

Operating Instructions
for the
PLUGSYS® module

WLA Wilson Lead Amplifier Type 702

ECG amplifier for
unipolar chest leads after Wilson

(Version: 1.0 / printed: February 11, 2003 / from Ser.No. 97001 / H. Steiert)

Contents	Page
1. Introduction, manufacturer's details	1
2. Safety note	1
3. General description, application	2
4. Installing the module in a housing	2
4.1 Installation procedure	3
4.2 Internal instrument settings, jumpers.....	3
5. Starting up	5
6. Signal input.....	6
6.1 Input socket	6
6.2 Input connection	6
7. Description of the controls	7
8. Frequent errors, causes and remedies.....	8
9. Maintenance and cleaning.....	9
10. Transport and storage	9
11. CE Conformity	9
12. Block diagram of the WLA module	10
13. Technical data	11

1. Introduction, manufacturer's details

These Operating Instructions describe the operation and use of the **WLA** Module Type 702. It is part of the equipment and should be kept close to it.

All the information in these Instructions has been drawn up after careful examination but does not represent a warranty of product properties. Alterations in line with technical progress are reserved.

This PLUGSYS[®] module is manufactured by:

Hugo Sachs Elektronik
Gruenstr. 1,
79232 March-Hugstetten
Germany

Phone (Germany): 07665-9200-0
(others): int. + 49 7665-9200-0

Fax (Germany): 07665-9200-90
(others): int. + 49 7665-9200-90

eMail: HSEMain@aol.com

Copyright

This product and the corresponding documentation are protected by copyright. All rights reserved. This document must not be copied, photocopied, reproduced or translated, either as a whole or in parts, without prior written agreement by Hugo Sachs Elektronik, March/Hugstetten, Germany.

Trademark

PLUGSYS is a registered trademark of Hugo Sachs Elektronik, March/Hugstetten, Germany.

2. Safety note



Warning: the equipment is not suitable for operation in hazardous areas and/or in a flammable atmosphere.

3. General description, application

The **WLA** module Type 702 is a module of the HSE PLUGSYS measuring system and is used for capturing and amplifying unipolar ECG chest leads after Wilson. Up to 6 chest electrodes (V1 to V6) have to be connected up.

IMPORTANT: correct recording of the Wilson unipolar chest ECG potentials requires the central reference signal (Ventral Terminal Point = CTP) which is formed from the bipolar Einthoven extremity leads. Use of the **WLA** therefore requires also the module EGM Type 701 which provides the CTP signal. The correct connection between the two modules is made through the input box.

The **WLA** module incorporates isolating input amplifiers in order to avoid hum interference. In this way the inputs are isolated from the output circuits and from the housing. The isolation barrier can withstand voltages up to 200 Volt.

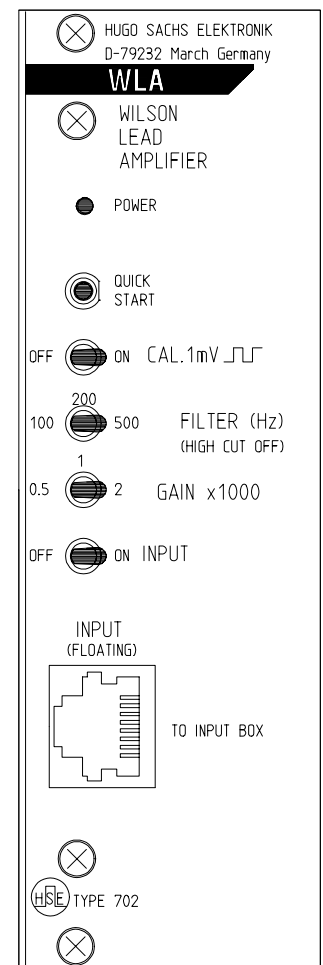
The 6 output voltages of the different chest leads can be linked through jumpers to the PLUGSYS system bus. From there the signals can be taken for recording or for computerised data evaluation via a ROM module (Recorder Output Module, e.g. ROM-DL).

A square-wave calibration generator with a 1 mV amplitude is incorporated for calibrating the amplitudes.

Input leads

V1, V2, V3, V4, V5, V6 and CTP

CTP = Central Terminal Point = reference signal
(extra output of the EGM module Type 701)



FILE: WLA_FP1.fcd

Fig. 1: Front panel

For use, the **WLA** module has to be installed in a PLUGSYS housing Series 600.

4. Installing the module in a housing

If you have received the module as a separate unit you should read this Section. If the module has however been supplied already installed you can omit Section 0 and continue at Section 0.

Before you can use the **WLA** module it has to be installed in a suitable HSE PLUGSYS housing Series 600 (July 97: 601 to 609). If the module is supplied as part of a completely installed PLUGSYS measuring system the work described below has already been carried out and the selected signal paths have been entered in the bus diagram.

4.1 Installation procedure

Before the module is installed in a housing the connections of the module to the bus lines have to be determined by plugging in jumpers as described in the next section (Sections 0).

Do not forget to enter the selected connections in the bus diagram (in the white Operating Manual folder for the PLUGSYS housing under Section 1).

Brief procedure (for full details see the Operating Manual of the housing):

- Pull out the mains plug on the housing.
- Remove the blank panel at the housing slot position intended for the **WLA** module.
- Prepare module according to Section 0 (set jumpers).
- Insert the **WLA** module, note the guide rails.
- Push the module firmly into the bus connector.
- Screw on the front panel.
- Reconnect the mains plug to the housing.
- Plug in the input cable and connect up the electrodes
- Switch on the housing

4.2 Internal instrument settings, jumpers

Warning: The **WLA** module has to be protected against electrostatic discharges while it is outside the housing!

The **WLA** module contains highly sensitive MOS components which can be damaged or destroyed by electrostatic discharges. If you are removing the module from the housing or carry out any operations on the module outside the housing you must ensure potential equilibration before touching part of the printed circuit. (Touch an earthed item, such as earthed housing, PLUGSYS housing or similar).

Before you install the **WLA** module into the PLUGSYS housing it is necessary to set 6 cable jumpers on the circuit board in order that the output signals are linked to the appropriate or required bus lines. The module can only be used as intended if the bus lines have been connected up correctly.

Do not forget to enter the selected signal assignment in the bus diagram for the PLUGSYS housing (the bus diagram is filed in the Operating Manual folder of the PLUGSYS housing under Section 1).

If the module is supplied as part of a completely installed PLUGSYS measuring system, the operations described below have already been completed and the selected signal paths have been entered in the bus diagram.



Note: When selecting the bus line (AV1...16) be sure to use a free line and check this in the bus diagram. If there is no appropriate information in the bus diagram you can determine the bus line assignment only by removing all the modules and determining the signal paths selected on them using the corresponding operating instructions.

The position of the cable jumpers is shown in 2. 6 analogue outputs (A1 to A6) have to be linked to the required bus lines (AV1 to AV16). If the "QUICK START" function is to be operated not only with the key on the front panel but also centrally via the system bus, it is necessary to set also the jumper X.

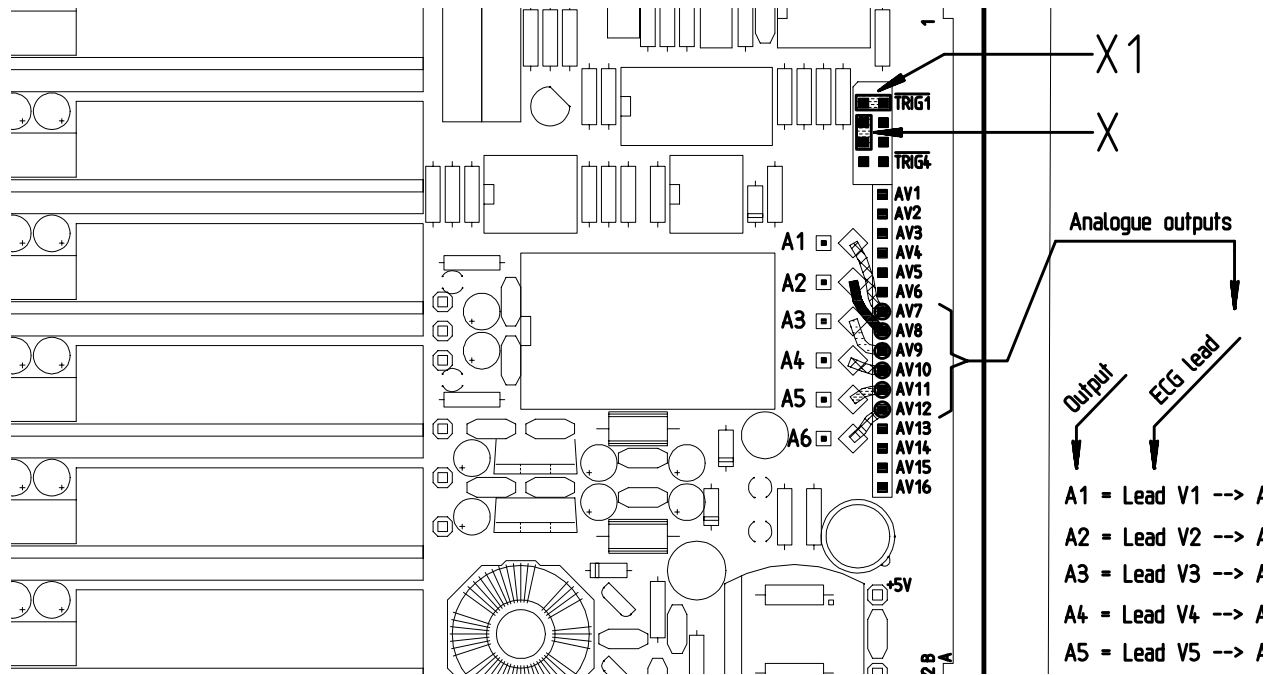


Fig. 2: Position of the internal jumpers

Cable jumpers A1 to A6: The signals of the various ECG leads are carried on the cable jumpers marked A1 to A6. The connectors of these cable jumpers have to be plugged on to the pins for the analogue bus lines (AV1 to AV16). The individual cable jumpers carry the following ECG leads:

Cable jumper:	A1	A2	A3	A4	A5	A6
ECG leads:	V1	V2	V3	V4	V5	V6

Jumper X: The "QUICK START" function generally activated by pressing the "QUICK START" key. When several amplifiers are being used simultaneously (e.g. module EGM for extremity leads after Einthoven and Goldberger) it may be desirable to operate this function centrally. In this case the jumpers X of all the modules have to be set to the same line of the trigger bus TRIG1 to TRIG4. If this trigger line is then activated, either manually by a central key or e.g. by a PC connected to this line, a quick start is performed simultaneously on all modules connected to this trigger line. As an example, 2 shows the jumper X1 set to trigger line TRIG1.



Note: when selecting the trigger line (TRIG1 - TRIG4), be sure to use a free line and check this in the trigger bus diagram (the trigger bus diagram is filed in the Operating Manual folder of the PLUGSYS housing under Section 1). If there is no appropriate information in the diagram you can determine the bus line assignment only by removing all the modules and determining the signal paths selected on them using the corresponding operating instructions.

Do not forget to enter the selected trigger signal assignment in the trigger bus diagram for the PLUGSYS housing (the trigger bus diagram is filed in the Operating Manual folder of the PLUGSYS housing under Section 1).

If central triggering of quick start is not required, the jumper has to be placed in the parking position (jumper X in 2).

5. Starting up

After the ECG input cable or the input box has been connected to the input sockets, and to the output sockets a recorder, monitor or data evaluation system (= **visualisation unit**) you can switch on the housing.

NOTE: it is essential that the outputs are correctly connected to the individual channels of the visualisation unit and mark the channels with the appropriate leads (V1 to V6).

Check first the function of the entire measurement system from **WLA** to the visualisation unit by switching off the input on the **WLA**, setting the gain to 1000 and switching on the calibration generator:

- set switch "INPUT" to "OFF"
- set switch "GAIN x1000" to "1"
- set switch "CAL. 1 mV" to "ON".

All outputs then show a square-wave signal with a frequency of 2 Hz (= 120 min⁻¹) and an amplitude of 1 Volt. Now set the required amplitude on the visualisation unit by suitable adjustment of its sensitivity. In between switch off the calibration generator briefly (switch "CAL. 1 mV" to "OFF"), briefly press the "QUICK START" key (1 - 2 sec) and then adjust the required zero position on the visualisation unit.

During recording the switches should be set to the following positions:

- switch "CAL 1 mV" to "OFF"
- switch "FILTER (Hz)" to "200"
- switch "GAIN x1000" to "1"
- switch "INPUT" to "ON"

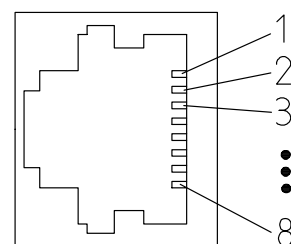
"GAIN" and "FILTER" may require a different setting depending on the actual conditions of your experiment.

6. Signal input

6.1 Input socket

The input socket of the **WLA** module is an 8-way Steward socket RJ45. The front view of the socket with marking of the contact numbers is shown in 3. The contacts are used as follows:

Contact 1:	V1
Contact 2:	V2
Contact 3:	V3
Contact 4:	V4
Contact 5:	V5
Contact 6:	V6
Contact 7:	(internal reference IGND)
Contact 8:	not used
Metal case:	screen null



FILE: EGM_INP1.FCD

Fig. 3: Input socket

6.2 Input connection

Important ! An input box Type 701/2, 701/3 or 701/1 is absolutely required (see below).

Operation of the **WLA** module requires also the module **EGM** Type 701. That module evaluates the Einthoven extremity leads and from them generates the CTP signal required for the unipolar Wilson chest leads. The input box incorporates the connections required for proper recording of the different leads. Input sockets (suitable for solid 2 mm pin plugs) are provided for connecting the electrodes. The following electrodes have to be connected:

4 extremity electrodes: **RA** (right arm),
 LA (left arm),
 RF (right foot) and
 LF (left foot)

6 chest electrodes: **V1 to V6**

Following input boxes are available:

Type 701/2: for combination of module **EGM Type 701** and **WLA Type 702**

Type 701/3: same as above with additional inputs for 1 module **MAPM Type 703** (6 MAP electrodes)

Type 701/1: same as above with additional inputs for 2 modules **MAPM Type 703** (12 MAP electrodes)

7. Description of the controls

The item numbers in the descriptions below refer to 4.

- (1) Green LED. This lights up while the amplifier is switched on.
- (2) The "**QUICK START**" key serves to return the ECG signals quickly to the isoelectric line. This key has to be pressed for rapid "**zeroing**". The key acts simultaneously on all the leads.
- (3) Switch "**CAL 1 mV**". When set to "**ON**" a square-wave calibration signal with a frequency of 120 min^{-1} (2 Hz) and an amplitude of 1 mV is generated and superimposed on the input signal. With the input switched off (switch INPUT set to OFF) the output carries the pure calibration signal.

The calibration signal appears simultaneously on all leads.

The 1 mV amplitude is referred to the input and serves for evaluating the amplitude of the ECG signal. The calibration signal appears with different amplitudes depending on the selected gain setting (switch GAIN); at GAIN = 1000, output = 1 V; at GAIN = 500, output = 0.5 V; at GAIN = 2000, output = 2 V.

- (4) Switch "**FILTER (Hz)**" ("**HIGH CUT OFF**") is used to set the upper frequency limit. This filter permits some smoothing of the ECG signal. When selecting the filter setting, note that "excessive filtering" may reduce the amplitude of the steep parts of the trace (R-wave)!

The switch setting should therefore always be selected from the top downwards, i.e. always start with 500 Hz, then switch to the lower steps (200 Hz - 100 Hz) and observe the amplitude (height of the R-wave). With excessive filtering the amplitude of the R-wave is reduced and the trace is no longer true.

The filter acts simultaneously on all leads.

- (5) Switch "**GAIN x1000**". This switch selects the amplification for all leads simultaneously. The actual gain is obtained by multiplying the selected switch position by 1000: at "0.5" the gain is then x500, at "1" it is x1000, and at "2" it is x2000.
- (6) Switch "INPUT". Using this switch all signal inputs can be simultaneously switched on (position ON) and switched off (position OFF). The setting of the switch does not affect the input impedances of the input circuit.
- (7) Input socket (RJ45), 8-way (for details see Section 0). The input circuit of the isolating amplifier has a floating input and can withstand voltages up to 200 V DC.

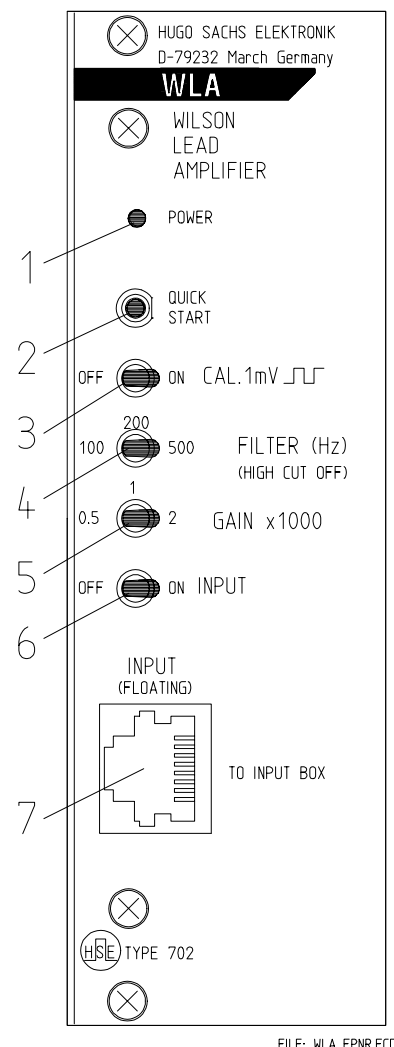


Fig. 4: Controls

8. Frequent errors, causes and remedies

Error: No output signal, although input cable is connected correctly.

Cause: Input switched off.

Remedy: Set switch "**INPUT**" to "**ON**".

Error: Signal amplitude very small. Deflection on recorder or screen barely visible.

Cause: Amplification "**GAIN**" too small.

Remedy: Increase amplification (switch "**GAIN**"). The recorder or monitor used may not have sufficient sensitivity.

Error: Interference on the ECG signal through "mains hum" (superimposed 50 Hz interference).

Cause: - Not all the 4 electrode leads are connected up.

- There is a source of 50 Hz interference close to the electrodes (mains cable, lamp etc.)

- Electrode resistances are too high.

Remedy: - Check the electrode leads for proper connection to the electrodes.

- Search for source of 50 Hz interference and remove it, or provide screening to prevent interference pick-up.

- High electrode contact resistances enhance interference pick-up. Check electrode contact and improve if necessary.

Error: R-wave not clearly defined but flattened.

Cause: Excessive filtering, selected filter step is too low.

Remedy: Set filter "**HIGH CUT OFF**" to 500 Hz and observe the recorder. Switch down to 200 Hz and 100 Hz and watch the shape of the R-wave. The R-wave must not change its height, otherwise the selected filter step is too strong.

NOTE: for representing the R-wave of an ECG signal at the correct amplitude the recorder must have a sufficiently high frequency limit (30 - 100 Hz). "Slow" potentiometric recorders, so-called laboratory recorders (usually with a width of 250 mm) are not suitable.

Error: Output shows only square-wave signals.

Cause: The Cal generator is still switched on and the input is switched off.

Remedy: Set switch "**CAL. 1 mV**" to "**OFF**" and switch "**INPUT**" to "**ON**".

9. Maintenance and cleaning

The PLUGSYS modules do not readily require any maintenance. The **WLA** module is supplied fully calibrated. Any contact with or modification of the electronic circuit invalidates the warranty and the product liability of the manufacturer.

The front panel can be cleaned if necessary with a slightly moistened (not wet!) cloth. Before cleaning, always pull out the mains supply plug to ensure operator safety!

No moisture must find its way into the unit and especially not into the switches and keys, since this leads to corrosion at the switch contacts resulting in faulty operation. In general the PLUGSYS housing should be protected against splash water and salt solutions as this may damage individual components and may cause a short-circuit!

10. Transport and storage

In order to avoid transport damage when returning the unit to the factory, the PLUGSYS housing should be packed in a suitably large carton. (The carton should allow a spacing of about 10 cm all round to provide sufficient space for padding material, e.g. polystyrene, foam plastic or similar, to absorb any shocks.) When shipping an individual module it should also be protected by adequate padding and should first be enclosed in antistatic foil or envelope.

11. CE Conformity



This product and accessories conform to the requirements of the Low-Voltage Guideline 73/23/EWG as well as the EMC Directive 89/336/EWG and are accordingly marked with the CE symbol. For conformity with the standard it is essential that the details in these Instructions are strictly observed during operation.

12. Block diagram of the WLA module

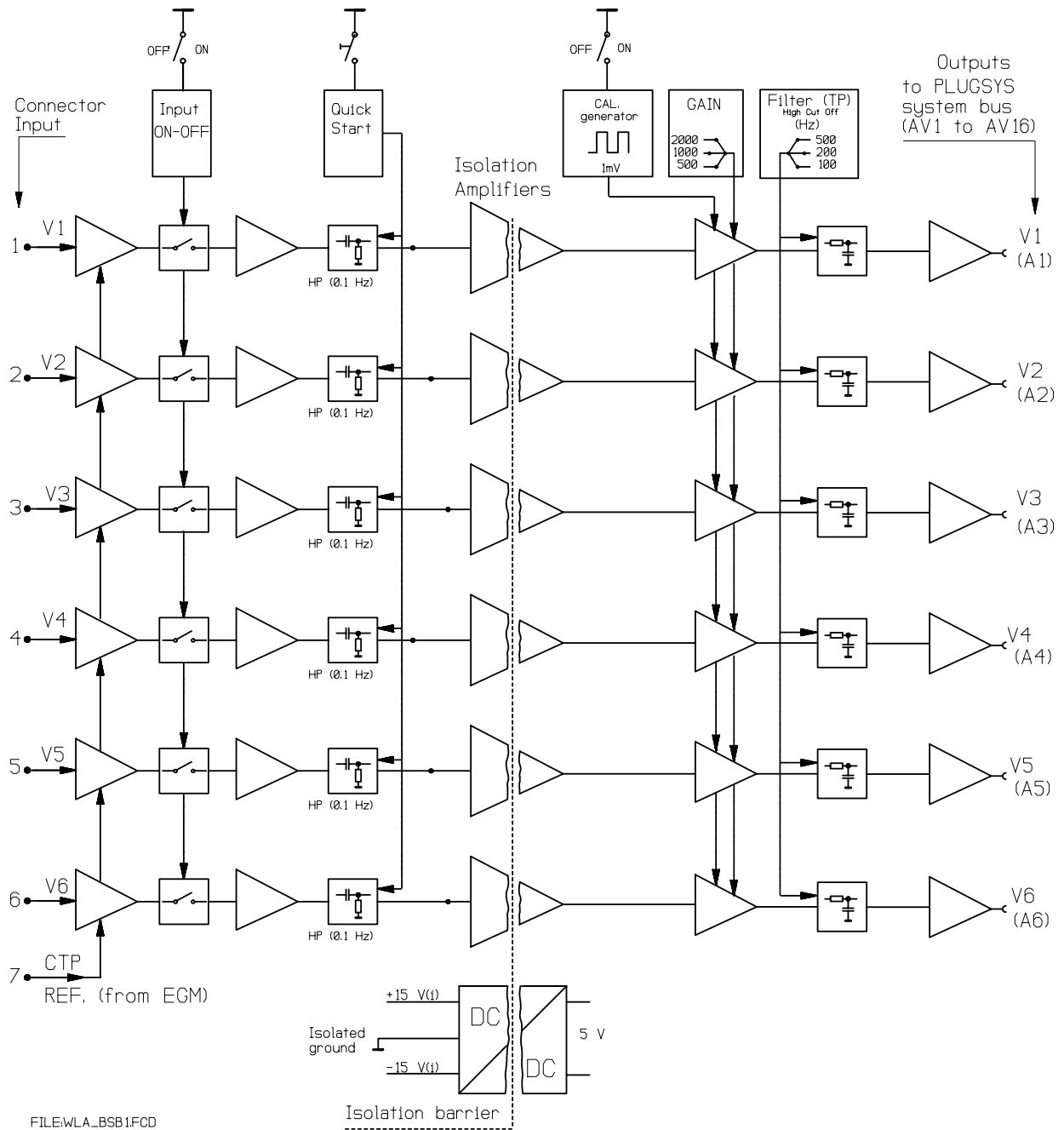


Fig. 5: Block diagram

13. Technical data

ECG leads:	6 unipolar chest leads after Wilson: V1 to V6.
Input circuit:	isolated input circuit (floating input), max. isolation voltage 200 V DC
Input impedance:	10 ⁷ Ohm
Filter:	low-pass filter 100 Hz, 200 Hz and 500 Hz high-pass filter 0.1 Hz, fixed
Gain:	in position x0.5 500 in position x1 1000 in position x2 2000
Calibration:	square-wave signal 1 mV, 2 Hz (120 min ⁻¹). The calibration signal is switched on with a toggle switch.
Recorder outputs:	the outputs of the 6 ECG leads are linked to the PLUGSYS bus system by cable jumpers. The connection to the recorder is made through the Recorder Output Module (ROM) installed in the PLUGSYS system.
Ambient conditions:	operating temperature: 10 to 40°C humidity: 20 to 80% rH, no condensation storage temperature: -20 to +60°C
Supply:	5 V 1.2 A, supplied through PLUGSYS system bus

Mechanical data:

Dimensions:	module for PLUGSYS housing width 8 E (40.8 mm) height 3 U (128.7 mm) depth Eurocard (220 mm)
Connector:	DIN 41612, 96-way VG connector RJ-45, 8-way
Weight:	430 g
Accessories:	Operating Instructions
Input box: (must be ordered separately)	- input box with 4 + 6 inputs for simultaneous use of this WLA module Type 702 and an EGM module Type 701 for 4 bipolar Einthoven extremity leads (I, II, III) and unipolar Goldberger extremity leads (aVR, aVL, aVF) with correct internal connection of the CTP.