User manual for Helvest®FleX SM400 board

1. General product overview

1.1 SM400 servomotor drive module

Fig. 1

The SM400 board drives up to 4 servomotors. These motors are very popular in model railroading because they permit movements with rather precise speeds and positions. They do not rotate continuously, but move between two positions, which in the following we will refer to as A and B (see figure 1), making a complete rotation, which can be an angle of 180° (a semicircle) or a different arc depending on the type of motor.

These motors operate on 5V and need a specific drive.

Given the very wide variety of servomotors on the market, the precision and smoothness of operation are very variable: if the motor is cheap and very inaccurate, these construction limitations cannot be counterbalanced by the decoder.

SM400 is a "layout" type module for the HP100 motherboard. It must be plugged into the appropriate "layout" connectors on the HP100 board and is automatically detected by it.

To insert the module, switch off the HP100 board's power supply, ensure that the connectors are aligned and apply a slight pressure until the module is fully inserted into the slot.

1.2 Firmware version

In order for SM400 to be recognised and managed by the motherboard it must have firmware version 3.0 or higher.

If you bought the HP100 together with the SM400 module there is no problem: it has the latest firmware. If you have owned an HP100 for some time, you may have an older firmware version.

Fig. 2
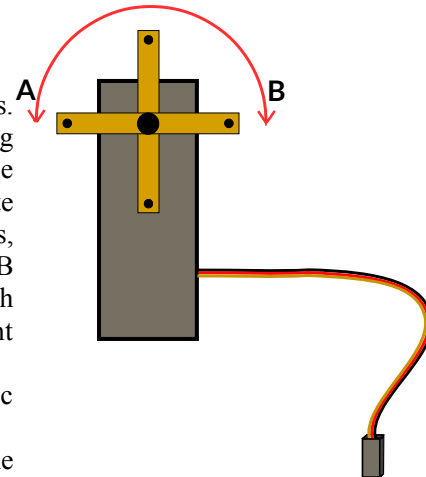
To check the firmware version, check the label on the underside of the HP100, as in figure 2: The first line should have a value of "3.0" or higher.

If you need to update the firmware, please contact your dealer or support service. An easy way to update the board will shortly be available to the public..

3.0
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2135

1.3 Mounting the board on the layout

The complete board must be mounted in such a way that it does NOT touch anything during operation. In particular, it must not come into contact with any metallic material.

Fig. 3

For temporary installations, it can be placed on a non-flammable insulating surface (plastic, glass, ceramic floor, etc.). For fixed installations, it is recommended to mount the HP-100 on a wooden surface using the screws and spacers provided. (figure 3). This operation should be done before inserting the SM400 module. (If layout or net modules have already been inserted, these can be removed gently without any problems.)

### 1.4 Electrical connections

CAUTION:

- All the following operations must be carried out with **power switched off.**

Insert the module on the HP100 board, taking care to align the connectors correctly and inserting the board without forcing it.

Insert the connectors of the servomotors in the two appropriate connectors indicated with "1" in figure 4. Take care to insert them correctly: they must be oriented so that the negative is on the right in the image (side of the connector indicated with "-", usually it is the black cable) and the positive in the centre (indicated with "+" in the card, usually it is the red cable).
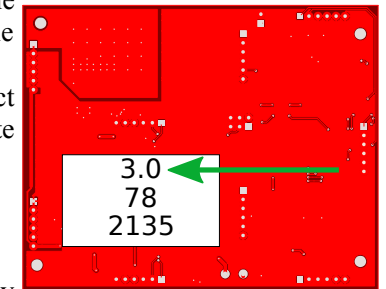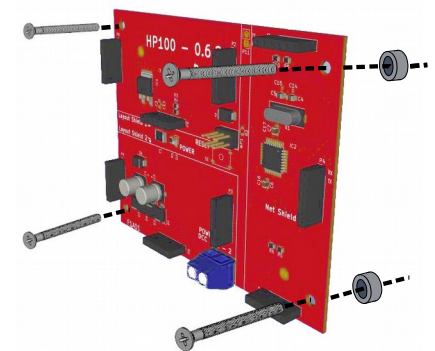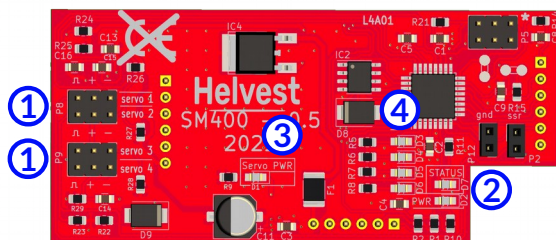
Some types of servomotors have differently arranged connectors, check **Fig. 4** the manufacturer's instructions if necessary.

Insert the "net" module into the housing of the HP100 (see HP100 instructions).

The DCC signal must be connected to the terminal block of the HP100 (see HP100 instructions).

OPERATION OF THE DCC DECODER

2.1 Powering up the board

Once all connections have been made, power up the board. The green LED in position no. 2 "PWR" and the green LED in position no. 3 "Servo PWR" light up, indicating that power is being supplied to the decoder and servos.
The LED marked "status" indicates that communication with the HP100 is active (it lights up after a few moments).

2.2 Motor switching

The plugged motors are operated in one direction or another via the digital control unit.
The four LEDs shown with No. 4 in figure 4 indicate when the motors are activated, lighting up continuously for the duration of the activation time.
The module executes individual commands in real time, i.e. as soon as they are received. If several commands are activated at the same time, they are executed simultaneously.
It is possible to assign an address to the individual port (default: 1, 2, 3, 4 for the "layout 1" module and 5, 6, 7, 8 for the "layout 2" module), or an address to each module (default: 1 for the "layout 1" module, 2 for the "layout 2" module) according to DCC specifications. The address of the individual motors, or the global address of

the board, can be modified via the digital control unit as indicated in the following paragraph.
On helvest.ch website, under Support → Download ("I want to download instruction manuals and other information material") → "Table of DCC address correspondence of the decoder/address of the outputs/CV to be programmed", it is possible to download the complete table of addresses and the correspondence between the address of the port and that of the card.

2.3 Programming

The module supports the most common servomotors. Due to the wide variety of these products, the accuracy of the movement, its regularity and power are not uniform. Cheaper motors may be more inaccurate.
Adjustments can be made normally via the DCC control unit, like any other decoder.
On helvest.ch, under Support → Download ("I want to download instruction manuals and other information material") → Custom generator of CV table you can download the complete table of CVs corresponding to the configuration of the modules you have mounted.
The CVs for assigning addresses to the individual outputs are also shown in the table below:

Layout	Motor	Default	CV
1	Servo 1	1	120
1	Servo 2	2	130
1	Servo 3	3	140
1	Servo 4	4	150
2	Servo 1	5	160
2	Servo 2	6	170
2	Servo 3	7	180
2	Servo 4	8	190

CAUTION:

- If the digital control unit is equipped with a specific programming output, **connect the programming output**.

- During programming, the control unit must **only be connected to the decoder to be programmed.**
- Before starting the programming procedure, **remove all layout modules** from the HP100, and reinsert them only when programming is complete.

2.4 Basic settings: position and switching time.

The motor position at both ends is indicated by A and B (see figure 1). To adjust the start and end position it is necessary to use the appropriate CVs, which accept values from 0 to 40. The value 20 is the default and is the intermediate position, values below 20 move position A (or B) to one side, values above 20 move it to the other.
It is possible to adjust the position in the same way for all motors in the module ("global" CV 40, 41, 43 and 44) or to adjust the position of one motor at a time (124/125, 134/135, 144/145 etc...).

In the same way, the switching time is adjusted by a specific CV (see table). If you want the same time for all motors in the module, you can change the global CV (39 or 42), or you can adjust each output individually (CV 123, 133, 143 ...).
Increasing the switching time makes the motor turn more slowly, decreasing it makes it move faster: the switching time varies accordingly from a minimum of a few tenths of a second to a maximum of over 30 seconds.

2.5 Current sensing sensor

The module is equipped with a sensor which monitors the current absorption of the motors and temporarily switches them off in the event of excessive absorption by one or more motors. This is to avoid unstable situations in the event of a motor failure or if one of the motors encounters an obstacle. It also avoids that, if the motor is incorrectly adjusted, it may damage the mechanical objects to which it is connected (for example, if the needle of a turnout presses too hard against the rail, it may bend in the long run).
When a motor is switched off because of an emergency, it stops running at the point where the problem occurred, and the corresponding LED flashes quickly. To try to move the motor again, simply give it a new command via the control unit.
The absorption control can be triggered if:
- the motor encounters an obstacle, which must be removed.

- the motor forces at the end of its travel, for example because the turnout needle presses against the rail as mentioned above. In this case the end position (A or B) of the motor must be adjusted differently, so that it stops earlier.
- the motor is faulty and must be replaced.
- the motor draws too much current, so the threshold above which the limiter is activated can be raised or eliminated.

Even if the single motors move without any problems, it can happen that the total exceeds the threshold if they are moved simultaneously. In this case, the threshold can of course be raised if it is not possible to prevent the motors from moving simultaneously.

It is possible to modify the sensitivity of the sensor for each individual motor by acting on CV 126, 136, 146.... for single motors. The higher the value, the lower the degree of sensor intervention. The lower the value, the more sensitive it is. Programming the CV of the sensor with 255 completely eliminates the intervention of this system. The board is still protected if the motor absorbs so much that it could be damaged.

2.6 Continuous supply of motors

The board normally stops supplying current to the motors when they have completed their movement. That is, when the motor reaches the final position (A or B) it is turned off. In the vast majority of cases, the motor remains in this position because the mechanical resistance it offers is more than sufficient to keep it stationary.
In cases where it is preferred to keep the motors powered even when stationary, for those very few situations in which they are subjected to such stress that it is feared that they may move at the end of their stroke, it is possible to program CV 45 (for the module inserted on Layout 1) and 46 (for the module inserted on Layout 2) to keep them powered when stationary: simply write the value "1" in the CVs indicated. To restore the previous situation, simply write the value "0" in the same CVs.

We recommend that you keep the motors switched off when they are stationary (as in the factory configuration), because keeping them powered has three main disadvantages:
- the current consumption is higher (so in a system with many motors, the control unit or the power supply is overloaded);

- the motors are noisy (they can make buzzing or ticking noises when stationary)
- the motors are subject to greater strain, which may reduce their service life.

3 . Troubleshooting

To resolve power supply/connection issues etc., see troubleshooting the motherboard.
The table below shows the main causes of malfunctioning and proposes remedies.

Problem	Possibile reasobs
The module is plugged in but not responding, and the power LEDs remain off.	If the HP100 board is powered (green LED on the HP100 is lit), the module is incorrectly inserted. Check for correct insertion. The board is in contact with metal parts.
The module is plugged in, the power LEDs are on, but the yellow "status" LED is off	Check that the board is inserted correctly into the HP100. Turn the power off and on again. Check whether the HP100 firmware is up to date. It must be at least version 3.0. (see § 1.2)
The module is plugged in, the power and status LEDs are lit, but one or more motors are not moving and the motor LED is not lit.	The address is incorrect: read the address CVs, or reprogram them. See NET board troubleshooting.
The motor LED lights up steady, but the motor does not moveCheck the motor connections The motor is faulty: try replacing it with a different one.	Check the motor connections The motor is faulty: try replacing it with a different one.
The motor moves, but does not reach the end of its stroke. The motor LED turns off after the movement.	The motor position must be adjusted differently: see section 2.4.
The motor moves, but does not reach the end of its stroke. The motor LED flashes quickly after movement	There is an obstacle blocking the motor and preventing it from moving beyond a certain point. Remove the obstacle. The motor draws too much current. Adjust the emergency stop differently (section 2.5).The "layout" modules were not removed before starting programming. Remove the modules and try again. The track output of the digital control unit has been connected instead of the programming output. Disconnect

	the DCC cables you are using and replace them with the programming cables.
The decoder cannot be programmed	The "layout" modules were not removed before starting programming. Remove the modules and try again. The track output of the digital control unit has been connected instead of the programming output. Disconnect the DCC cables you are using and replace them with the programming cables.

If the above measures do not work, please contact us via the form on helvest.ch.

4 . TECHNICAL SPECIFICATIONS

Board type: Servomotors power module. for HP100 motherboard

Logic circuitinput power: 5V DC, from motherboard
LEDs: logic power, motor power, individual motor switching.
Output voltage: 5V DC
Max. power for every output: 500 mA
Woking temperature: 0 °C - 40 °C
Dimensions   80 x 35 mm

Firmware HP100   > = 3.0

User manual rev. 1.0 (2021).