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PARALLEL PROTOCOL
HOPPER U-II

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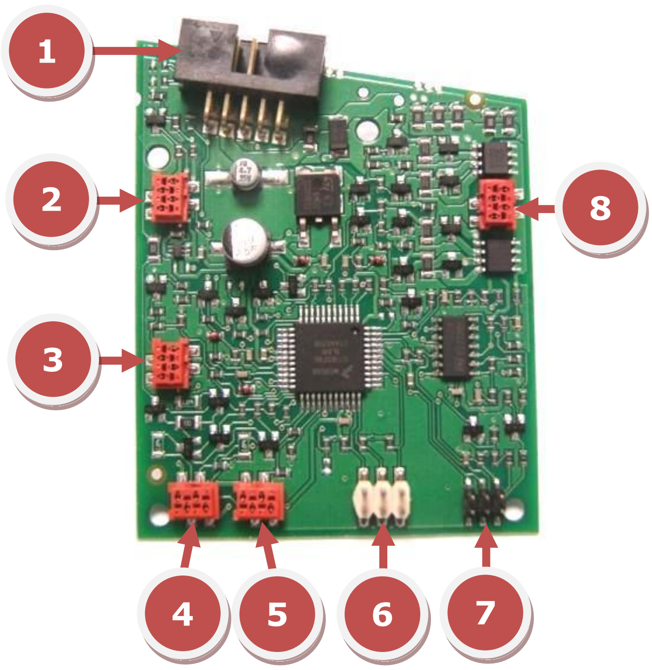
1. PARALLEL PROTOCOL

This manual explains the working of the parallel protocol used in the Hopper U-II.

2. CONNECTIONS FOR PARALLEL PROTOCOL

The following figure shows the use of each of the connectors on the control board.



1- Protocol/Machine connector

2- Coin exit detection

3- Double count

4- Empty sensor

5- Full sensor

6- Logic & Working mode selection

7- Tools connector

8- Motor

Figure 1. Parallel control board

There is only one model of board for all the Hopper U-II parallel.

2.1. Connector for communication with the machine (parallel protocol).

The Hopper U-II uses a 10-pin (2x5) 2.5mm connector, series Molex 8624 or similar, for communication with the machine.

The pin out of the connector depends on the working of the Hopper:

Pin	Function
1,2,3	Vdc
4,5,6	GND
7	Control
8	Error
9	Coin

Figure 2. Pin out Hopper U-II parallel standard.

Pin	Function
1,2,3	Vdc
4,5,6	GND
7	Control
8	Error
9	Coin
10	Empty sensor

Figure 3. Pin out Hopper U-II parallel with empty sensor.

Pin	Function
1,2,3	Vdc
4,5	GND
6	Full sensor
7	Control
8	Error
9	Coin
10	Empty sensor

Figure 4. Pin out Hopper U-II parallel with full and empty sensor.

2.2. Connector for configuration of the Parallel logic & working Mode.

Using connector 6 in figure 16 you can configure the logic, related to the signal levels and the working mode for the Hopper UII

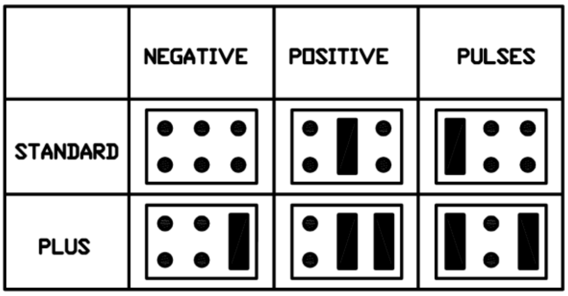


Figura 5. Logic & Working Mode configuration

3. DESCRIPTION OF THE PARALLEL PROTOCOL

3.1. PARALLEL PROTOCOL. WORKING MODE.

3.1.1. Negative logic

In this mode the machine activates the Hopper and starts the payout of coins by applying to the pin a 0 logic (<=0.5 Volts) to pin 7 (control) on the connector, and it stops the payout by applying a 1 logic (voltage between 4 Volts and Vcc ±10 % Volts) or disconnected.

This voltage provokes the activation of the control board and starts the motor using an "H" bridge controlled by two pairs of MOSFET transistors, one on channel P and the other on N.

3.1.2. Positive logic.

In this mode the machine activates the Hopper and starts the payout of coins by applying to the pin a 1 logic (voltage between 4 Volts and Vcc ±10 % Volts) to pin 7 (control) on the connector, and it stops the payout by applying a 0 logic (voltage between 0 and 0.25 Volts).

3.1.3. Control by pulses.

When this mode is used, the extraction of coins from the Hopper is carried out by applying pulses to pin 7 (control) on the CEN1 connector. The characteristics of the pulses should be:

- Positive logic pulses (signal of rest at low level).
- Minimum duration, in both high and low level, at least 5 milliseconds.
- The validation of the pulses is carried out in the ascendant phase.

3.2. DESCRIPTION OF THE PROTOCOL. SIGNALS.

3.2.1. Control signal. Pin 7.

Using the control signal, (with pin 7 on the exterior connector), the machine governs the activation/deactivation of the extraction system of the Hopper. The format of this signal depends on the working mode selected on the control board (positive or negative logic or pulses), as explained above.

3.2.2. Coin exit signal. Pin 9.

The Hopper detects the exit of a coin using an optic sensor (reflexive opto). This opto communicates a 30 millisecond pulse to the machine through pin 9 on the CNE1 (exterior connector). These pulses are generated with an open collector transistor and is active at "0", that is at rest, this signal is at high level.

When the photocell detects the coin, the Hopper puts pin 9 at 0. This line is kept at 0 for between 30 and 65 milliseconds. If after 65 milliseconds the photocell continues to detect the coin, the line is kept at 0 but the hopper will generate an error code (error 1) on pin 8 on the same connector.

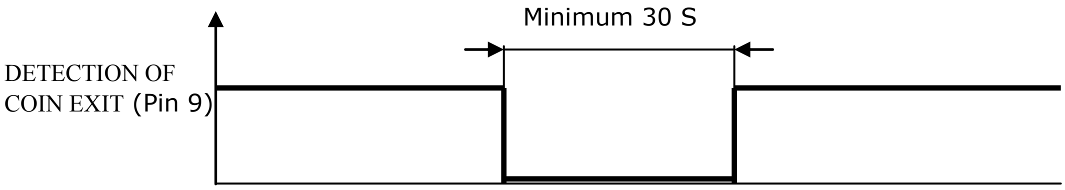


Figure 6. Coin exit signal.

3.2.3. Empty signal. Pin 10 (optional).

The Hoppers U can incorporate an empty hopper detector, which consists of a photocell (photodiode and phototransistor) in the bottom of the coin bay.

The signal emitted by the photocell is communicates to the machine via the exterior connector (using an open collector transistor) applying a low level signal (0 volts) when the Hopper is **not** empty and a high level signal when it is empty.

3.2.4. Full signal. Pin 6 (optional).

The Hoppers U can incorporate a full hopper detector, which consists of a photocell (photodiode and phototransistor) in the top of the coin bay.

The signal emitted by the photocell is communicates to the machine via the exterior connector (using a open collector transistor) applying a low level signal (0 volts) when the Hopper is full and a high level signal when it is **not** full.

3.2.5. Error signal. Pin 8

The hopper is capable of auto-detecting various errors. These errors are made known to the machine so that it can take the necessary action.

The error signal is communicated to the machine through pin 8 on the exterior connector and is generated by an open collector transistor. The signal is active at "0", so that at rest it is at high level.

In section *3.3* is a list of all the errors the Hopper U-II is capable of detecting and reporting, such as is working and format of the error signal.

3.3. ERROR CONTROL.

3.3.1. List of reported errors.

	Description	**Meaning**	**CONSEQUENCES**
Error 1	Detection of coin permanently in exit sensor	The coin exit is superior to the maximum of 65 milliseconds	Stop the Hopper and coin signal permanently ON
Error 2	Detection of coin exit sensor permanently at rest	Coin exit detected with hopper stopped.	Stop the Hopper and coin signal permanently OFF
Error 3	Detection of permanent jam	The hopper cannot free jam and maximum time has passed.	Stop the Hopper and coin signal permanently OFF
Error 4	Detection of maximum span	Various spans detected that are more than maximum time (3 spans maximum.	Stop the Hopper and coin signal permanently OFF
Error 5	Motor not detected	Start of motor not detected on applying voltage.	Stop the Hopper and coin signal permanently OFF
Error 6	Fault in coin exit sensor	The coin exit connector is disconnected or photodiode is faulty.	Stop the Hopper and coin signal permanently ON
Error 7	Power supply out of range	The power supply is lower than the minimum range or higher than the maximum.	Stop the Hopper and coin signal permanently OFF

Table 1. Common errors.

3.3.2. Format of the error signal.

The error signal starts with a pulse of 100 milliseconds at 0 volts and continues with a string of 10 millisecond pulses at both high and low level (Relation T on/T off = 10 milliseconds/ 10 milliseconds). The number of pulses generated is equal to the error detected and this is repeated until a new order is received to activate the Hopper.

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If the activation signal is between 1 and 5 milliseconds, the motor will not start.

The graph below represents the signal that corresponds to error 4, you can see the format of the pulse strings and how these disappear when the Hopper detects the activation signal.

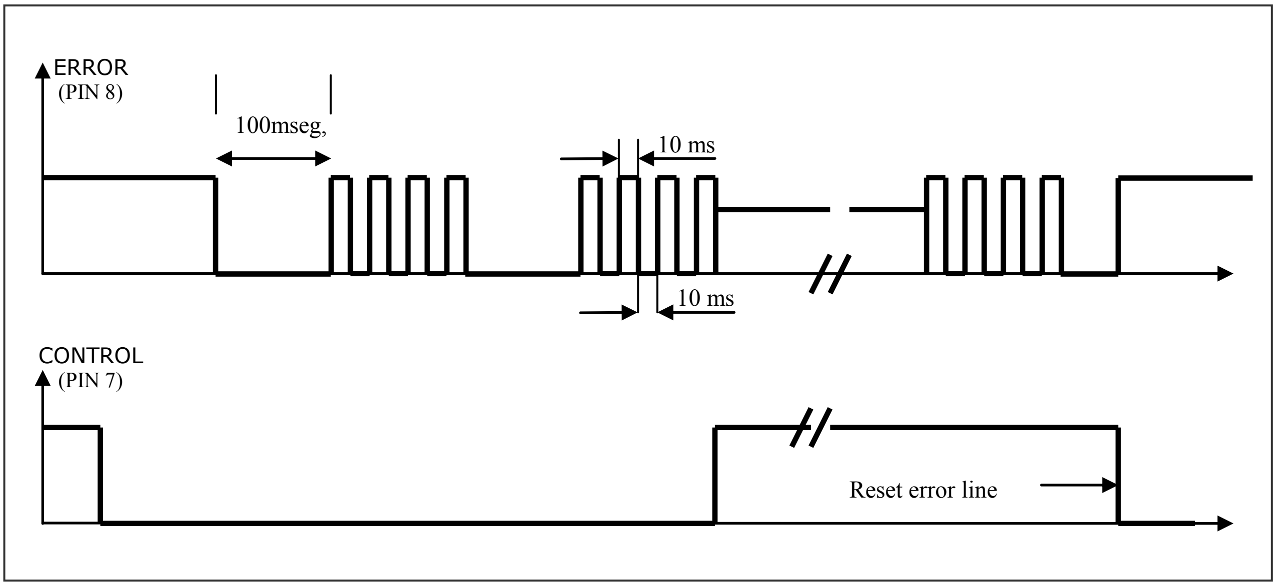

Figure 7. Negative logic

For those machines that do not monitor the error signal line and cannot be informed of certain critical errors that should put the Hopper out of order, it will report the occurrence of some of these errors using the coin signal line. Errors 1 and 6 activate the Coin signal line permanently, except for when the jammed coin disappears from in front of the opto.