Technical Manual

Electronic Coin Selector
EMP 8x0.00 v6
EMP 8x0.04 v6
EMP 8x0.13 v6
EMP 8x0.14 v6

- version 1.40 -

Table of Contents

Safety Precautions

You are advised to observe the safety information during operation, maintenance and repairing of electronic coin selectors of the EMP 800 series. Failure to do so may result in warranty and other claims being excluded.

Whilst every care has been taken in the preparation of information contained in this manual, *w*h Münzprüfer Berlin GmbH will not be liable for any consequential loss or damage howsoever caused.

The Company would be very grateful if any accidental inaccuracies could be pointed out to us with any other constructive criticism which might lead to a better understanding.

1. Introduction

1.1. Preface to the Manual

This manual describes the design, functionality, adjustment and servicing of the coin selector series EMP 800 v6 with its versions Standard (6 parallel output lines, EMP 8x0.00 v6), Standard-binary (6 parallel output lines binary coded, EMP 8x0.04 v6), serial (MDB or ccTalk protocol, EMP 8x0.13 v6) and USB (interface EMP 8x0.14 v6).

1.2. Further applicable Technical Documents and Manuals

Programming Software wheasy 4	Manual wheasy4.pdf
3-way-sorter SRT 800	SRT 800_info.pdf
3-way-sorter SRT 400 / SRT 500	SRT 400_info.pdf
Power supply N 820	N 820_info.pdf
Electronic motor reject EMR 100	EMR 100_info.pdf
Electronic motor escrow E 105	TM E 105_pdf
Electronic anti-pin system ES 003	ES 003_info.pdf
Chassis CH 800	Chassis CH 8xx_info.pdf
ccTalk USB HUB CCT 900	TM CCT 900.pdf
Display D 801	N820_D800.pdf

1.3. Basic Operating Mode of the EMP 800 v6

The EMP 800 v6 is an electronic coin selector with a highly specialized inductive measuring system. The measuring system consists of various coil alignments, which are located directly behind the coin insert in the flap and in the main body.

The coins are measured when rolling through the measuring system. The determined measuring values are compared with the reference values, which are stored in the memory.

A whole group of reference values is assigned to every programmed coin, each with an upper and lower acceptance limitation. This group of stored reference values is called "coin channel". The EMP 800 v6 has 32 coin channels for a maximum of 16 different coins. If the measured coin values of an inserted coin lie within all acceptance bands of a programmed coin channel, then the coin selector assigns this coin to this specified channel.

Just before the coin selector activates the solenoid for the coin acceptance, it then verifies whether the respective coin channel is blocked for coin acceptance. This blocking can be made via the DIP-switches on the back of the coin selector or via the machine interface. If the coin is blocked for an acceptance, the coin selector searches for suitable reference values within the other coin channels. A coin is accepted, when a suitable unblocked coin channel is found.

Normally at least 2 different acceptance bands are stored in a coin selector for each coin to be accepted. That means two different coin channels with different limit values. Should the acceptance only be carried out in the channel with narrow tolerance bands for a better

separation of foreign coins, the coin acceptance of the broad channel must be blocked (see chapter 3.4 Coin Blocking).

16 out of the 32 coin channels are defined to be the master- and the other 16 to be slave channels. Any number of slave channels can be assigned to a master channel. They always have the same coin value, the same coin output lines and the same sorting path as the assigned master channel. In general they serve for the programming of adjustments with medium or narrow tolerances or differing coinage.

The acknowledgement of an accepted coin is effected not before it has passed through the coin selector. The correct coin flow pass is monitored by light sensors.

The measuring quality is primarily influenced by the steadiness of the coin passing through the measuring system, with the help of an integrated element which slows the coin down. The position of the coin selector and the insertion situation also influences the measuring quality.

In general care should be taken to ensure an incline of 5° of the coin selector, to make certain that the coins can pass along the contact surface in an ideal way (see image 1).

The coin insert should allow the coin to roll into the coin selector by a minimum of kinetic energy.

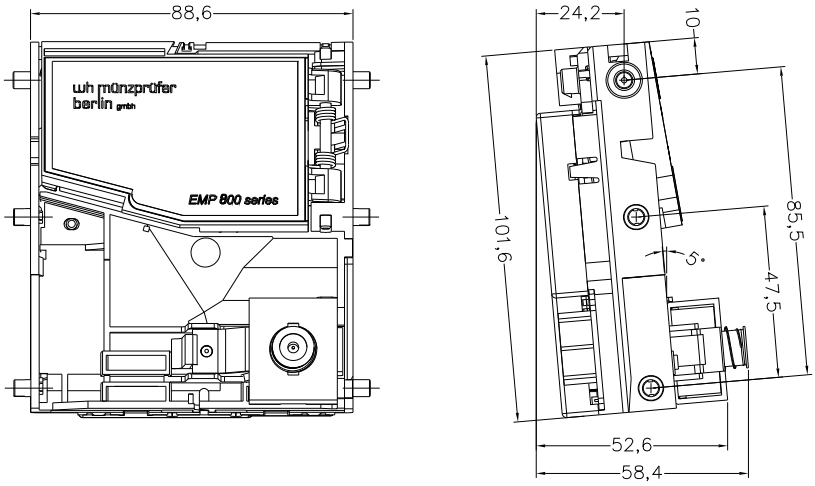


Fig. 1 EMP 8x0 v6 – Dimensions and Positioning

1.4. The EMP 8x0.00 v6, 8x0.04 v6 and 8x0.13 v6 series

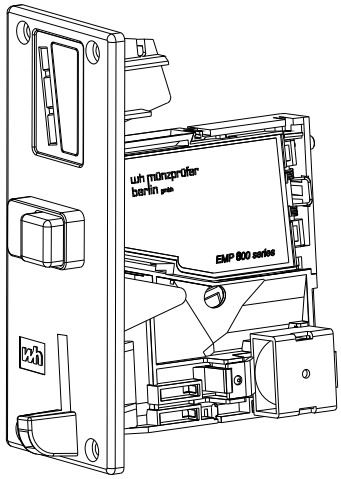
The electronic coin selectors EMP 8x0.00 v6, EMP 8x0.04 v6, EMP 8x0.13 v6 and EMP 8x0.14 v6 are available in the following versions:

with front plate:

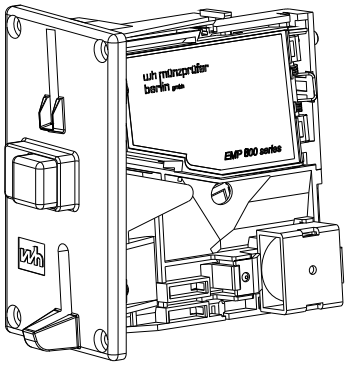
Standard front plate	(F 800)	**EMP 800**.xx v6
Mini front plate	(F 810)	**EMP 890**.xx v6
Stainless steel front plate	(F 801)	**EMP 850**.xx v6

for chassis / channel mounting:

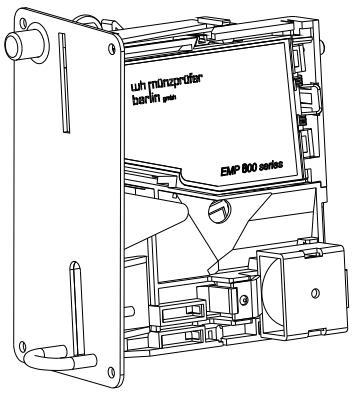
reject down and to the front	**EMP 820**.xx v6
reject down and to the rear	**EMP 830**.xx v6
reject laterally	**EMP 840**.xx v6
full access opening, reject to the front	**EMP 860**.xx v6
full access opening, reject to the rear	**EMP 870**.xx v6
full access opening, reject laterally	**EMP 880**.xx v6



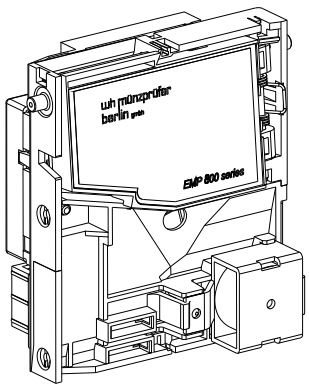
EMP 800.xx v6



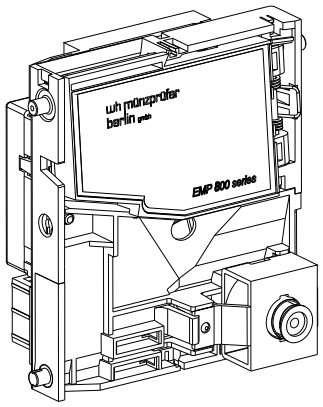
EMP 890.xx v6



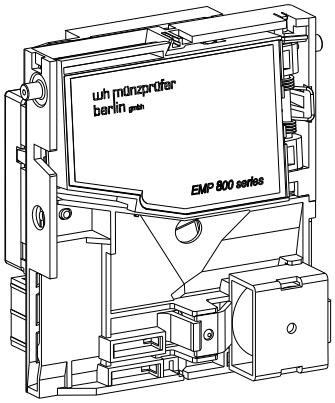
EMP 850.xx v6



EMP 820.xx v6



EMP 830.xx v6



EMP 840.xx v6

The second digit of the model number indicates the mechanical version and the two digits after the decimal point identify the electronic interface.

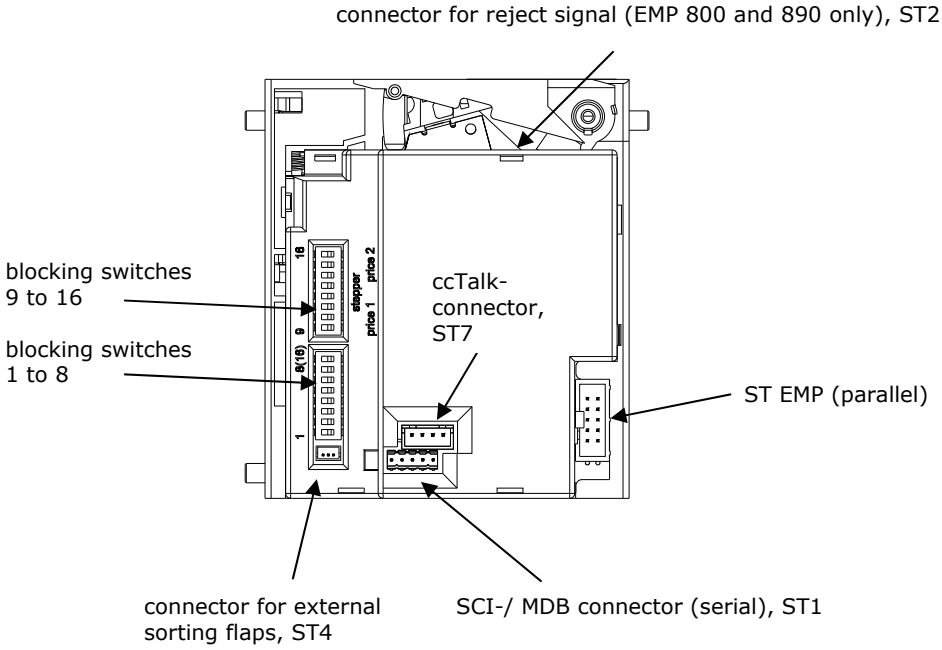


Fig. 2 Location of connectors and control elements

2. Technical Data

2.1. Interfaces EMP 8x0.00 v6, 8x0.04 v6, 8x0.13 v6 and 8x0.14 v6

The EMP 8x0.00 v6 is a 6-output line coin selector. Any coin may be assigned to any parallel output channel and the length of the output pulse signal may be set from 1 ms to 65 seconds. Only 5 output

channels will be available if one of the output lines is used for an inventory impulse.

The EMP 8x0.00 v6 allows to assign each coin channel to exactly one parallel output line. In addition to this the EMP 8x0.04 v6 offers to program any combination of output lines (binary coding).

The EMP 8x0.13 v6 coin selector interface supports the serial multi drop bus Protocol (MDB) and the ccTalk interface. In all other respects this coin selector functions in the same manner as the EMP 8x0.00 v6 and EMP 8x0.04 v6

The EMP 8x0.14 v6 has an exceptional position with the 8x0 series, as it is based on another hardware compared to the others. This coin selector has a USB-interface for direct connection to a PC.

The power consumption is optimized, so that the supply of the coin selector can be achieved through the USB-bus (5 V at 500 mA current consumption, maximum at coin acceptance). As an option the coin selector can be powered by a 12 V power supply (N 789) if the PC or a hub, which is connected in between, cannot supply the specified 500 mA current consumption for the USB-bus.

The EMP 800 v6 has been designed with the ability to direct external coin sorting flaps (Option /X). Three additional output lines can be used to sort a coin to a maximum of 8 different sorting flaps. Each of the 16 master channels can be assigned to one of the 8 external sorting shafts. For sorting of coins the 3-way sorter SRT 400, SRT 500 or SRT 800 are available.

The EMP 800 v6 is equipped with scalable safety functions including detection of "coin-on-a-thread" (strimming) or "coin jamming". It has also a coin tracing system as a security provision against manipulation. Any coin jamming or drawing back of a coin-on-a-thread would cause an alarm signal to be emitted via the serial interfaces. The parallel interface may also be configured to signal alarms. The alarm signal pulses are adjustable so that they can be differentiated from the coin pulse signals. The coin selector monitors each coin for a proper trajectory through the coin path. Deflections that suggest an attempt at manipulation are dealt with. An early detection of such an occurrence will cause the coin to be rejected. Additionally, no credit is given for a coin detected, but too late for rejection. The coin selector can be programmed in such a way that after an attempt at manipulation the coin acceptance is blocked for a programmable period of time.

The EMP 800 v6 series can be programmed through the serial interface. The PC software *w*heasy 4 is available for these procedures.

wh Münzprüfer maintains a policy of continuous research and development and unconditionally reserves the right for technical modifications with respect to the EMP 800 v6 series coin selector and the *w*heasy 4 software.

2.1.1. Technical Overview EMP 8x0.00 v6, 8x0.04 v6 und 8x0.13 v6

coin acceptance	32 coin channels, 16 master and 16 slave channels
coin blocking	Complete blocking via the machine controller. In addition, any individual coin, or group of coins can also be blocked through DIP switches.
	Individual coin blocking via coin output lines (Option /O)
output signals	Six open collector output lines are available. Each output line can be freely assigned to any of the 16 master coin channels through programming.
	45 Volt / 500 mA
output pulse length	1ms to 65 seconds, programmable
coin return	The coin selector gives an active LOW signal on the coin reject line when the coin return button is pressed.
supply voltage	10 V to 26 volts DC
supply current	< 30 mA in standby, during coin acceptance briefly 300 mA. No power is needed for battery operated coin selectors in standby
temperature range	+10°C to +70 °C
humidity classification	according to DIN 40040: F
coin sizes	max. diameter x max. thickness: 32.5 x3.4 mm
dimensions	height x width x depth: 104 x 53 x 93.5 mm (without front plate)

Options

/A	power supply connections are reversed, 7 coin output lines, no coin reject signal
/B	battery operation (standard)
/C	battery operation with inductive sensor
/E	extended temperature and humidity range −20°C to +70°C, humidity classification E/D:
/F	large coin funnel
/I	inventory impulse
/N	coin output signals inverted
/O	individual coin blocking via parallel lines
/P	no coin reject signal
/R	additional light barrier to observe coin return path
/S	preceding coin output signal
/T	teach mode (2 coin channels activated)
/X	control for external sorting flaps
/Z	additional external strimming detection

3. Programming and Adjusting the Coin Selectors

3.1. Introduction

This chapter gives directions for preparing the EMP 800 v6 for programming. Please conform to all safety precautions before making changes to the unit.

Please note that all setting / programming of our electronic coin selectors may be carried out at the factory or by any authorised "*w*h Münzprüfer Service Centre."

Coin operated machines, as well as coin selectors are dangerous electrical devices. Always follow proper safety procedures when working with electrical devices. Please turn the power off before making or removing connections or otherwise performing work on the unit.

wh Münzprüfer v6 coin selectors can only be programmed with *w*heasy software version 4.00 onwards. An interface converter is needed for the connection to a PC, which is included in the delivery of wheasy 4. For owners of a wheasy 3 an upgrade to wheasy 4 is available.

This manual assumes that the *w*heasy 4 programming manual and the programming software are available and that the operator is familiar with them. References here to *w*heasy 4 software, are only made relative to its specific application to the particular coin selector and its functions.

To power up the EMP 800 v6 and the associated PC interface, we strongly recommend our N 780 power supply for this purpose. The power supply must be set to the 12 V position for programming and testing the EMP 800 v6. The coin selector is connected to the dongle (interface converter) with the cable provided with the software to the N 780 power supply. The dongle is connected to an available COM or USB port. See figure 3.

If the programming should take place directly at the machine, the coin selector may also be connected to the PC without power supply, as shown in figure 4. This procedure requires the use of the cable K818/1800, which is not supplied with the standard *w*heasy kit.

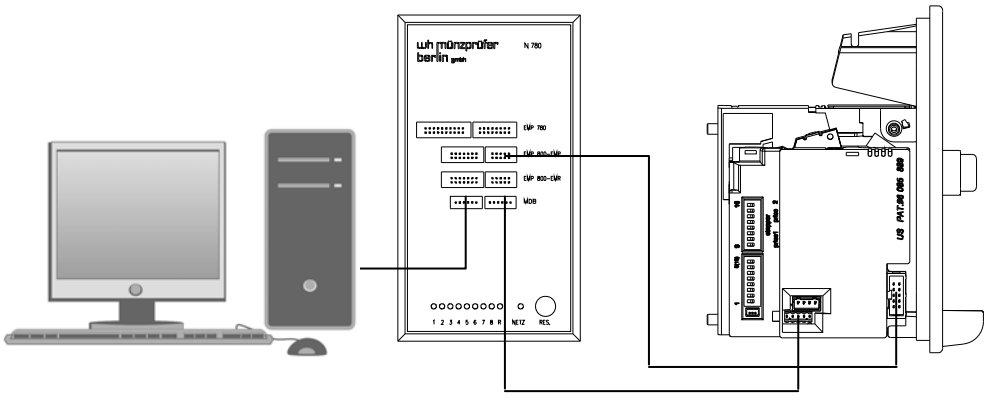


Fig. 3 Connection of the coin selector with the N 780 and the PC

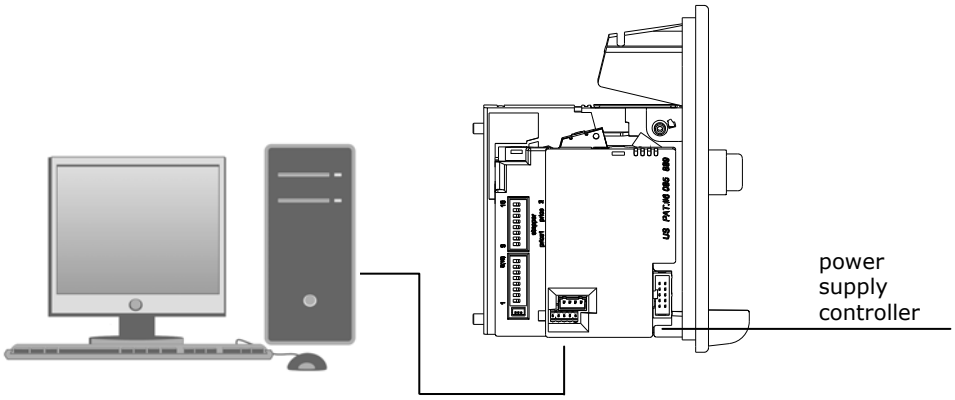


Fig. 4 Connection between a coin operated machines (controller), an installed coin selector and a PC

Every coin selector is fully tested and configured at the factory and is supplied ready for installation. Please store the factory settings on the hard disk before making changes. The settings could be stored with a file name incorporating the serial number. Additional information are available from our technical manual, wheasy 4.

Please also note the information on the coin selector label.

It is important that the coin selector be located in an upright position when programming. Similarly, the bottom surface of the coin selector needs to be horizontal. The best programming results are achieved when using the programming stand T 800. Alternatively you may also mount the coin selector in the same way as it is installed in the machine itself.

The following sections detail each Windows™ software *w*heasy 4 related function of the coin selector. Each function has its own chapter as listed in the table of contents in this manual.

3.2. Programming of Coins

There are a variety of ways in which the coin or token acceptance of the EMP 800 v6 may be programmed.

The coin selector can "learn" new coin parameters, including individual tolerance requirements, with the help of the Calibration Function. Calibration is carried out either using the PC based *w*heasy 4 software or directly in the vending machine using the Teachmode Function (see On site programming).

Yet another alternative would be to transfer a previously prepared complete coin parameter data set from the PC to the coin selector. This is commonly referred to as the Cloning Function. This method is far less involved than calibration because it dispenses with the time consuming task of inserting coins. A pre-requisite however is that an approved and appropriate coin parameter data set is available. These may be acquired via the internet from *w*h Münzprüfer (info@whberlin.de).

By means of *w*heasy 4 it is possible for the first time to create a data set originating from a coin selector of the EMP 800 v6 series. This data is stored to your PC and may then be copied to other coin selectors. For this purpose a special function has been developed (see chapter 3.2.3) in order to make this procedure more convenient.

3.2.1. Calibration

3.2.1.1. Calibration using *w*heasy 4

Under the Edit pull down menu is the function "Calibration". Pressing the <F4> key can also directly access this window. This will bring up the following window:

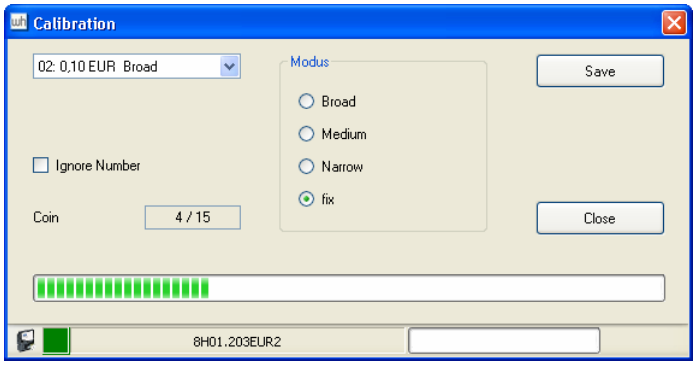


Fig. 5 Window Calibration

At the top left side a coin channel to be calibrated is selected. The coin value and currency code for the selected channel is displayed provided that it has been written to the file as being programmed to that channel. This is shown next to the channel number.

Not only the coin channel may be chosen but also the calibration mode. The calibration mode is activated for the chosen coin channel from the data set, it may be modified at any time until the end of the calibration.

The calibration mode "fix" is intended for use with coins and coin channels for which preset tolerance parameters are available and calibration mode "fix" is also preset. As a general rule, "fix" provides the best results when such information is already available.

The coin tolerances are automatically adjusted to the test coin set when "narrow", "average" or "broad" are chosen. This makes them particularly appropriate for the calibration of new coins or tokens in the absence of coin data sets.

Each of the calibration ranges approximates coin acceptance as follows:

narrow	approx. 95%,
average	approx. 98%,
broad	approx. 99%.

Obviously, the actual acceptance rate in a vending application may vary from the figures above. The level of variation relates directly to just how the coin set used for calibration is typical of the coins currently in circulation.

The number of inserted coins as well as the overall number of coins required is shown in the calibration window. The total number of required coins is determined by the data file. Calibration automatically ends once the required number of coins have been inserted and the procedure may now be finished or another coin channel selected for calibration.

3.2.1.2. Calibration Using the Teach Mode Function (Option /T)

The coin selector can be delivered with an optional teach mode function (on site programming). The teach mode can be set up for a maximum of 14 channels at the factory. No PC is required for the teach mode, since the necessary software is built into the coin selector.

The teach mode is activated by setting the number 8 switch on the left side of the DIP switches to "ON". The number 7 switch of the same DIP switch block is used to set the acceptance tolerance to "broad" or "narrow". The "ON" setting selects a narrow tolerance.

To start the calibration it is necessary to select a channel to be calibrated by setting one channel switch to "ON". The left DIP switch on the left side corresponds to channel 1 and right DIP switch on the right side corresponds to channel 16.

The coin channel must be chosen after activation of the teach mode switch 8. The advantage is that it is not necessary to set all DIP switches to "OFF" first before programming a particular channel.

Channels 7 and 8 cannot be calibrated with the teach mode because the DIP switches 7 and 8 are used to set the acceptance tolerance and to activate teach mode respectively.

Only 15 blocking switches are available on those coin selectors that have been factory set with the teach mode. The coin selector will not accept any coins while it is in the teach mode.

Figure 6 below shows the example of setting up channel 15 for calibration with narrow acceptance tolerances.

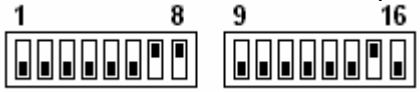


Fig. 6 Example DIP switch settings for teaching channel 15 with narrow tolerances.

The following procedure is for coin selectors with activated teach mode (factory setting):

1. The coin selector is configured, so that only **coin channel 15** and **16** (i.e. coin output lines 5 and 6) may be used for teaching.

2. The teach mode is activated via **blocking switch no. 8** (ON). Additionally please insert a coin into the coin selector incorporating battery operation (EMP8x0.xx /B). The coin selector remains switched on until the teach mode will be switched off again.

3. If **blocking switch no. 7** is activated additionally (ON), teaching is effected using **narrow tolerances**

4. The **blocking switches 15** and **16** are used to teach **coin channels 15** and **16**. The switches have to be set to the OFF position when activating the teach mode, otherwise the coin selector software blocks the two channels for the teach mode.

5. If any coin blocking switches are activated (ON) for channels which are not released for the teach mode, the coin selector magnet will operate briefly three times to indicate an incorrect operation.

6. To program the coin selector with the teach mode a **minimum of 10 coins or tokens** must be inserted. When the requisite number of coins have been inserted and the teaching procedure has been completed (by setting the blocking switch no. 15 or 16 back to the OFF position), the coin selector solenoid will operate briefly and once only.

7. Should the coin selector establish an **overlapping** of the newly programmed coin with a coin / token already programmed, then the coin selector solenoid will operate briefly twice and no new data will be stored in the memory of the selector.

8. **Insufficient coins** being inserted will result in the solenoid not operating and no new data will be stored into the memory of the selector.

9. For security reasons during teaching, the coin selector will rate all measured values of added coins as overlapping unless at least one parameter differs from any existing coin parameter tolerance. Should the programming not be successful when using „broad" tolerances (blocking switch no. 7 OFF), teaching could be still possible using the narrow tolerances.

10. The teach mode is deactivated via **blocking switch no. 8** (OFF). When the teach mode is deactivated, all blocking switches may then be used for individual coin blocking with the exception of blocking switch no. 8.

3.2.2. Cloning (Programming without Coins)

Cloning is the fastest way in which to program a coin set. Using this method, coin parameter sets are transferred into the coin selector from the PC. It is also possible to transfer a coin parameter set from one coin selector to another thereby giving it nearly identical acceptance and reject rates.

As a prerequisite to cloning, it is necessary for the coin measuring system of the originating coin selector to be the same as the measuring system of the target coin selector. wheasy 4 automatically compares the measuring configuration of the attached coin selector with the measuring configuration of the coin selector that produced the coin parameter set. Cloning is only accomplished if the two systems are indeed the same.

Other data sets are available from *w*h Münzprüfer if *wheasy 4* does not allow cloning because of a mismatch in the measuring system characteristics.

Cloning can begin once the PC has been loaded with the cloning data set and when the coin selector has been connected. This function can be accessed by selecting "Clone EMP" from the "Edit" pull down menu or directly by clicking

 on the tool bar.

The following window opens up after selecting the function "Clone EMP":

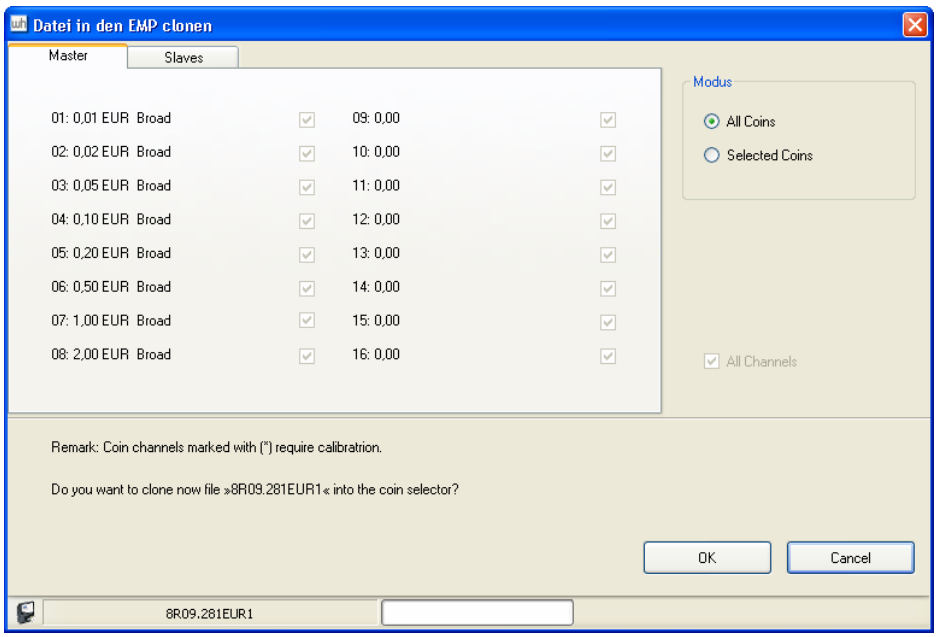


Fig. 7 Window „Clone EMP"

In certain situations it is possible to selectively clone individual channels. This can be carried out provided that the loaded data file is identical with the name of the file loaded from the coin selector. This we refer to as selective cloning.

Selective cloning is useful when the parameters for a specific coin are to be changed, or maybe a token is to be added without overwriting the fine tuning of other coins. With selective cloning all coin channels with activated coin boxes will be cloned.

The actual cloning process takes about 4 seconds after the OK button has been pressed.

3.2.3. Generating a Data Set for Cloning

It is simple to generate a data set for cloning with wheasy 4 from an existing coin selector EMP 800 v6 series. The coin selector from which the data set needs to be generated is connected to wheasy 4 and the software automatically reads it out. The following steps must be taken:

1. Go to menu "File" and click to "Generate File from Coin Selector".

2. Select a path to save the data and use preferably the preset data name.

3. Confirm with OK to store the data set.

3.3. Coin Selector Output Signals

There are 6 open collector parallel outputs (current sink) on the EMP 800 v6 10-pin connector. They can be freely assigned in any combination to the 16 master channels. This means that (depending on the model) one coin channel can show up on multiple output lines or that one output line can be activated by multiple channels. The 16 slave channels always have the same output combination as the associated master channel.

In addition the number of output impulses for every coin can be programmed (multi pulse operation).

The coin selector signals an active LOW pulse after accepting a programmed coin or token to a particular output line or to a combination of output lines. Pulse width (in case of multi pulse operation also pulse pauses) can be programmed between 1ms and 65 ms.

For some applications it is necessary to invert the output signals, i.e. switching from LOW to HIGH (Option /N) instead of from HIGH to LOW. This can easily be programmed using wheasy 4.

This multiple configuration possibilities guaranties highest flexibility of the selectors. The *w*heasy 4 manual details the assignment of output lines to specific coin channels, as well as the pulse width assignment.

If no output line is defined for a coin channel, then the coin selector accepts the coin without generating an output signal!

3.3.1. EMP 8x0.00 v6 Interface

Only one output line per channel is assigned on the EMP 8x0.00 v6. Correspondingly, only 6 different coin type signals can be identified with this version. If more than 6 coin values are required the multi pulse operation can be used. For example 2 pulses can be generated for 20 Cent on 10 Cent output line.

3.3.2. EMP 8x0.04 v6 Interface

Multiple output lines can be assigned with the EMP 8x0.04 v6 version and each coin channel can have a binary coded output. Multi pulse can also be generated with binary coded output signals.

3.3.3. Preceding Coin Output Signal (Option /S)

The selector can be programmed at the factory to give an assigned preceding coin output signal. This output pulse is given as soon as the coin has been identified. The signal is, however, of a very short duration relative to the normal acceptance output signal (credit pulse).

This preceding coin output signal pulses before the coin selector magnet is activated. The signal has a maximum width of 15 ms if the coin selector is blocked (from accepting coins) via the general blocking input. The coin selector will only accept the coin if the general blocking signal is changed to "accept coin" during this 15 ms interval. The coin selector will release the normal coin acceptance signal (credit pulse) once the coin has passed the coin light barrier.

The following two diagrams illustrate the function and timing of the preceding signal.

Figure 8 shows the preceding coin output signal of a coin output line without changing the main blocking line to high. The coin is rejected and the preceding coin output signal has a maximum length of 15 ms.

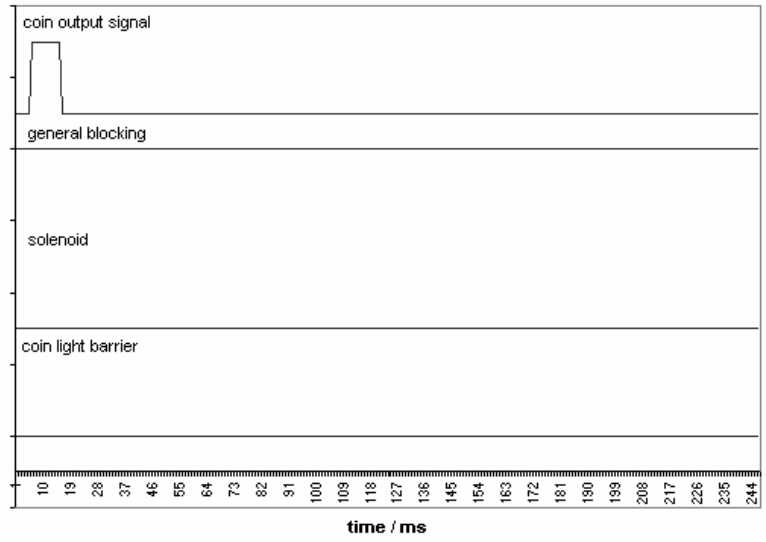


Fig. 8 Preceding signal after the coin has been identified. The main blocking input line does not go high

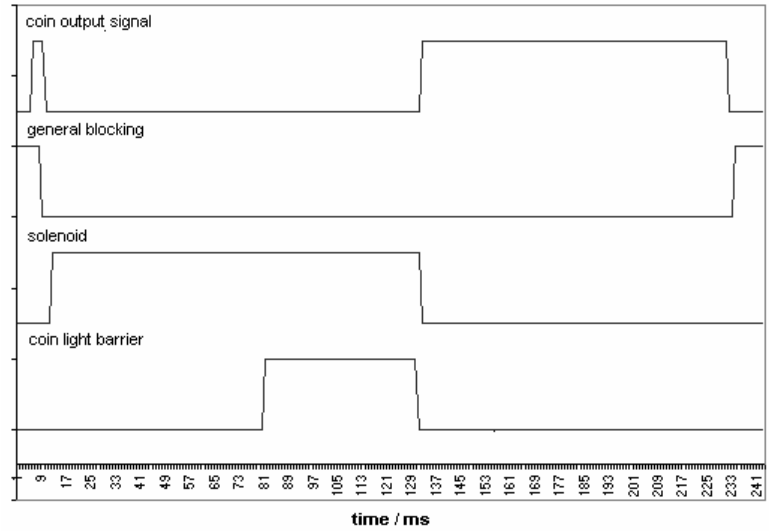


Fig. 9 Preceding signal after coin identification, followed by the acceptance of the coin

Figure 9 shows the acceptance of the coin after it has been identified. The sequence of events is as follows:

- The preceding signal starts on the assigned output line (s) after the coin has been identified.
- The machine controller removes the general blocking signal after 3 ms. Almost immediately, the coin selector ends the preceding signal and energizes the acceptance magnet.
- Approximately 60 ms later the coin interrupts the light barrier.
- Approximately 50 ms after this the coin has passed the light barrier and the coin selector gives the normal output impulse (50 ms in this example).
- The machine controller re-instates the general blocking line no later than on completion of the credit pulse.

3.3.3.1. Why use the preceding coin output signal?

It is a very useful facility should there be a need to block specific coins or in applications where the coin selector has to activate an additional sorting mechanism prior to the coin leaving the coin selector.

External single coin blocking activated by the machine controller is not possible with standard coin selectors, but this may now be carried out very simply with general blocking. When coins are to be rejected by the machine, the machine controller simply does not remove the general blocking following receipt of the preceding coin output signal. Those coins are rejected and no credit is given. For coins that are to be accepted, the general blocking is removed by the machine controller and the normal output signal (credit pulse) is released by the coin selector.

Additionally the machine controller can activate a post-coin selector sorting mechanism even before the coin has left the coin selector (chapter 3.7.1 Option /X).

Preceding pulses can also be used in combination with binary coded output signals. It is not advisable to use it in combination with multi pulse operation.

3.3.4. Inventory Impulse (Option /I)

The EMP 800 v6 can be programmed to release an inventory or credit impulse. This inventory impulse is intended for the counting and logging of accepted coins. The impulse length and impulse pause are individually programmable in the range of 1 to 255 ms. Inventory impulses can be assigned to any output line. The factory standard is an impulse duty factor of 50 ms/50 ms released on output line 6.

The function inventory impulse may be activated individually for each coin by means of wheasy 4 and may be assigned to inventory impulse line 1 or 2. The corresponding check boxes are to be found under "Configuration" – "Currencies and Coins" on the tabs of the master channels. Also here the value is specified, for which an inventory impulse shall be generated.

As a rule the value of the inventory impulse corresponds with the value of the smallest programmed coin. The EMP 800 v5 allows programming of higher values. Inserted coins are added up and the inventory impulse is given after the S.Value has been reached.

For special cases it is also possible for the EMP 800 v6 to generate inventory impulses with differing values to two different output lines.

3.3.5. EMP 8x0.13 v6 Interface

The EMP 8x0.13 v6 supports the serial multi drop bus protocol (MDB) and the ccTalk protocol. Chapter 4 has more information about this interface.

3.3.6. Parallel Output Connector (ST EMP)

The parallel output connector is a 10-pin, dual row .1-inch center jack as specified by DIN 41651. The connector has the following pin out:

Pin No.	Connection
1	GND
2	power supply (UB)
3	coin output 5
4	coin output 6 or inventory impulse
5	reject (active low)
6	general blocking (input)
7	coin output 1
8	coin output 2
9	coin output 3
10	coin output 4

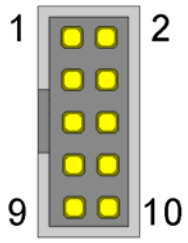


Fig. 10 Position of the connecting pins (EMP plug)

3.4. Coin Blocking

Coin blocking may be accomplished in various ways. One possibility is the general blocking input line, which will block the coin selector from accepting all coins. Secondly, it is possible to block coins or groups of coins individually through 16 DIP blocking switches on the coin selector. The DIP blocking switches are accessible through a recess in the coin selector cover.

The factory option /O can be specified for the individual blocking of up to 6 different channels or groups of channels via the six parallel output lines.

3.4.1. General Blocking

General blocking is activated through pin 6 of the 10-pin connector on the coin selector. The general blocking signal is a standard active "high" to block. Unless programmed otherwise, an open (unconnected) input will allow coins to be accepted. Any voltage between 5 and 24 V DC is considered a high signal.

The signal polarity of the blocking line is programmable. The programming can be carried out using *w*heasy 4 under the menu selection "Configuration". Select "Blocking". In this window you will find in the lower part of both check boxes "General Blocking by means of "0"" and "General Blocking by means of floating input" as well as "External Individual Blocking". The following table shows all different kinds of the coin selector input "General Blocking", which may block the coin selector according to the programming.

selected check box		general blocking input		
general blocking with „0"	general blocking with an open input	HIGH	LOW	TRISTATE
		X		
	X	X		X
X			X	
X	X		X	X

Table 1 The function of general blocking depending on the programmed mode of the coin selector

In certain circumstances, the general blocking signal can also be used to block individual coins (see chapter 3.3.3 Preceding Coin Output Signal (Option /S)).

3.4.2. Individual Coin Blocking via DIP switches

The coin selector has 16 DIP switches for individual coin blocking. Blocking is not active, that is, the coin will be accepted when the switch is in the "OFF" position. A coin will be rejected when the switch is "ON".

The 16 switches can be freely assigned to the 32 coin channels. Each coin channel can be associated with two switches. This configuration makes it possible to block individual coins or, if multiple currencies are programmed, it is possible to block a whole currency with one switch. For example 12 individual coins can be assigned to the first 12 switches. Then switch 13 to 16 can be used to block whole currencies. This optimal use of the switches allows the easy selection of one currency or even multiple currencies at the same time.

The following figure illustrates the assignment of blocking switches and also the numeric identity of each switch.

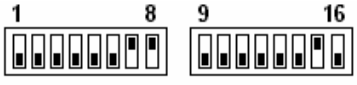


Fig. 11 Blocking DIP switches

The lower switch position is the "Off" position. The upper switch position denotes "ON". In this example all coins assigned to switch 7, 8 and 15 are blocked

The programming of the blocking switches is done with *w*heasy 4 and is explained in the *w*heasy 4 technical manual.

3.4.3. Individual Coin Blocking via the Parallel Output Lines (/O Option)

The /O option makes it possible to block up to 6 coins or coin groups through the 6 parallel (open collector) output lines. This blocking is accomplished when the machine controller pulls the associated output line LOW.

In comparison to its predecessor model EMP 800 v5, this blocking function works independently from the Blocking switches. Therefore now a free allocation of the output lines may be effected to the coins to be blocked.

The option /O must be specified at the time that the coin selector is ordered. The coin selector cannot be retrofitted with this option.

3.4.4. Bank Switching

There are different modes for the specification and selection of the so called channel or coin channel banks. The 16 master channels are divided up in banks, which can be chosen as active bank during operation without using the blocking switches.

The following describes the different modes of the channel bank switching

MODE 1 2 banks
bank 1: channels 1 to 8
bank 2: channels 9 to 16

MODE 2 3 banks
bank 1: channels 1 to 8
bank 2: channels 9 to 16
bank 3: channels 1 to 16

In mode 1 and 2 the switching between the banks is effected when the reject and general blocking line are activated via the 10-pole EMP connector for 10 seconds. With every switching process you reach the next bank, i.e. from bank 1 to bank 2, from bank 2 to bank 3, from bank 3 to bank 1, etc. The coin selector signals the bank switching by activating the solenoid. When activating bank 1 the solenoid operates one time, when activating bank 2 the solenoid operates two times, when activating bank 3 the solenoid operates three times.

This can be set in wheasy 4 under "configuration" – "general setting" – „variants". It is here possible to change the active bank directly. (see Fig. 12).

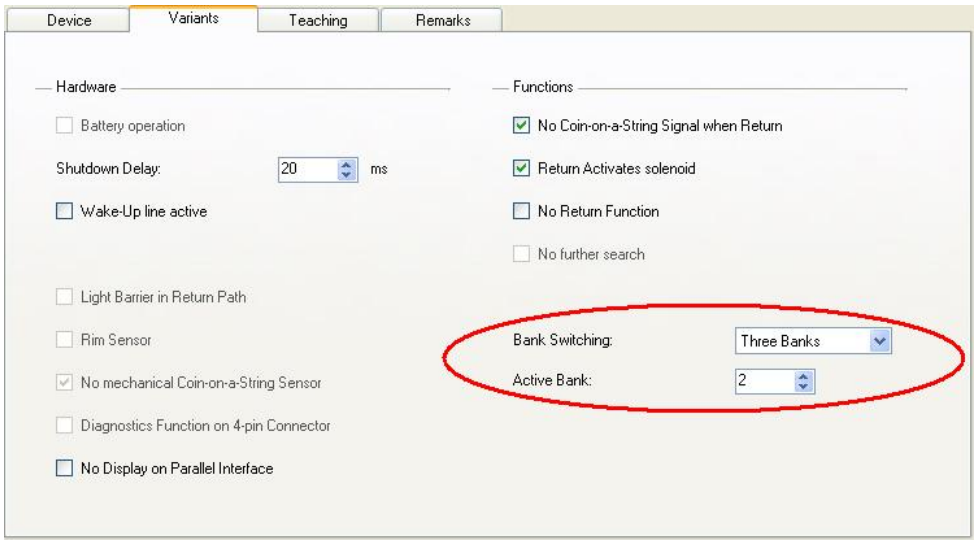


Fig. 12 programming of channel bank switching

MODE 3 2 banks
bank 1: programming of channels assignment to bank 1
bank 2: all channels which are not assigned to bank 1

For this mode please choose under "configuration" – „general setting" – „variants" „non" at channel switching. Activation of bank switching after MODE 3 is carried out by assigning at least one coin channel to bank 1. This is set under "configuration" – "blocking" in menu "external". The assignment is effected by a "click" within the column "Bank 1" in the respective coin row.

Blocking Line	1	2	3	4	5	6	7	8	Bank 1
01: Token 51 MS									
02: 0,10 GBP									
03: 0,20 GBP									
04: 0,50 GBP									
05: 1,00 GBP									
06: 2,00 GBP									
07:									
08: Token 51 MS									X
09: 0,05 EUR									X
10: 0,10 EUR									X
11: 0,20 EUR									X
12: 0,50 EUR									X
13: 1,00 EUR									X
14: 2,00 EUR									X
15: TK15									
16: TK16									X

Fig. 13 Assignment of coin channels to coin bank for MODE 3

Fig. 13 shows the assignment of coins to channel bank 1. The example above shows the assignment of coin channel 8 to 14 and 16 to bank 1 and all other channels to bank 2.

Switching between banks is carried out via the reject line of the EMP connector. If the reject line is open, bank 1 is active, if set to LOW bank 2 is active.

The reject function of the coin selector is deactivated when in bank switching MODE 3. The reject may be pressed however no reject signal will be send via the parallel interface.

3.5. Coin Values

Each coin programmed into the coin selector is also given a coin value. This value may be used for the inventory impulses and it is also used as part of the MDB or ccTalk status request. During programming with wheasy 4 the coin value is also required for displaying the coins already programmed and the respective channel assignment.

16 different coin values can be programmed into the master channels. The slave channels always have the same coin value as the master channel.

The "Coin Values" selection is available under the "Configuration" – "Currencies and Coins" pull down menu. This window can be used to set and edit the coin values for each channel. Please note that only part of the information in this window is transferred to the coin selector. The remaining information (grey background) is just stored as part of the data on the PC and is used to better describe and understand each channel while working with *w*heasy 4.

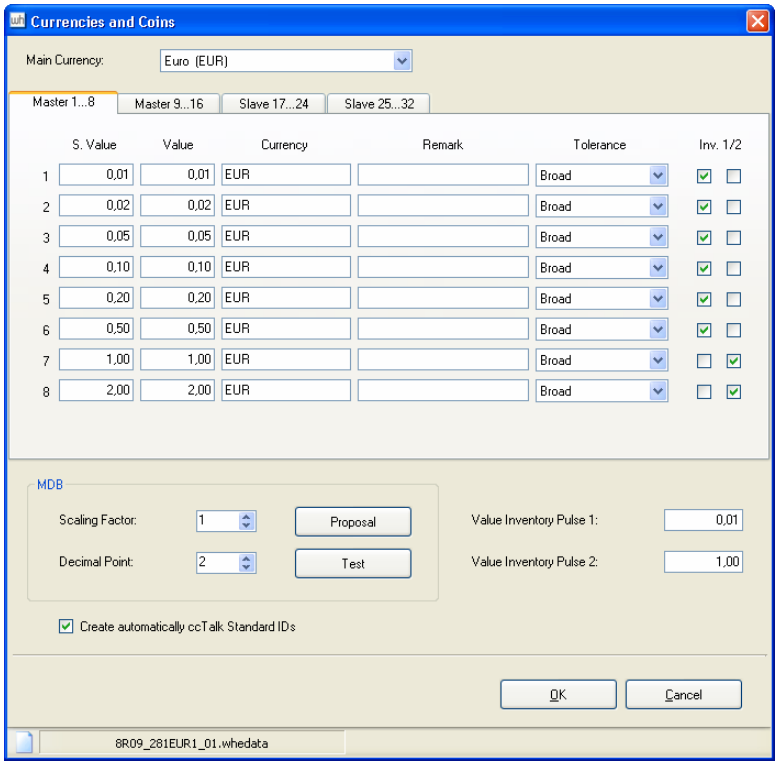


Fig. 14 Window „Currencies and Coins"

The individual fields are defined as follows:

- S.Value (Calculated Coin value)
  The calculated coin value is stored in the coin selector. This value uses the machine controller for the determination of credit and the selector for calculating the number of inventory pulses.

- Value (Actual coin value)
  This "value" is not stored in the coin selector. In certain situations it

may be necessary to give a coin an S.value other than its face value. For example, a rebate value may be assigned to a particularly valuable coin. In this case, the "value" is displayed for clarity when working with *w*heasy 4.

- Currency
  The currency information is also stored in the coin selector EMP 800 v6. This information is specially of importance when working with multiple currencies in a coin selector.

- Tolerance
  The tolerances are stored in the coin selector. They serve to provide a choice of active tolerance bands with regards to the MDB or ccTalk interface and gives a better overview when working with wheasy 4. The desired tolerances "broad", "narrow", "or very narrow " or "no indication" may be entered here.

- Inv. 1/2
  Here a choice is offered between two check boxes, if for the corresponding coin inventory impulse 1 or 2 is applied.

There are some special fields at the bottom of the window which are important for the "Scaling" of the MDB Bus. These adjustable parameters have the following meaning:

- Scaling Factor
  This value is used in vending machines that communicate with the coin selector over the serial MDB protocol. The vending machine may read these values during a status request.

- Decimals
  A decimal point location is likewise transferred to the vending machine during a status request as part of the MDB protocol. This value tells the vending machine how many digits to use after the decimal point as part of the coin value.

- Value Inventory Impulse 1
  Here the value for the inventory impulse 1 is defined.

- Value Inventory Impulse 2
  Here the value for the inventory impulse 2 is defined.

- Test button
  This button is used to let *w*heasy 4 test whether it is possible to create 8 bit coin values for the MDB status request with the given scaling factor and decimal location

- Proposal button
  *w*heasy 4 attempts to find a scaling factor and a decimal point position that works for the status request. It is not possible to find such a value if the largest coin value is more than 255 times greater than the smallest coin value. In this case an error message is shown.

3.6. Slave Channels

The generation v6 selectors also have 16 slave channels (Channels 17 to 32) available in addition to the so-called 16 master channels. The slave

channels can have their own settings for the coin parameters and blocking switches. The slave channels may be assigned arbitrarily to any master channels. It is even possible to assign multiple slave channels (up to 16) to a master channel. The slave channel assignment can be carried out in *w*heasy 4 with the "Configuration"- "Currencies and Coins" pull down here on the tab "Slave 17 – 24" resp. "Slave 25 – 32".

The slave channels share the following attributes with the associated master channel:

- Output channel. This means that the slave channel will always signal the same output line as the associated master channel.
- Coin Value
- Sorting shaft

The slave channels are intended for serving alternative acceptance tolerances of the assigned master coins. For instance the 2,00 € coin could be programmed with the broad acceptance band in master channel 8 and the slave channels 24 and 32 have the medium and narrow tolerance band programmed.

3.7. Control for External Sorting Flaps

There are different 2-way or 3-way sorters (SRT 400, SRT 500 and SRT 800) available for the EMP 800 v6 series. The coin selector can also be used in combination with many other sorters available on the market.

3.7.1. Option /X

The EMP 800 v6 incorporating option /X provides a control for external coin sorting flaps. The control signals of the microprocessor are transmitted via 3 additional output lines. The output lines are protected by a 330 Ω resistor. Therefore no further circuit is necessary to drive 3 transistors for the control of 3 solenoids.

8 possible sorting shafts can be achieved by means of the various combinations. The sorter itself needs driver transistors in order to actuate the solenoids.

The desired external routing can be assigned to any of the 16 master coin channels by the use of *w*heasy 4. The routing possibilities are programmed by means of the binary code using the values from 0 to 7. When zero is programmed only the solenoid of the coin selector will be activated and none of the additional output lines. The values 1 to 7 stand for the binary coded combination of the activated drive signals for the external sorter.

The programming of external sorting solenoids is described in the *w*heasy 4 manual in the "Sorting Shaft" chapter. Sorter models SRT 400, SRT 500 and SRT 800 are available. The coin selector is compatible with various sorters from other manufacturers, for which pre-adjustments are already available.

3.7.2. Control of sorting flaps via coin output 5 and 6

Via coin output line 5 and 6 it is also possible to control sorting flaps. The output transistors can drive a current up to 500 mA. This function

can be activated by using *w*heasy 4 under "Configuration" – "Coin Routing" – tab "Solenoids" click checkbox "external solenoid controlled by coin output".

The sorting signal can be selected for each coin channel. The following table shows an overview on the different sorting possibilities.

Sorting shaft	Output line 5	Output line 6
0	0	0
1	1	0
2	0	1
3	1	1

The solenoid retaining time for the control of the sorting flaps can be set independently to the timing of the coin output signals.

For this version only coin output lines 1 to 4 are available for releasing coin output signals. Models to be used for this application are the sorters SRT 800, SRT 400 and SRT 500.

Detailed adjustments of all sorting flaps parameters are set when producing the coin selector according to the sorter specified by the customer.

3.7.3. Hold time

The required hold time (pulse width) for the external sorting mechanism can be programmed at the factory to match the requirements of the mechanism. The maximum hold time is 510 ms, with the start time measured from the time that the coin exits the coin selector. The coin selector will not accept any additional coins during this hold time unless they are of the same type as those then being sorted.

Optionally, the hold time can be shortened by programming at the factory. The hold time will be cancelled by briefly activating the general blocking line. If the external sorting mechanism can track the coin trajectory, the machine controller can signal the coin selector to accept another coin sooner once it has been determined that a coin has cleared the sorting mechanism.

3.7.4. Main Cash Box

The EMP 8x0.13 v6 can be set up to direct coins to a main cash box when connected to the vending machine through the MDB or ccTalk protocol. The main cash box is then specified for all accepted coins.

The programming of the main cash box is discussed in the *w*heasy 4 manual in the "Edit/Configuration" chapter, under the sub-heading "Sorting Shafts."

3.8. Coin Return

The coin selector EMP 800 v6 has a feature which will identify and give credit for a coin, and then return it. This feature can be used, for example with test tokens. It can also be used where certain persons, for example employees, are to receive benefits without cost (e.g. car parking).

The setting of this function is also discussed in the *w*heasy 4 manual in the "Edit/Configuration" chapter, under the sub-heading "Sorting Shafts".

3.9. Battery Operation

3.9.1. Option /B

Battery operated selectors with option /B use a piezo-electric element for the wake up function. A coin selector with the battery operation option will not use any current while in the stand by mode. The coin selector only turns itself on when a coin is inserted. The coin selector turns itself back off after the coin has been measured, passed the acceptance light barrier and an output impulse has been released. The coin selector is on for a maximum of 800 ms while it attempts to recognize a coin.

The activation of battery operation can be set with *w*heasy 4 with the "Configuration" - "General Settings" in the tab "Variants".

Do not enable battery operation unless the coin selector has been manufactured with this necessary hardware. The coin selector label will specify the /B option if this is the case.

The EMP 8x0.13 v6 has some additional special requirements for battery operation. These are discussed in chapter 4.3.4.

3.9.2. Option /C

An inductive switch is used for the wake up function for battery operated units with option /C. During standby the current consumption is less than 10 µA. This option should be considered if there might be vibrations that could wake up the coin selector (for example table footballs). All other functions are identical to the coin selector with option /B.

3.10. Safety Features

3.10.1. Coin on a String (Strimming)

The EMP 800 v6 is equipped with multiple safety functions to prevent almost every coin-on-a-string manipulation.

As an additional security the coin selector can signal attempts at manipulation to the machine controller. It is also possible to block coin acceptance for a programmed time in order to make further attempts at manipulation more difficult.

After the acceptance of a coin the light barriers are still monitored for 20 sec. (not applicable for battery-operated units). If a coin is identified within the acceptance channel, without having been passed through the measuring system in a correct way, a manipulation is noticed (coin on a string). The coin selector is able to signal this strimming attempt via the parallel interface to the machine. The coin output line or a combination of coin output lines, via the strimming is reported to the machine, can be freely chosen and programmed ex factory.

The strimming information is transmitted with an impulse width that can be set separately to distinguish it from a normal coin pulse. The machine is able to distinguish between coin-on-a-thread detection and a normal receipt signal, as it can recognise the different width and (or) identify a combination of simultaneously arranged coin output lines. The default setting for the strimming information is an impulse width of 200 ms.

The message "coin-on-a-thread" is also transmitted via serial SCI, MDB and ccTalk interface (see chapter 4.2 and 4.3).

If a coin is still identified in the light barrier after 200 ms have passed, the information will be repeated. During that time, no coin can be accepted.

3.10.2. Coin Jam

If the measuring system identifies a coin, but measuring is concluded via “timeout” instead of the correct measuring procedure (coin leaves coin selector passing the receipt light barrier or the return), this will be interpreted as “coin jamming”.

Via the parallel interface, the coin selector can give a signal for coin jamming to the machine. The customer can choose any of the coin output channels or a combination of channels through which coin jamming will be signalled. The information is emitted with an impulse width that can be set separately to distinguish it from a normal coin pulse. The machine is able to distinguish between coin jamming and a normal receipt signal, as it can recognise the different width and (or) identify a combination of simultaneously arranged coin output lines.

The message "coin jam" is also transmitted via serial SCI, MDB and ccTalk interface (see chapter 4.2 and 4.3). The serial interface also allows the position of the coin jam to be discriminated:

- Coin jam 1 (in the measurement system)
- Coin jam 2 (between measurement system and reject light barrier), only option /R
- Coin jam 3 (between measurement system and acceptance light barrier)
- Coin jam 4 (in the acceptance light barrier)
- Coin jam 5 (not possible with the EMP 800 v6)
- Coin jam 6 (in the reject light barrier) only option /R

If a coin is still identified in the light barrier after 200 ms have passed, the message will be repeated. During this time, coin acceptance is blocked.

3.10.3. Additional External Strimming Detection (Option /Z)

For certain applications an additional strimming detector to avoid manipulation is recommended, especially when working with an escrow.

The sensor also allows a coin on a string detection in units even if the coin selector is switched off , e.g. battery operated machines. In this case a 14-pole plug is used instead of a 10-pole EMP plug. Here the signal of the string sensor can be directly polled potential-free via pin 11 and 12 of the 14-pole EMP-plug.

The reed contact of this sensor is closed if a coin-on-a-string is detected. The signal is analyzed by the micro-processor of the coin selector and signalled to the machine via the parallel or serial interface. Battery-operated coin selectors are immediately switched on as soon as the string sensor is operated.

3.10.4. Additional light barrier to observe Coin Return Path (Option /R)

A complete monitoring of coins from insertion through to the point of leaving the selector is possible with this option. As an example - coin jamming in the return shaft caused through manipulation can be signalled to the machine controller. As an extra protection an anti pin system can prevent the insertion of further coins and thereby further damage to the machine. Or a motor-driven reject may terminate a possible coin jam.

Via the parallel interface a coin jamming signal can be given. Using the serial interfaces coin jamming 2 or coin jamming 6 is signalled.

Coin selectors with option /R do not have two light barriers in the acceptance shaft.

3.11. Further Options

3.11.1. Power Supply Connections Reversed (Option /A)

The polarity of the power supply inputs are reversed with this option, i.e. pin 1 of the EMP connector is UB (instead of GND) and pin 2 is GND (instead of UB). As there is no output channel being used for the reject signal, 7 output channels are now available. This version is especially designed for gaming machines on the Spanish market.

3.11.2. Large Coin Funnel (Option /F)

An alternative funnel can be supplied if a bigger insertion is required. Dimensions are shown in the drawings below.

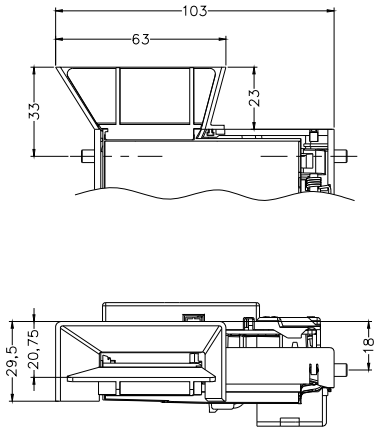


Fig. 15 Coin funnel (Option /F)

4. Serial Interface

The EMP 800 v6 serial interface communicates over one of three different protocols with the vending machine. The first serial protocol is the SCI (serial communication interface), in which the coin selector sends out a 5-byte data frame to the machine controller after each event. The other serial protocol is the MDB protocol (Multi Drop Bus). The third serial protocol is ccTalk, which has its own connector on the coin selector and which serves also as a programming interface.

All three interfaces operate at 9600 baud rate.

4.1. Serial Connector

An AMP (Quick 828548-5) single in line 5-pin connector is used as serial connector for the SCI and MDB protocol. Via this also the programming of the coin selector is effected.

PIN No.	Description
1	GND
2	UB (8 ... 26 V DC)
3	CLK
4	TDO
5	RDI

4.2. SCI Interface

The EMP 800 v6 communicates through a serial interface with the following specifications:

data format: 9600 Baud, 1 start bit, 1 stop bit, no parity, 8 data bits, separate send and receive lines.

high level	+ 5V	logical 0
low level	0 V	logical 1

The SCI interface of the coin selector can be programmed to operate in one of two modes:

1. The programmed coin value of the last accepted coin is sent repeatedly at a rate of 5 Hz.

2. The programmed coin value is only sent once after the coin is accepted.

The SCI mode can be configured with the programming software *w*heasy 4. Select the "Configuration" pull down menu. Select "Interfaces" and then the "Receipt" tab. The checkbox "SCI only once" sets the mode so that the data set is only set once.

It is also possible to set up the EMP 800 v6 so that the possible error messages are the same as those of the EMP 800 v3. This may be necessary if the EMP 800 v6 with the SCI interface is to be integrated into older systems. Using *w*heasy 4, select the "Configuration" pull down menu. Select "Interface" and then the "Receipt" tab. Select the check box "SCI v3 compatible."

The EMP 800 v6 sends a 5-byte data frame with each message. The first 4 bytes each are one digit of the value of the accepted coin. The fifth byte contains information such as the channel number (with accepted coins), whether the coin return was pressed, if the channel was blocked, error messages, etc.

The data bytes have the following format:

1. Start bit
2. LSB
   ...
9. MSB
10. Stop bit

The least significant byte (LSD) of the data bytes is sent first. All other bytes follow relative to their ascending value. The details of the value of the corresponding decimal place is included (hexadecimal) in the lower nibble of the bytes. The upper nibble shows again the place.

Value of the data bytes (X: value between 0 and 9)	**Ascending Value**
FXh	MSD (Most Significant Digit)
EXh	
DXh	
CXh	LSD (Least Significant Digit)

The EMP 800 v6 is always a master device when it is in SCI Mode. The SCI interface transfers 5 bytes with a refresh frequency of 5 Hz or after each result.

Definition of the 5th byte:

value of the 5th.byte (HEX)	Meaning		
	standard	32 channel messages	SCI v3 compatible
70H ... 7FH	/	coin channel 17 ... 32 recognized	/
80H ... 8FH	coin channel 1 ... 16 recognized		
90H	coin return button pressed		
91H	reject – coin following to closely		
92H	coin jam 1		/
93H	reject – no matching parameter set		
94H	/		reject - coin channel blocked
95H	coin jam 2		/
96H	reject – DIP switch blocking		/
97H	coin jam 3		coin jam
98H	coin jam 4		/
99H	coin jam 6		/
9AH	reject – rim detection (not available yet)		
9BH	reject – lead detection		
9DH	coin on a thread		
9EH	reject – general blocking		
9FH	reject – coin selector busy		

Example:

programmed value of the accepted coin	transferred data, binary	data, hexadecimal
channel 1 20.00	1100 0000 1101 0000 1110 0000 1111 0010 1000 0001	C0 D0 E0 F2 80
channel 2 05.00	1100 0000 1101 0000 1110 0101 1111 0000 1000 0010	C0 D0 E5 F0 81
channel 3 00.50	1100 0000 1101 0101 1110 0000 1111 0000 1000 0011	C0 D5 E0 F0 82
channel 4 00.25	1100 0101 1101 0010 1110 0000 1111 0000 1000 0100	C5 D2 E0 F0 83
chan. 17 00.05	1100 0101 1101 0000 1110 0000 1111 0000 0111 0001	C5 D0 E0 F0 70

Fig. 16 Data format for acceptance of coins with different coin values and different channels

4.3. Multi Drop Bus (MDB)

The coin selector can be set up to communicate with the machine controller using the MDB protocol. *w*heasy 4 can be used to program this setting. Select "Configuration" – "Interfaces". Set the operating mode to MDB/ccTalk.

The EMP 800 v6 has an implementation of the MDB protocol according to I.C.P. (MDB European Version). The still free available address 15 h was chosen in order to avoid conflicts with other MDB devices. The command set and the bus timing correspond to I.C.P. standard. Additionally a MDB adapter (MDB 100) is available if the hardware specification of the interface is also requested.

4.3.1. Protocol specifications

- **Data format:** 1 Start Bit
  8 Data Bits
  1 Mode Bit
  1 Stop Bit

- **Mode Bit: VMC zum EMP**

The mode bit distinguishes ADDRESS bytes and DATA bytes. ADDRESS bytes are read by all peripheral devices and DATA bytes are only read by active peripheral devices. An active peripheral device is defined as a device that has successfully established a contact with the master (VMC).

The mode bit is set (logically 1) in order to mark an ADDRESS byte. When the mode bit is not set (logically 0) it marks a data byte.

- **Mode Bit: EMP to VMC**

The mode bit is set with the last byte when the slave (EMP) is transmitting data to the master (VMC). Consequently, the slave (EMP) always sets the mode bit together with the check sum or with ACK.

- **Check sum**

The last byte of every data transfer from the VMC to the EMP is always the check sum.

4.3.2. Conventions

Using the Multi drop Bus all commands and answers must be answered within in given period or acknowledged respectively!

The coin selector answers every command and every polling within 5 milliseconds. If the coin selector is busy and therefore can not answer within the 5 milliseconds the selectors looses the command. The VMC (Vending Machine Controller) must handle this as a NACK (FFh). All answers from the coin selector to a poll command must be acknowledged through the VMC within 5 milliseconds with ACK (00h). Older specifications of the MDB protocol defined 5 ms, nowadays it is 20 ms. With the EMP 800 v6 this timing can be programmed. As a standard

for the EMP 800 v6 8 ms are set. If no acknowledgement has been received within 8 milliseconds the coin selector handles this as a NACK and transmits the same answer on the next poll command again.

4.3.3. Basic Commands

Command	Code	Data
RESET	78h	-

The acceptance of coins is blocked. The response to the next poll is 07h (Reset).

Command	Code	Data from the EMP
STATUS	79h	30 byte Z1 to Z30

Z1	[reserved]
Z2 - Z3	country code
Z4	scaling factor
Z5	decimal place
Z6	number of sorting shafts (upper nibble) shaft of main cash box (lower nibble)
Z7 - Z14	channel – shaft assignment in one nibble the number of a coin channel beginning with the shaft number of type 0; in the upper nibble beginning with Z7
Z15 - Z30	values of coins, beginning with type 0 in Z15

Command	Code	Modifier	Data from EMP
Master – Slave assignment	7Fh	23h	8 Bytes Z1 to Z8

Z1 – Z8	Master – Slave assignment, coded in one nibble. Beginning with the master for channel 17 (slave 1) in the upper nibble of Z1 to the master for channel 32 (slave 16) in the botton nibble of Z8.

Command	Code	Data from EMP
POLL	7Bh	1 byte

When a response is given it is important whether the coin selector is operating in ordinary or in extended MDB protocol.

- ordinary multi drop bus protocol

00h	no result (ACK)
07h	reset
8nh	type n[1)]
90h	coin return button pressed
91h	subsequent coin in measuring system
92h	coin jam 1
93h	coin does not match parameter set
94h	multi drop blocking
95h	coin jam 2
96h	coin blocking
97h	coin jam 3
98h	coin jam 4

99h		coin jam 5
9Ah		rim detection error
9Bh		lead detection
9Ch		coin following to closely in TCAP1
9Dh		coin-on-a-thread detection
9Eh		sorting error
9Fh		coin selector busy

1)
If the interface has been set to "Report 32 channel" (factory setting) the channels 1 to 16 are reported with 80h to 8Fh and channels 17 to 32 are reported with 70h to 7Fh. This is a special *w*h Münzprüfer function, as the MDB specifications only define for a maximum of 16 coin channels.

- Extended Multi Drop Bus Protocol

00h		No result (ACK)	
07h		Reset	
8nh	0nh	type n 1)	shaft m
90h	8nh	coin return button pressed	type n 1)
91h	8nh	subsequent coin in measuring system	type n 1)
92h		coin jam 1	
93h		coin does not match parameter set	
94h	8nh	multi drop blocking	type n 1)
95h	8nh	coin jam 2	type n 1)
96h	8nh	coin blocking	type n 1)
97h	8nh	coin jam 3	type n 1)
98h	8nh	coin jam 4	type n 1)
99h	8nh	coin jam 5	type n 1)
9Ah		rim detection error	
9Bh		lead detection	
9Ch	8nh	coin following to closely in TCAP1	type n 1)
9Dh	8nh	coin-on-a-thread detection	type n 1)
9Eh	8nh	sorting error	type n 1)
9Fh		coin selector busy	

1)
If the interface has been set to "Report 32 channel" (factory setting) the channels 1 to 16 are reported with 80h to 8Fh and channels 17 to 32 are reported with 70h to 7Fh. This is a special *w*h Münzprüfer function, as the MDB specifications only define for a maximum of 16 coin channels.

Command	**Code**	**Data to the Coin Selector**
Coin Type	7Ch	4 Bytes Y1 to Y4

Y1 - Y2	coin release for each type 1 bit, 1 = release Note: the least significant bit is assigned to type 1!
Y3 - Y4	coin in main cash box for each type 1 bit, 1 = to main cash Note: the least significant bit is assigned to type 1!

The coin type command is equally valid for the master and all assigned slave units.

Command	Code	Modifier	Data to the Coin Selector
Extended Coin Type	7Fh	20h	6 Bytes Y1 to Y6

Y1 – Y4	coin release for each type 1 bit, 1 = release Note: the least significant bit is assigned to type 1.
Y5 – Y6	coin in main cash box for each type 1 bit, 1 = to main cash Note: the least significant bit is assigned to type 1.

The extended coin type command allows for the individual blocking or unblocking of each of the 32 coin channels. The main coin box rerouting applies to all master and associated slave channels equally.

Command	Code	Data to the Coin Selector
Channel assignment	7Eh	9 Bytes Y1 to Y9

Y1	Number of the main coin box
Y2 – Y9	Assignment of the channel/shaft, one nibble each
Y2 Y3	Channel 1/2 2/3

The given default coin sorting sequence is reverted to after a reset.

Command	Code	Modifier	Data from EMP
Identify	7Fh	00h	33 Bytes Z1 to Z33

Z0 - Z3	WHM
Z4 - Z15	number of machine
Z16- Z27	number of model / bar code
Z28- Z29	software version packed BCD-code
Z30- Z33	future options

Command	Code	Modifier	Data from EMP
Request	7Fh	01h	13 Bytes Z1 to Z13

Z1 – Z2	Coin Release, 1 Bit per type, 1 = Unblock coin
Z3 – Z4	Coin routed to cash box, 1 Bit per type, 1 = cash box
Z5	Cash box sorting shaft
Z6 – Z13	Sorting shaft number of each type of coin; one nibble per type, beginning with type 1 in the upper nibble Z6

This request is used to establish the actual blocking and sorting of the 16 master channels.

Command	**Code**	**Modifier**	**Data from EMP**
Extended Request	7Fh	21h	15 Bytes Z1 to Z15

Z1 – Z4	Coin Release, 1 Bit per type, 1 = Unblock coin
Z5 – Z6	Coin routed to cash box, 1 Bit per type, 1 = cash box
Z7	Cash box sorting shaft
Z8 – Z15	Sorting shaft number of each type of coin; one nibble per type, beginning with type 1 in the upper nibble Z8

The extended request is used to establish the actual coin release and sorting of all 32 channels. The sorting of the master and slave channels are always the same.

Command	**Code**	**Modifier**	**Data from EMP**
Coin Precision	7Fh	FFH	13 Bytes Y1 to Y13

Y1 – Y4	ASCII-Code for BDTA
Y5	Command Code 00H
Y6 – Y13	Value for the desired acceptance band width for coin type 0 – 15 coded in half bytes.
00H:	wide
01H:	medium
02H:	narrow
03H:	very narrow
0AH:	tests factory-wise
OEH:	give back max. possible default setting
OFH:	no modification of current adjustments

Data for VMC:

Z1 – Z8	current value for the acceptance band width coded for coin types 0 – 15 in half bytes

4.3.4. Multi Drop Bus and Battery Operation

With the EMP 800 v6 it is also possible for the coin selector to be battery operated, even when using the MDB protocol.

Various improvements and changes where made in order to make it easier to implement this protocol in a battery operated vending environment. In MDB mode a coin selector with battery operation remains always switched on for 2 seconds after a wake up.

4.3.4.1. Coin Type default

It has been proven difficult for machine controllers to initialize the coin selector once it has turned itself on because it has detected a coin. That is, it was difficult to send the coin type command in time so that the inserted coin could still be accepted.

In order to make things easier, the coin selector now has the facility to initialize itself when in MDB mode. In *w*heasy 4, select „Configuration", then „Interfaces", and select the „MDB" tab. Check "Coin Type Default". The coin selector will initialize the Coin type command from its own EEPROM after power up and therefore is immediately ready to accept coins. In this mode no "Reset" message is sent after the power on Reset, because this information must be transferred first after the poll command. There may not be enough time to do this if the coin selector has to be instantly ready to accept coins.

A coin type command, which is sent from the machine controller to the coin selector is stored in the EEPROM in this mode and therefore still valid after a power on reset until the next coin type command is received.

4.3.4.2. Polling

2 seconds after the last polling the coin selector turns itself off after a coin has been accepted. As long as the polling command is active the coin selector stays switched on.

For a reliable operation of a battery operated coin selector in MDB mode the master transmit line must be carried out as an open collector. Please note that no additional pull up resistor must be used!

4.4. ccTalk Interface

A 4-pin JST connector B 4B-XH-A is used for the cctalk interface.

Pin No.	Connection
1	UB (10 ... 26 V DC)
2	Not used
3	GND
4	Data Line (Bi-directional)

Coin selector selectors to be used with the ccTalk interface have to be set to MDB. The coin selectors recognises automatically the active protocol of the connected controller.

4.4.1. Command Overview

Header	Function	Answer, data and remarks
254	Simple poll	Answer with ACK
253	Address poll	MDCES support acc. to specification
252	Address clash	MDCES support acc. to specification
251	Address change	MDCES support acc. to specification
250	Address random	MDCES support acc. to specification
249	Request polling priority	[002][020] = 10ms × 20 = 200ms
248	Request status	[000] = OK [001] = reject activated [002] = coin-on-a-string manipulation
247	Request variable set	2 Byte customer identification (wh specific)
246	Request manufacturer id	‚wh Berlin'
245	Request equipment category id	‚Coin Acceptor'
244	Request product code	‚EMP'
243	Request database version	[000] = no remote programming via ccTalk
242	Request serial number	[032][003][000]
241	Request software revision	‚EMP-V4.29b' or later version
240	Test solenoids	Bit 0 = acceptance solenoid Bit 1 = solenoid 1 Bit 2 = solenoid 2 Bit 3 = solenoid 3 activated for 500ms
238	Test output lines	Bit 0…7 = output 1…8 activated for 500ms
237	Read input lines	6 Byte

		0 = DIP-Switch 1 1 = DIP-Switch 2 2 = DIP-Switch 3 3 = DIP-Switch 4 4 = external blocking 5 = general blocking, reject
236	Read opto states	Bit 0 = acceptance light barrier Bit 1 = reject light barrier
233	Latch output lines	Bit 0…7 = output 1…8 activated continuously
232	Perform self-check	Answer with ACK, no activities
231	Modify inhibit status	2 Bytes for 16 coins 0 = blocked, 1 = released, all blocked after power on
230	Request inhibit status	[inhibit 1][inhibit 2]
229	Read buffered credit or error codes	Buffer with 5 events, see also table 2 must be transmitted at least every 500 ms, otherwise the coin acceptance will be blocked.
228	Modify master inhibit	0 = coin acceptance blocked 1 = coin acceptance released
227	Request master inhibit status	[inhibit] Bit 0 gives general blocking: 0 = blocked, 1 = released
226	Request insertion counter	[count1][count2][count3] Number of inserts since power on
225	Request accept counter	[count1][count2][count3] Number of accepted coins since power on
222	Modify sorter override status	2 Byte for 16 coins cash box redirection, 0 = into cash box, 1 = normal routing, After Power on normal routing for all coins is activated
221	Request sorter override status	[override1][override2] Polling of cash box redirecting
216	Request data storage availability	[000] [000] [000] [000] [000] no more data storage available
213	Request option flags	[000] „Coin Position Format" is used
212	Request coin position	[pos1][pos2] provides inhibit vector for given coin number
210	Modify sorter path	Changes sorting path for given coin number. After power on the preset shaft is active.
209	Request sorter path	Provides sorting path for given coin number
202	Teach mode control	Format (a) Transmitted data: [position] Received data: ACK Format (b)

		Transmitted data: [position] [extension] Received data : ACK [position] Channel 1 to 16 [extension] tolerance broadening Once in teach mode the device should be polled with the 'Request teach status' command to see what is happening.
201	Request teach status	Format (a) - default Transmitted data: [0] Received data: [no. of coins] [status code] Format (b) - abort teach operation Transmitted data: [1] Received data : [no. of coins entered] [status code] [status code] 252 - teach aborted 253 - teach error 254 - teaching in progress (busy) 255 - teach completed This command is used to monitor the progress of teach mode. Only when a 'teach completed' status message is received can the operation be deemed successful. The actual teach mechanism is under the full control of the slave device. It decides when enough coins have been entered.
197	Calculate ROM checksum	[000] [000] [000] [000], no activities
196	Request creation date	Provides date of last factory programming
195	Request last modification date	Provides date of last customer programming
194	Request reject counter	[count1][count2][count3] number of rejects since power-on
193	Request fraud counter	[000] [000] [000], not supported
192	Request build code	Provides 16 ASCII codes technical specification
185	Modify coin id	Actually not supported, changes are only possible using wheasy 3 from version 3.08 onwards
184	Request coin id	Provides 6 ASCII codes coin ID, for example EU200A

183	Upload window data	Answer with ACK, not supported
182	Download calibration info	Answer with ACK, not supported
173	Request thermistor reading	temperature in °Celsius
170	Request base year	‚2000'
169	Request address mode	[132] Address is stored in EEPROM and can be changed
100	Coin Precision	Subheader 3 16 half bytes coded in 8 bytes starting with channel 1 in Highbyte 1 etc. 0 = wide 1 = medium 2 = narrow 3 = very narrow A = for testing purposes E = give back max. possible default setting F = no modification of current adjustments, only return Response: Z1 – Z8 current value for the acceptance band width coded for coin types 0 – 15 in half bytes.
100	Coin Precision	Subheader 4 Request of current Coin Precision
4	Request comms revision	[001][004][000] ccTalk Level 1, Specification 4.0
3	Clear comm status variables	Clears communication error counters
2	Request comm status variables	Provides 3 communication error counters
1	Reset device	Carries out software reset

4.4.2. Assigning MDB error codes to cctalk error codes

MDB	Remarks	ccTalk	Remarks
$90	Coin return button pressed	254	Coin return button pressed
$91	Subsequent coin	8	Subsequent coin
$92	Coin jam 1	19	Coin too slow
$93	Coin does not match parameter set	1	Coin rejected
$94	MDB blocking	2	Coin blocked
$95	Coin jam 2	19	Coin too slow
$96	DIP switch blocking	2	Coin blocked
$97	Coin jam 3	19	Coin too slow
$98	Coin jam 4	19	Coin too slow
$99	Coin jam 6	19	Coin too slow
$9A	Rim detection error	1	Coin rejected
$9B	Lead detection	1	Coin rejected
$9C	Old: coin following to closely in TCAP1	255	Unknown error
$9D	Coin-on-a-thread detection	20	Coin on a thread manipulation
$9E	General blocking	2	Coin blocked
$9F	EMP busy	13	Not ready

5. EMP 8x0.14 v6 with USB Interface

The electronic coin selector EMP 8x0.14 v6 was specially developed for the operation directly on the USB-interface of a PC. The current consumption was optimized in a way, that the device gets its current supply from the USB-bus. As an option the coin selector may be supplied via our 12 V power supply (N 789), if the specified 500 mA power supply is not guaranteed by the USB-bus of the PC or an intermediary hub. There is no guarantee that the coin selector can be operated on all PCs without an external power supply.

For the EMP 8x0.14 a virtual serial interface is setup when the USB coin selector is installed under Windows®. The ccTalk protocol is to be applied. Therefore already existing solutions for ccTalk coin selectors may be adjusted to the EMP 8x0.14 v6 with little complexity.

Substantial support is available for the software development and the integration of the EMP 8x0.14 v6 into one's own application. Not only a classic Windows-DLL is available but also a class library for Microsoft Visual Studio as well as a sample project in C#.

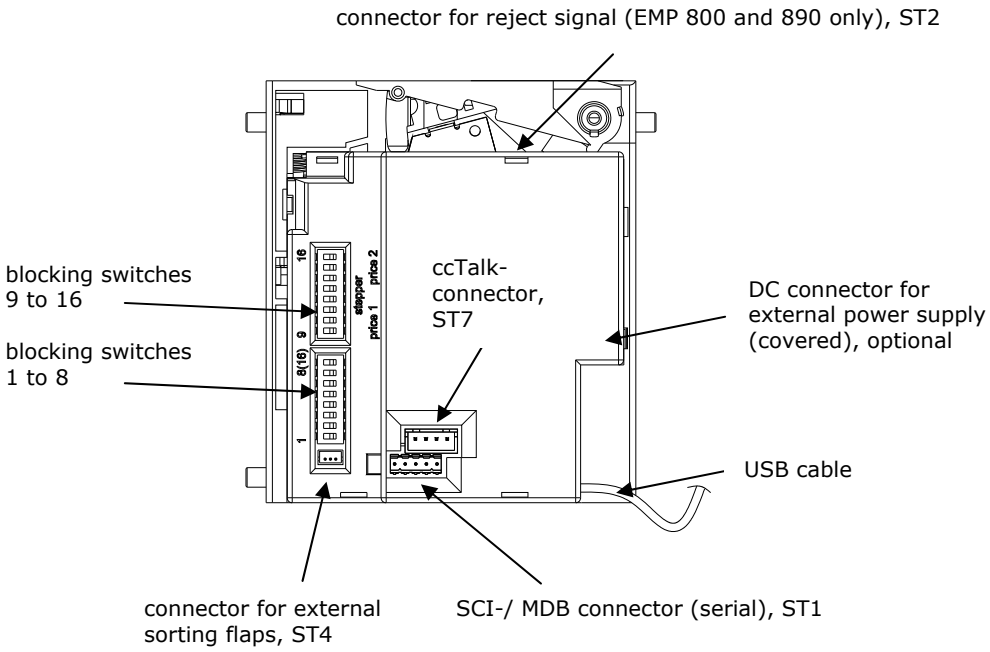


Fig. 17 Location of connectors and control elements EMP 8x0.14 v6

5.1. Technical Data EMP 8x0.14 v6

coin acceptance	32 coin channels, 16 master and 16 slave channels
coin blocking	Complete blocking via the machine controller. In addition, any individual coin, or group of coins can also be blocked through DIP switches. Individual coin blocking can also be carried out via the serial interface.
interfaces	USB, ccTalk
supply voltage	with USB Port: 5 volts DC with power supply: 8 to 16 volts DC
supply current stand by	with USB port: approx. 70 mA with power supply: < 30 mA
during coin acceptance	with USB port: approx. 510 mA for 40 ms and 350 mA for approx. 150 ms with power supply: approx. 320 mA for 40 ms and 185 mA for approx. 150 ms
temperature range	+10°C to +70 °C
humidity classification	according to DIN 40040: F
coin sizes	max. diameter x max. thickness: 32.5 x3.4 mm
dimensions	height x width x depth: 104 x 53 x 93.5 mm (without front plate)

Options

/E	extended temperature and humidity range –20°C to +70°C, humidity classification E/D:
/F	large coin funnel
/P	no coin reject signal
/T	teach mode (2 coin channels activated)
/X	control for external sorting flaps
/Z	additional external strimming detection

An additional power supply is mandatory if the coin selector shall be operated in connection with a sorter, as the required current for the external sorting flaps cannot be made available from the USB port of the PC.

6. Coin Selector Label

The label of the coin selector has all the necessary information required by the machine controller such as the output lines and blocking switch configurations. The following section explains and clarifies the format and legend on the label.

Fig. 18 Example of an EMP 800 v6 label

At the top is printed the exact type of coin selector. In this example:

EMP 800.00 v6

At the end of the same line you find the installed options. In this example:

/T Teachmode

On the left, besides the barcode (turned 90°) is the serial number and the week and year of manufacture. The same information is contained in the bar code. On the very left is the number of the technical specification, that has been used when programming the device in the factory.

The remaining space on the label is devoted to the specification of the programmed coins. These specifications are in the form of a table. The columns have the following meaning:

 Coin type (Value und currency)
Teach mode channels are marked with TKn. „n" = number of blocking switch, which has to be used to activate the teach mode for this channel.

Blocking switch for the broad channel

Blocking switch for the narrow channel

Blocking switch for the very narrow channel

Blocking switch for a coin type or coin group (currency)

Output line

The output line is specified directly for the EMP 8x0.00 v6, which is a number between 1 and 6. The output line combination is given in the hexadecimal equivalent for binary code in the EMP 8xx.04 v6 (The sample shows a value of „0E" for 2,- €. This corresponds to the binary

code 001110, so that for 2,- € the output lines 2, 3 and 4 are activated).

7. Maintenance

7.1. Cleaning

The EMP 800 v6 is an extraordinarily robust coin selector and operates relatively maintenance free. However, it should be cleaned at regular intervals especially if it is operating in an environment with high levels of dust, smoke or nicotine. The cleaning intervals are of course dependent on the level of air borne contaminants.

Modest use with minimum contaminant levels indicate the need to clean the top of the coin path once a year. Open the coin path door and wipe the exposed surfaces with an alcohol moistened cloth. Also lukewarm water with a little dish liquid may be used. The light sensors may be cleaned with a soft brush or air spray duster.

Make sure that the coin selector is without power during the cleaning.

Use a damp not wet - cloth. Under no circumstances liquid should run into the coin selector.

Avoid solvent or abrasives which may affect the plastic material.

Never use an oily rag! Never lubricate the switch solenoid, hinge joints etc.!

7.2. Eliminations of Malfunctions

Not every malfunction is caused by a defect of the coin selector. Often it is caused by spoiled or loose connecting cables, wrong adjustments or a weak current supply.

The following chart gives you a survey of the most common malfunctions. Please check by means of this chart, if you cannot eliminate the defect by yourself.

Fault characteristics	**possible reasons**	**elimination of malfunction**
Coin selector does not accept any coins	no power supply	• Apply power to the device and ensure that the power supply really provides voltage • Check condition of cable, connect cable correctly to coin selector and the controller
Coin selector does not accept any coins	Teach mode function activated (selectors with option /T)	• Set Dip switch 8 to OFF
	Power supply too weak	• The consumption of current is raised for short period of time (40 ms) when the solenoid is activated. Make sure that the voltage does not drop below 8 volts when a load of 400 mA is applied.
	Coin blocked	• Check whether the coins are blocked via DIP-switches. • Make sure that the coin selector is not blocked by the controller via the signal „General Blocking" (pin 6) • Make sure, that pin 5 (reject signal) is not drawn to ground by the controller.
	Soiled Coin Selector	• Clean Coin Selector
	Reject lever or Reject button jammed	• Make sure, that the reject lever or reject button is not permanently actuated. The reject operation is detected by a micro switch (except Option /P) and signalled to the coin selector. It does not take any coins as long as the reject signal is activated. The micro switch is already operated, before the flap starts to open!
	Soiled light barrier at coin exit or blocked by an object.	• Clean light barrier • Remove foreign object from the coin exit
Coin Selector accepts coins, but does not give an output signal	Coin exit is blocked so that the coin stays too long in the light barrier or bounces again after having left the light barrier.	• Make sure, that the coin exit is not blocked by foreign objects or following machine elements.

8. Connecting Diagrams

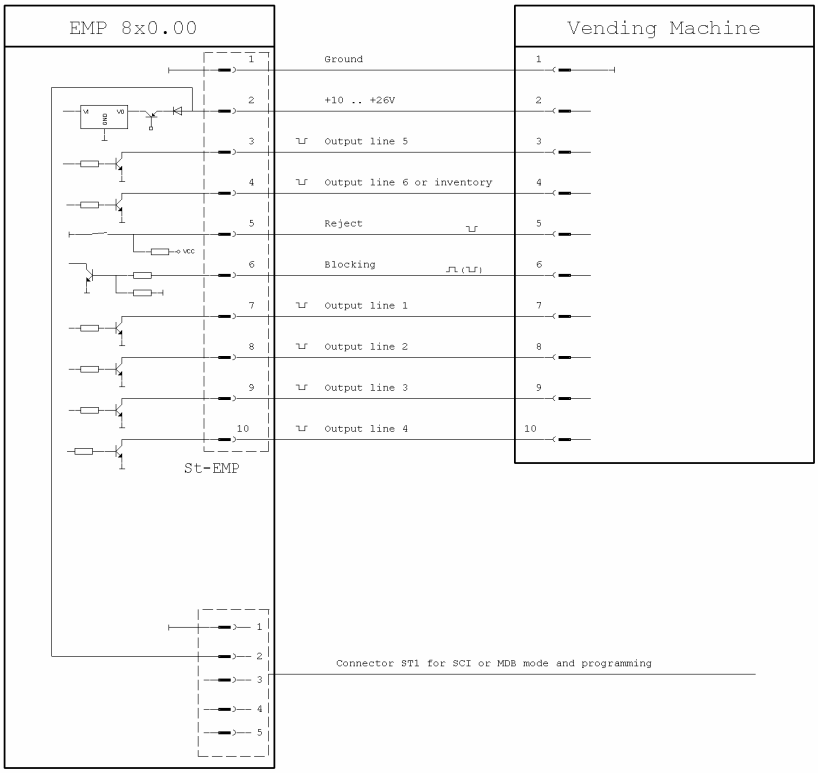


Fig. 19 Connecting diagram EMP 8x0.00 v6

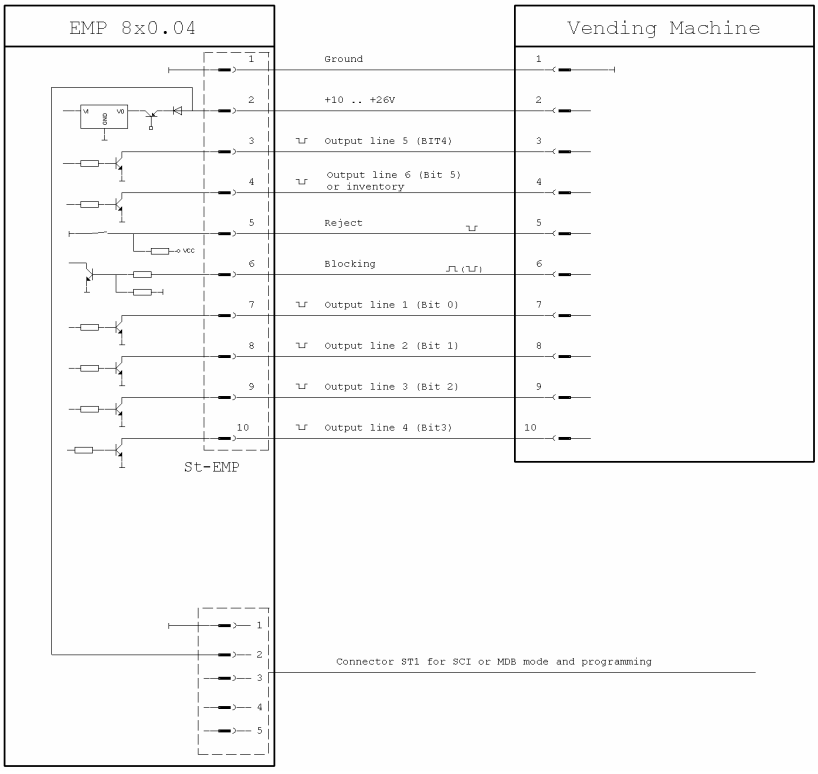


Fig. 20 Connecting diagram EMP 8x0.04 v6

9. EG Conformation Declaration

Product name: EMP 8x0.00v6, EMP 8x0.04 v6, EMP 8x0.13 v6
Date: 03.09.2007

Product name: EMP 8x0.14 v6
Date: 26.10.2007

Harmonized European Standard:

EN 61000-4-2: 2002
EN 61000-4-4: 2002
EN 55014-2: 2002
EN 61000-6-1: 2002

Our tests grant, that electronic coin selectors of type EMP 8x0.00 v6, EMP 8x0.04 v6, EMP 8x0.13 v6 and EMP 8x0.14 v6 meet the above mentioned general regulations. However, they do not exempt the seller of the machines from his duty of care as there are still some other important characteristics of the machine which could impede the CE conformity or restrict it.