

Operating Instructions  
for the  
PLUGSYS module

Programmable Stimulator Module Type 676  
(Version 1.0 / Okt. 1991 Zi/Hel)

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## 1 Application

The Programmable Stimulator Module (PSM) Type 676 is used for computer-controlled electrical stimulation. It is an universal square-wave single-channel stimulator with isolated constant-current output. It has been developed specially for stimulating isolated tissues in physiological and pharmacological research. The stimulator is controlled through an IBM XT/AT or compatible computer.

## 2 General description

The PSM (Programmable Stimulator Module) is a stimulator module specially designed for the HSE PLUGSYS measuring system.

The module is controlled through the Bus Interface BI Type 657 from the computer plug-in card ICI (IBM Control Interface Type 658) which is installed in the corresponding computer.

The software installed on the control computer presents a menu-controlled operating plane. The programmable parameters can be stored on disk for later use. Once the stimulator is programmed, the computer can be used for other applications. The stimulus software has to be recalled to make any changes in the stimulation parameters.

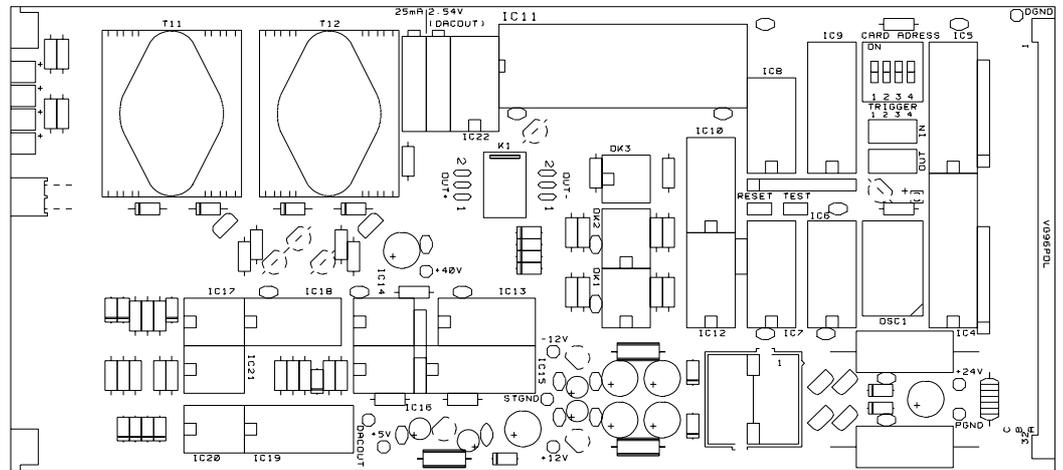
## 3 Control software

For detailed information about the stimulus control software see the extra user manual.

## 4 Hardware installation

## 4.1 Setting the coding switch

## 4.1.1 Location of the coding switch on the circuit board:



BEAR8	Unm./20.10.89	FILE DP676N1	DISK L19
BESTUECKUNGSDRUCK		DP-Nr. 676-1/ab	
Programmable Stimulator Mod.			

Fig. 1

For controlling the different plug-in cards from the computer interface each module which can be controlled is coded with a particular address. In this way it is possible to address each card independently of its position in the PLUGSYS system and to control it from the computer. For setting the card address of the PSM a coding switch is provided on the circuit board. It is located at the top right corner of the board close to the 96-pin VG bus connector. The coding switch can be used to set up addresses from 0 to 15 (try to not use address 0; this address is reserved for specific applications).

When a unit with several plug in modules is purchased the card addresses are set at the factory.

When installing additional modules in an existing system it is important to ensure that the new modules do not have addresses which are already been allocated from other cards.

Important:

!!!! The address setting is inverting !!!!

## 4.1.2 Example of coding

coding switch setting  
binary coding table (ON = 0; OFF = 1)

coding switch				Card address
1	2	3	4	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

## 4.2 Jumper installation

The following input and output are available:

- TRIGGER IN: input for the hardware trigger signal
- TRIGGER OUT: output trigger signal

(see section for more information)

The PLUGSYS system bus includes 4 module connections for trigger signals "Trigger 1" to "Trigger 4". For the module interconnection the trigger signals can be linked to these lines. Before the installation of the jumpers it is necessary to define which line is used for these specified trigger signals. If the module which delivers the trigger signal is already installed it is essential to ensure that the jumper on this module is set correctly. If the trigger signal is fed in from an external device through the trigger inputs (if optionally installed) from the rear of the PLUGSYS housing the TRIGGER IN has to be connected to "Trigger 3" or "Trigger 4" line. "Trigger 1" and "Trigger 2" cannot be accessed from the outside as a trigger input. These two lines are reserved for trigger output and are connected to the BNC connectors (if installed) on the rear of the mainframe. "Trigger 3" and "Trigger 4" lines cannot be accessed from the outside as trigger output. To synchronize an external device using the TRIGGER OUT of the PSM this output has to be connected to either "Trigger 3" or/and "Trigger 4".

The jumpers are located on the circuit board just below the dip switch for the card address. They are marked with TRIGGER and resp. IN / OUT. The numbers 1 to 4 define the trigger lines of the system bus.

### 4.3 Installation of the PSM into a PLUGSYS housing

When the dip switch has been set correctly and the jumpers are installed the module can be installed in the PLUGSYS housing.

Important:

before opening up your PLUGSYS unit, switch it off and pull out the mains plug !!!!  
If it is connected to the computer remove this connection also.

The PSM can in principle be fitted into any slot of the PLUGSYS system which can receive the extra supply of 24V. This slots are 5 and 7 in the housing model 601 plus 15 and 17 in the housing 600 and 603. When the wiring of one of this slots is installed it has to be marked with the delivered pin screw. This pin fits only into the corresponding hole in the front panel of modules which needs this supply.

When the PSM has to be fitted in an existing housing the slot must be provided with the +24V supply required by the module.

The bus board carries 3 pins for this purpose at the slot mentioned (5,7,15,17). These have to be connected to the power supply of the PLUGSYS by means of the cable supplied. The pins are marked P0, P1, P2

There are two different types of housings

- bench model 600 and 601
- rack model 603

The bench models have a front frame which must be removed to access the modules. To remove this you unscrew the two fixing screws at the sides and can now take off the front frame. The remaining procedure is the same for all models.

Wiring instructions:

Remove the top and bottom panels of the housing to obtain access to the power supply (black box at the back of the housing).

At each of the mentioned slots you can see three pins in the lower part of the mother board.

Take the connecting cable supplied and place the connectors on the pins as follows:

- white wire on pin P0
- green wire on pin P1
- black/green wire on pin P2

On the power supply loosen the terminal screws marked +24V, -12V and 0. Place the cable terminations on the terminals as below and the tighten the terminal screws again:

- white on +24V
- green on -12V
- black/green on 0

For installing a module a blank panel "EXTENSION" is unscrewed and the module is fitted at the desired location. Be sure that the module is correctly located between the guide rails on the housing. Push it in firmly the connector.

After securing the module with the screws supplied, the front frame is placed back and screwed down in case of a bench model.

Every module can be removed for servicing (after taking off the front frame in case of the bench housing) by unscrewing the two fixing screws at the top and bottom edge of the front panel.

#### 4.4 Installation of the BI module and the ICI plug-in board

The connection from the PSM to the computer needs two additional modules: the BI (Bus Interface) module type 657 which is located in the PLUGSYS housing and the ICI (IBM Control Interface) type 659 which is a plug-in board for the computer. Refer to the operating manual of these modules for the installation. After the installation of these two modules fit the 37-way link cable between them and secure the connector locks.

## 5 Front panel description

LED PULSE: flashing for the duration of a current

LED ERROR: signals an error condition (see description in section \*\*\*\*\*)

LED OUT +: ON if there is no output current  
OFF for negative output current  
ON for positive output current (and LED PULSE is on)

LED OUT -: OFF for positive or no output current  
ON for negative output current (during the pulse, the LED pulse is also on during this time)

OUTPUT CURRENT: this switch selects the output range (1...25 mA or 10...250 mA)

OUTPUT: connections for the stimulation electrodes (positive output current means the upper plug is the positive pole and the lower the negative pole)

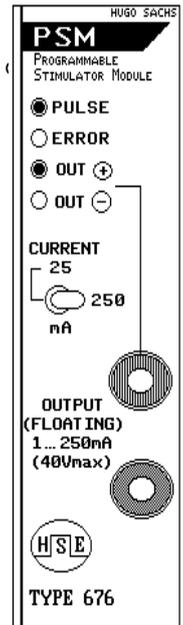


Fig. 2  
Front panel

## 6 Output characteristics, electrode connection

The output connection is an isolated constant-current output. The current range is 1...25mA or 10...250mA depending on the position of the "OUTPUT CURRENT" switch at the front panel. The maximum output voltage is 40V. The rise time of the stimulation pulse is 14µs for 40V output voltage and 250mA current.

The maximum resistance which can be driven with the module can be calculated as:

$$\text{Res} = 40\text{V} / \text{set current}$$

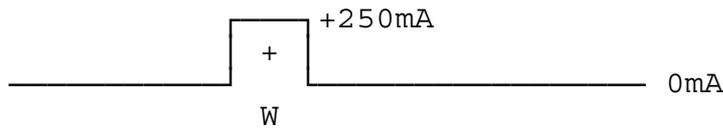
Example

$$40\text{V} / 250\text{mA} = 0.160 \text{ kOhm}$$

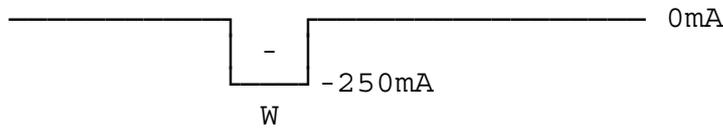
The resistance between the electrode must be less than 160 Ohm to be sure an output current of 250mA is available. If for example the resistance is of 200 Ohm only an output current of  $40\text{V} / 0.2 \text{ kOhm} = 200\text{mA}$  is delivered.

Depending on the selected output signal the output current can be either positive, negative, bipolar or alternating

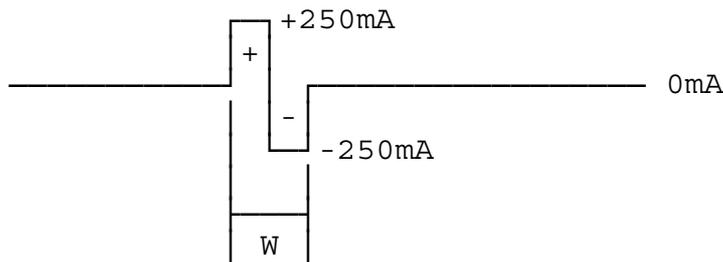
Positive output current pulse



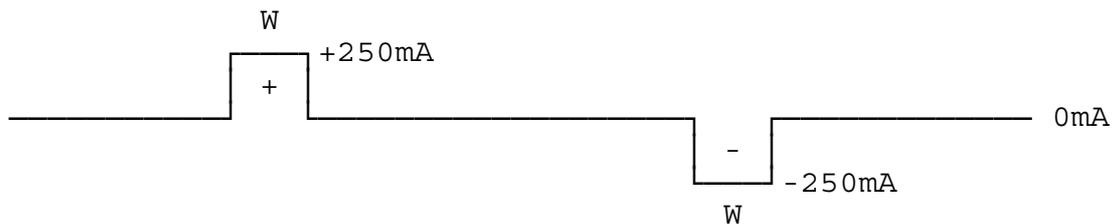
Negative output current pulse



Bipolar output current pulse



Alternating output current pulse



The output is isolated. There is no connection between the output plugs and the ground of the PLUGSYS unit or the earth. This allows to create a multichannel system with really independent outputs. It is important to have no connection between the different channels specially in experiments with isolated organs where sometimes the nutrition solution realize an interconnection of the organbath and where in case of non isolated outputs the current goes through the nutrition solution from one bath to the other instead over the tissue.

The electrodes have to be connected to the output plugs. The upper plug is considered as the positive pole, the lower as the negative pole. The selection of alternating or bipolar stimulation will reduce consequently the polarization of the electrodes as well as the electrical erosion of the positive pole.