-board 5v dc.

"0" - Ov (abs. min) < Vin < 12v (abs. max.)

"1" 3.6v (abs.min) < Vin < 24v (abs.max.)

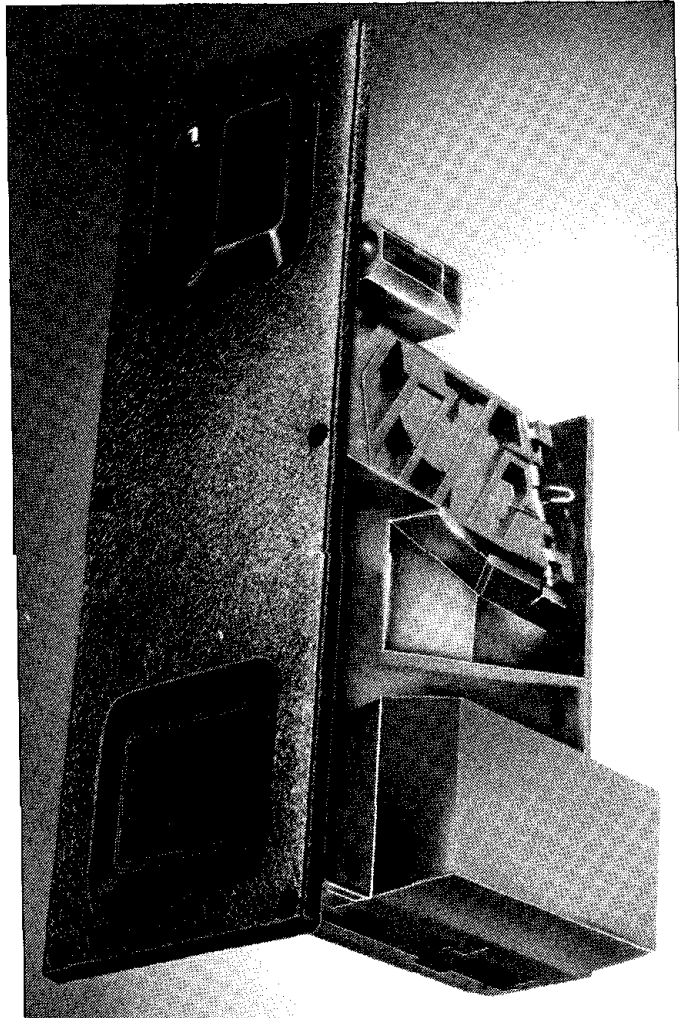
IMPORTANT NOTE: Application of signals or voltages outside of those specified above may cause damage to, or malfunction of the mechanism.

Environmental Conditions

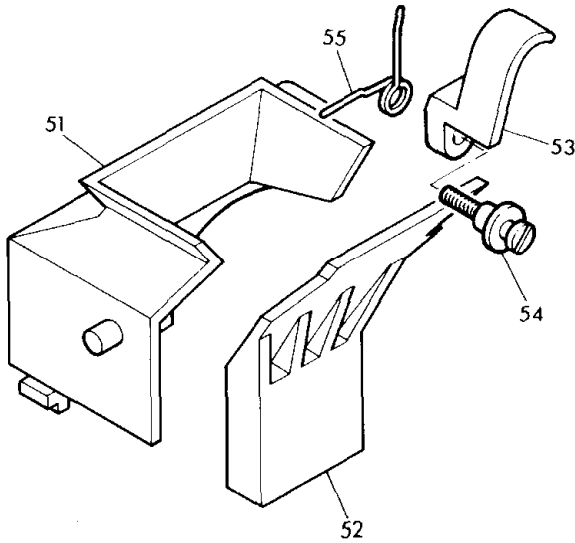
Temperature range:- 0° C to 50° C ambient

Relative Humidity:- 5% to 95% non-condensing

The SENTINEL Coin Mechanism

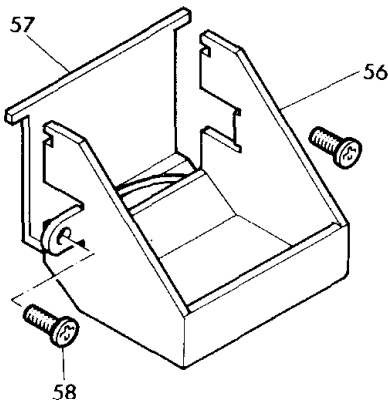
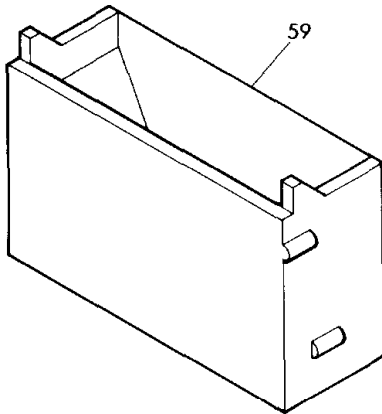


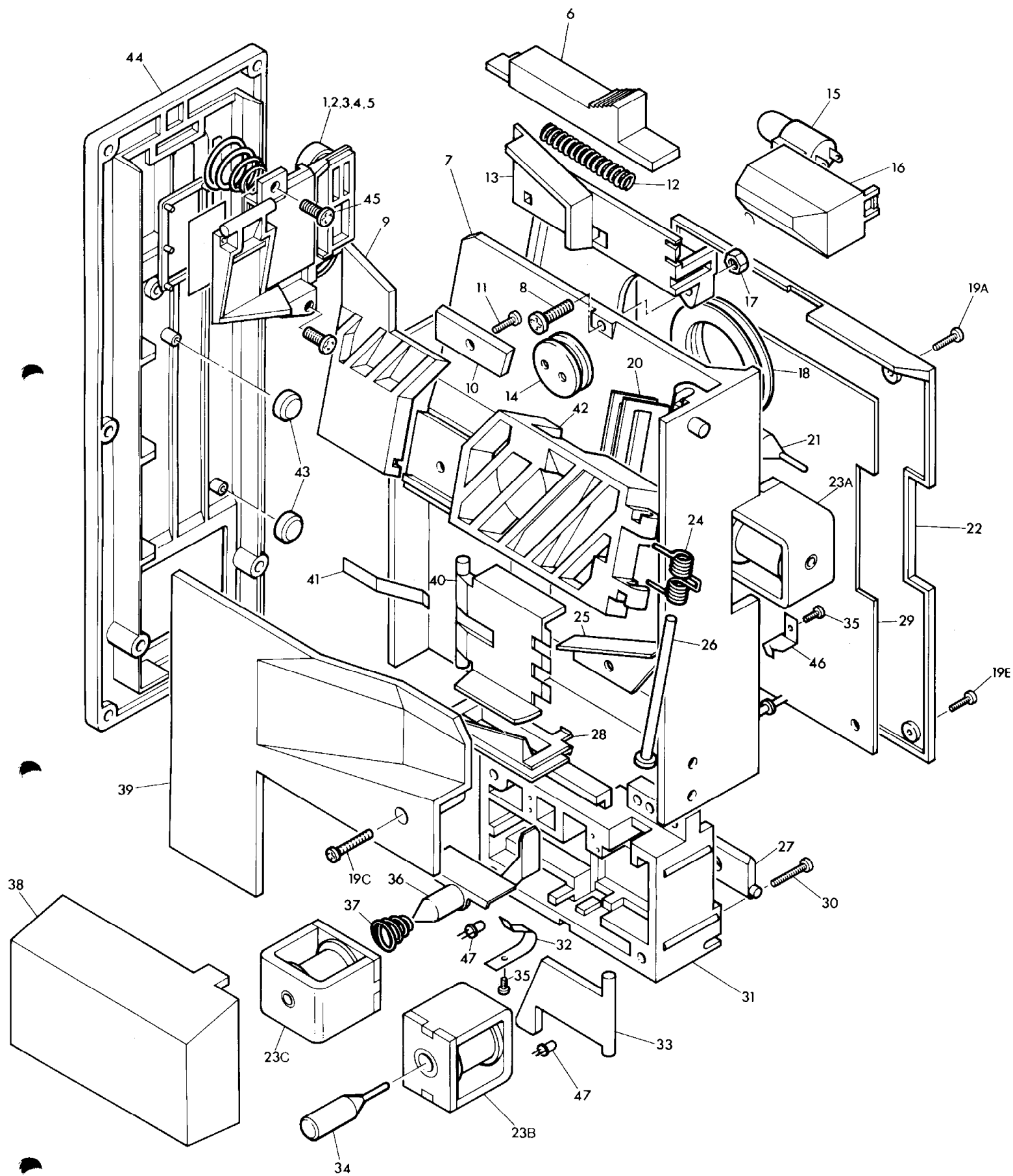
Parts List



- 1 Coin entry and button housing
- 2 Button
- 3 Button lid
- 4 Button cone spring
- 5 Button label
- 6 Quick release latch
- 7 Main body
- 8 M4.0 x 16.0 pozi pan HD screw
- 9 Front entry gate piece
- 10 Gate snubber
- 11 4.20 x 3/8\" pozi CSK screw
- 12 Quick release latch spring
- 13 Front entry
- 14 2nd sense coil assembly.
- 15 Bulb
- 16 Lamp holder
- 17 M4.0 full nut
- 18 1 st sense coil assembly
- 19 4.20 x 5/16\" pozi pan H D
- 20 3rd sense coil
- 21 Main body pole piece
- 22 P.C.B. cover plate
- 23 Solenoid assembly
- 24 Hinge pin spring
- 25 Main body snubber
- 26 Hinge pin
- 27 Sorter coin divertor flap
- 28 Final accept coil assembly
- 29 Printed circuit board assembly

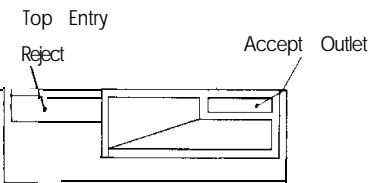
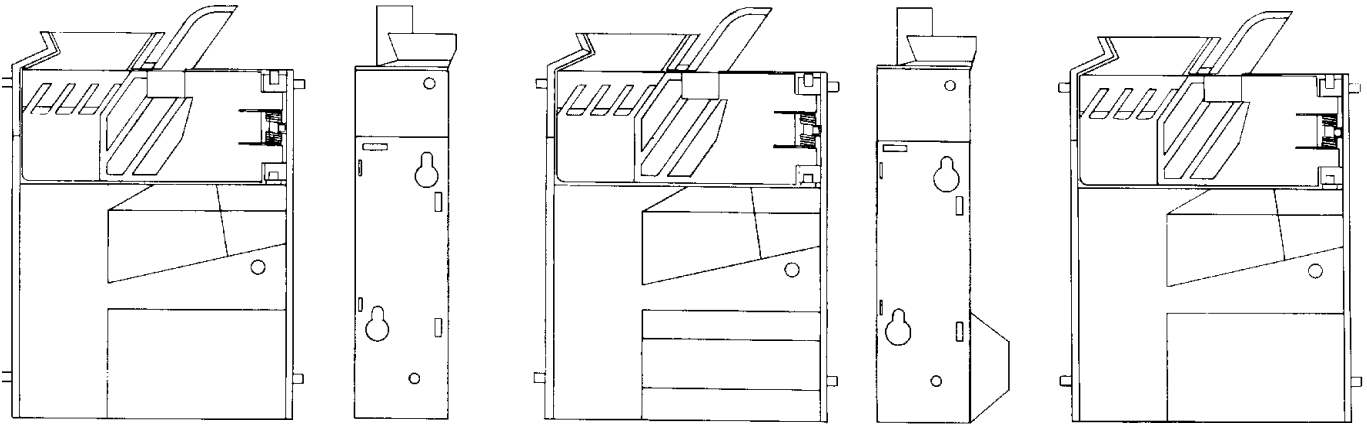
- 30 4.20 x 5/8\" pozi pan HD screw
- 31 Sorter centre plate
- 32 Coin divertor flap spring
- 33 Sorter solenoid flap
- 34 Solenoid flap pole piece
- 35 6.20 x 1/4\" pozi pan HD screw
- 36 Solenoid coin flap assembly
- 37 Sorter solenoid cone spring
- 38 Sorter solenoid cover
- 39 Coin rundown and reject cover
- 40 Accept gate
- 41 Accept gate spring
- 42 Reject gate
- 43 Mech. mounting studs
- 44 Front plate
- 45 M3.0 x 6.0 pozi pan HD screw
- 46 Cotton catch
- 47 Photo Cells
- 51 Top entry chute
- 52 Top entry gate piece
- 53 Top entry reject lever
- 54 Top entry reject lever pivot screw
- 55 Top entry reject lever spring
- 56 Reject clip
- 57 Reject clip flap
- 58 M3.0 x pozi pan HD
- 59 Single coin outlet



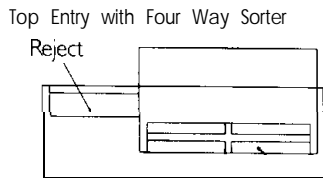


SENTINEL OPTIONS

TOP ENTRY OPTIONS



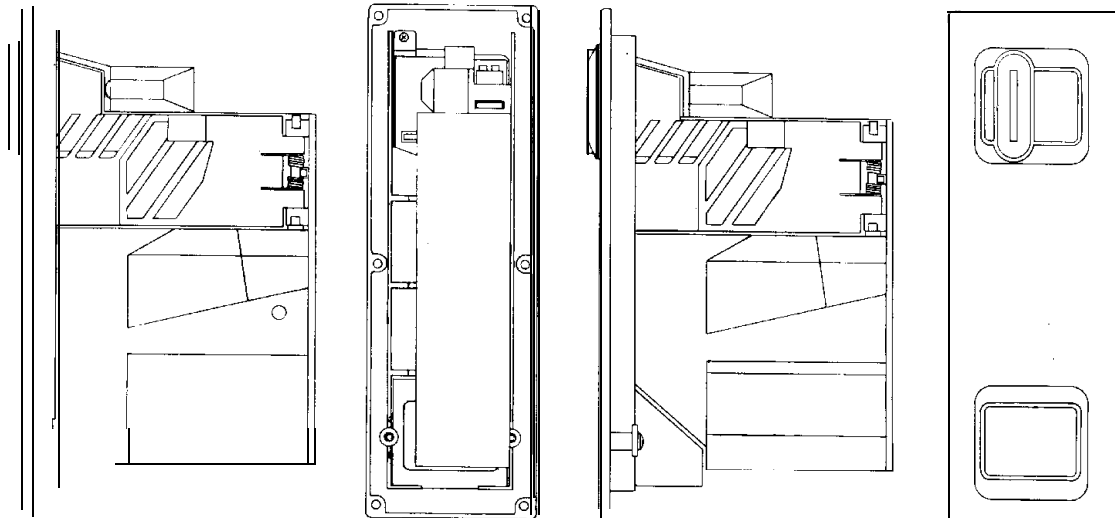
Single Accept Outlet



Four Coin Outlet

Top Entry with Standard Outlet

SENTINEL FRONT ENTRY OPTIONS



Front Entry with Front Plate and Standard Outlet

Front Entry with Front Plate, Direct Reject and Four Way Sorter

SENTINEL WITH AWP MANIFOLD

