

# Operating Instructions

## for the PLUGSYS® Module

### ROM RECORDER OUTPUT MODULE TYPE 670

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## 1. Introduction, manufacturer's details

These Operating Instructions describe the operation and use of the **ROM** Module Type 670. 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<sup>®</sup> module is manufactured by:

HUGO SACHS ELEKTRONIK-  
**HARVARD** APPARATUS GmbH  
Gruenstrasse 1  
D-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

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## Trademark

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## 2. Safety note



**Important:** This equipment is not suitable for operation in hazardous areas and/or in a flammable atmosphere.

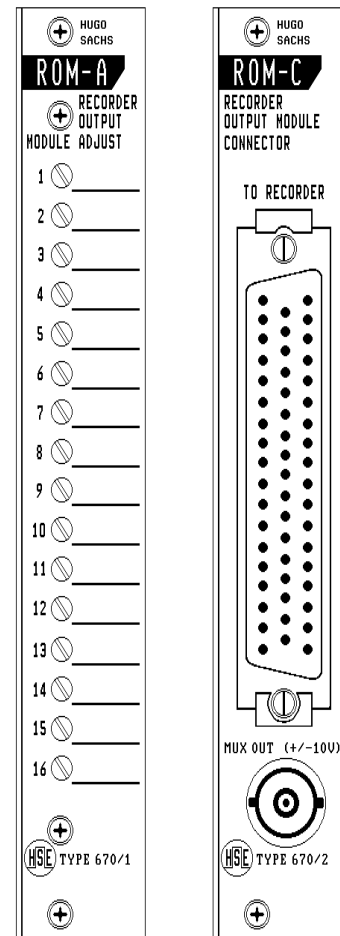
### 3. General description

The HSE RECORDER OUTPUT MODULE ROM Type 670 is the central analogue output of the PLUGSYS measuring system. It forms the central connection of all analogue outputs of the individual function modules to a recorder or monitor.

The ROM consists of two individual modules which are linked together inside the PLUGSYS system. These are the modules ROM-A (Adjust) and ROM-C (Connector). On the ROM-A the outputs of all 16 channels can be attenuated by means of potentiometers. This function serves to adapt the signal voltage to the input sensitivity of the recorder. ROM-C only contains an output connector to which a distributor with 16 BNC output sockets (Connector Block) is connected. The output lines are run through the 50-pin connector of ROM-C to the Connector Block with 16 BNC output sockets and can be linked there to the recorder. The output impedance of each output is 100 Ohm.

The units ROM-B and ROM-T are available as options. ROM-B carries 8 BNC sockets so that it is possible to use two ROM-B modules to take out all 16 analogue channels. The ROM-B modules are installed next to the ROM-C module since the signal lines of the ROM-B are connected to the ROM-C. There is provision for fitting them either at the front or at the back of the rack housing.

The extra module ROM-T (Trigger I/O) has two trigger outputs and two trigger inputs. This extra module can be fitted either at the front or at the back of the rack housing.



**Fig. 1:**  
**ROM-A and ROM-C**

### 4. Construction

The ROM Recorder Output Module Type 670 consists of two sub-modules designed for the HSE PLUGSYS measuring system.

Each sub-module occupies one slot; module ROM-C can be fitted either at the front or at the back of the housing. ROM-C together with the output cable to the connector block is normally fitted for space reasons on the back of the housing. The sub-module "Adjust" (ROM-A) occupies one slot on the front panel, corresponding to 1 x 4E width units (4 width units = 20.2 mm). The output lines are run through sub-module ROM-C on the back and through a link cable approx. 3 m long to a connector block with 16 BNC output sockets. A writing panel is provided on the side of the connector block, protected by transparent plastic foil; it can be used to mark the 16 output sockets AV-1 to AV-16.

## 5. Signal inputs

The signal inputs of the Recorder Output Module (ROM-A) are connected inside the PLUGSYS housing through a 96-pin connector directly to the analogue distribution lines (AV-1 to AV-16) of the PLUGSYS system bus.

## 6. Signal outputs AV-1 to AV-16

The signal outputs are wired in the ROM-C to a 50-pin connector. The output impedance of the outputs is 100 Ohm each. The signal voltage of the outputs can be adjusted with trimmers on the ROM-A to match the input sensitivity of the recorder to which they are connected.

### Suitable output connector:

Subminiature D-connector

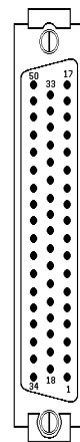
Type: TMC-P-50-503-833, supplier: Erni

Connector housing with slide lock:

Type: KSG-184-005 + 414-749, supplier: Erni

### The output socket details are as follows:

|     |    |   |       |                                    |
|-----|----|---|-------|------------------------------------|
| pin | 1  |   | AV-01 | output 1                           |
| pin | 2  |   | AV-02 | output 2                           |
| pin | 3  |   | AV-03 | output 3                           |
| pin | 4  |   | AV-04 | output 4                           |
| pin | 5  |   | AV-05 | output 5                           |
| pin | 6  |   | AV-06 | output 6                           |
| pin | 7  |   | AV-07 | output 7                           |
| pin | 8  |   | AV-08 | output 8                           |
| pin | 9  |   | AV-09 | output 9                           |
| pin | 10 |   | AV-10 | output 10                          |
| pin | 11 |   | AV-11 | output 11                          |
| pin | 12 |   | AV-12 | output 12                          |
| pin | 13 |   | AV-13 | output 13                          |
| pin | 14 |   | AV-14 | output 14                          |
| pin | 15 |   | AV-15 | output 15                          |
| pin | 16 |   | AV-16 | output 16                          |
| pin | 17 |   | A-GND | signal zero of the output voltages |
| pin | 32 |   | OUTAM | output MUX-OUT                     |
| pin | 18 | - | 31    | not used                           |
| pin | 33 | - | 50    | not used                           |



**Fig. 2:** Output connector

## 7. Signal output MUX-OUT

The signal output MUX-OUT provides a facility for reproducing all output signals of the PLUGSYS modules on a recorder channel or a display unit (e.g. oscilloscope). This function permits very easy functional testing of the individual channels or signals. This function is also very useful during calibration of the system since e.g. the zero of each bridge amplifier can be checked very simply. A further possibility is when there are insufficient recorder channels; use of the MUX function permits simple switching between all channels.

The signal required is selected with the key (MUX ON) which is fitted on each module. Pressing this key switches the output signal of the particular module to the BNC socket MUX-OUT on the ROM-C and to the BNC socket MUX-OUT at the head of the connector block.

The key function is self-maintained. This facility permits the output signals of the individual amplifier modules to be switched to the MUX-OUT output. When the equipment is switched on a POWER-UP RESET signal is generated which switches off all MUX outputs. As a result the output MUX-OUT only carries a signal when one of the MUX keys is pressed. The output impedance is 100 Ohm and the maximum signal voltage  $\pm 10$  Volt.

## 8. Adjusting the output voltage AV-1 to AV-16

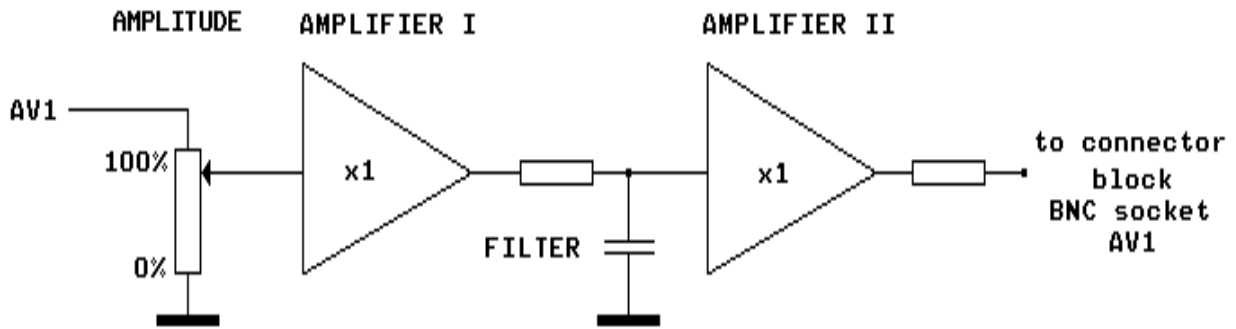
The signal amplitude of all analogue outputs is adjusted on trimmers on the front panel of the ROM-A module. The 16 trimmers are numbered 1 to 16 corresponding to AV-1 to AV-16. To the right next to the trimmers is a small writing panel to mark the setting.

**NOTE:** The trimmers permit an attenuation of the signal of 100% of the input amplitude (trimmer fully anticlockwise). The voltage at the output is then 0 Volt, the signal voltage is completely suppressed. In general the signal should only be attenuated if the recorder is overloaded. When installing a system it is important to ensure that all trimmer are fully clockwise in order to avoid attenuating the signal unnecessarily.

**9. Block diagram**

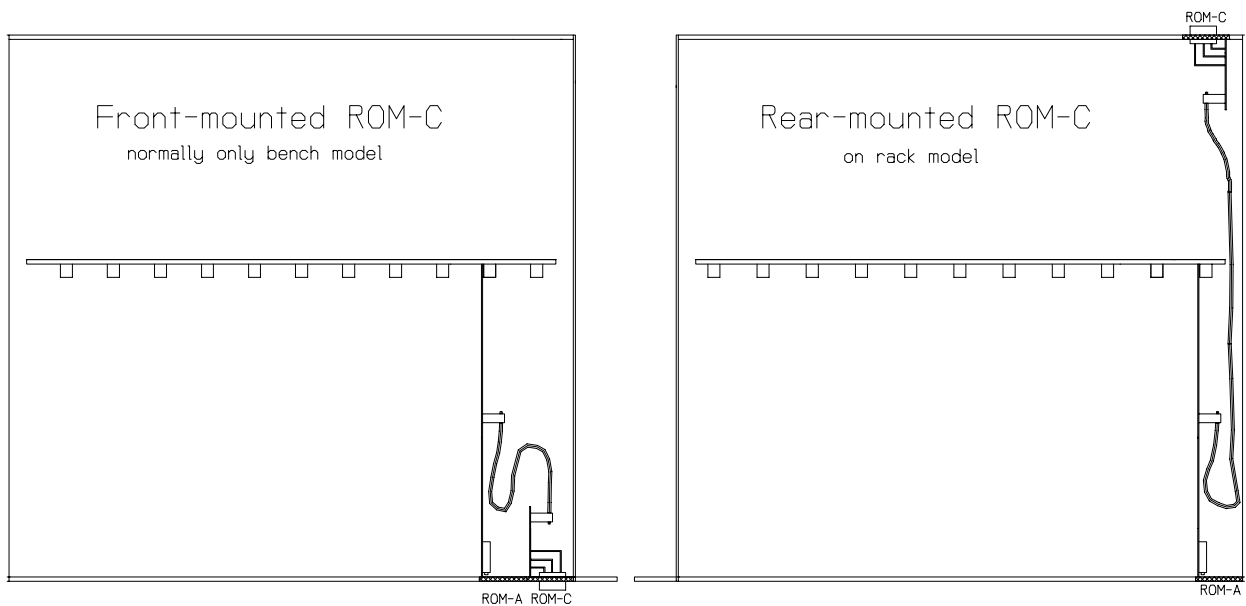
3 shows a block diagram of the first analogue distributor channel AV1. From the output of any module the signal passes to the AV line AV1. A trimmer potentiometer on the ROM can be used to attenuate the signal of each channel. From the trimmer the signal passes through a voltage follower to the low pass filter.

Through a further voltage follower the signal then passes to the connector block or to the ROM-B where it can be picked off on the BNC socket AV1.



**Fig. 3:** Block diagram AV1

**10. Installing the modules ROM-A and ROM-C**



**Fig. 4:** Installation diagram

**11. 96-pin connector to the PLUGSYS system bus**

VG connector, 96-pin, rows a, b and c used

| Row a    | Pin No. | Row b    | Pin No. | Row c    |
|----------|---------|----------|---------|----------|
| DGND     | 1       | DGND     | 1       | DGND     |
| AGND     | 2       | AGND     | 2       | AGND     |
| + ANALOG | 3       | + ANALOG | 3       | + ANALOG |
| - ANALOG | 4       | - ANALOG | 4       | - ANALOG |
| DB-0     | 5       | DAV      | 5       | TRIG 1   |
| DB-1     | 6       | NRFD     | 6       | TRIG 2   |
| DB-2     | 7       | NDAC     | 7       | TRIG 3   |
| DB-3     | 8       | R/W      | 8       | TRIG 4   |
| DB-4     | 9       | DS-1     | 9       | RDVM     |
| DB-5     | 10      | B-INT    | 10      | AM       |
| DB-6     | 11      | DV-1     | 11      | AV-1     |
| DB-7     | 12      | DV-2     | 12      | AV-2     |
| CS-0     | 13      | DV-3     | 13      | AV-3     |
| CS-1     | 14      | DV-4     | 14      | AV-4     |
| CS-2     | 15      | DV-5     | 15      | AV-5     |
| CS-3     | 16      | DV-6     | 16      | AV-6     |
| GS-0     | 7       | DV-7     | 17      | AV-7     |
| GS-1     | 18      | DV-8     | 18      | AV-8     |
| GS-2     | 19      | DV-9     | 19      | AV-9     |
| DS-2     | 20      | DV-10    | 20      | AV-10    |
| /RESET   | 21      | DV-11    | 21      | AV-11    |
| TAKT     | 22      | DV-12    | 22      | AV-12    |
| X1       | 23      | X6       | 23      | AV-13    |
| X2       | 24      | X7       | 24      | AV-14    |
| X3       | 25      | X8       | 25      | AV-15    |
| X4       | 26      | X9       | 26      | AV-16    |
| X5       | 27      | X10      | 27      | CAL      |
| POWER-0  | 28      | POWER-0  | 28      | POWER-0  |
| POWER-1  | 29      | POWER-1  | 29      | POWER-1  |
| POWER-2  | 30      | POWER-2  | 30      | POWER-2  |
| SHIELD   | 31      | SHIELD   | 31      | SHIELD   |
| + 5 VOLT | 32      | + 5 VOLT | 32      | + 5 VOLT |

## 12. Description of the signal lines used

### 12.1 Power supply

**+5 Volt** supply voltage of the digital circuit components and the DC/DC converter to supply analogue circuit components.

**DGND** Reference zero of the 5 Volt supply

**AGND** Reference zero of the analogue supply and the input and output signals.

**SHIELD** Ground (mains potential), only provided for screening. Do not use as ground connection.

**Note:** The reference zeroes of the individual voltages are connected together centrally on the terminator module inside the PLUGSYS housing (AGND with DGND with SHIELD, star ground connection).

### 12.2 Analogue Multiplex signal output (AM)

Analogue output signal  $\pm 10$  Volt. The output signal of amplifier units is switched through a key (MUX ON) on the front panel of each module to the AM signal line (Analogue Multiplex). The signal can be taken from the BNC socket MUX OUT on the ROM-C or on the connector block. The function of the MUX key is self-maintained. At the same time the line RDVM (Reset Digital Voltmeter Multiplex) is activated. This ensures that the previously selected module is disconnected from the AM (Analogue Multiplex) signal line. In this way the output signals of the individual amplifier units can be switched to a central analogue or digital indicating unit (e.g. the Digital Voltmeter Module DVM Type 666 or the Display Module DM Type 667). When the equipment housing is switched on a POWER-UP RESET signal is generated which switches off all analogue multiplex outputs.

### 12.3 Analogue signal lines (AV1 to AV16)

The analogue signal lines AV1 to AV16 (analogue bus) are used as input and output lines between the function modules of the PLUGSYS measuring system. The maximum signal voltage is  $\pm 10$  Volt. The assignment of the inputs and outputs is determined by jumpers on the function modules. The function of the modules is therefore independent of the slot position on the system bus.

To explain the use of the AV lines, 5 shows an arrangement of 4 modules for logging and evaluating left ventricular pressure. The first DC bridge amplifier is used to amplify the left ventricular pressure signal. The LVP output signal of this module is passed through a jumper to the analogue bus line AV1. In the differentiator the LVP signal is taken off the bus line AV1 and differentiated. As output we obtain  $dp/dt$ , the extreme values  $dp/dt_{max}$ ,  $dp/dt_{min}$  and the end diastolic pressure LVEDP.  $dp/dt$  is fed into AV2, the maximum to AV3, the minimum to AV4 and LVEDP to AV5. The quotient module forms the ratio of  $dp/dt_{min}$  to  $dp/dt_{max}$  which is then fed to AV6. The perfusion pressure signal is amplified by the second DC bridge amplifier and fed to AV7. The signals are passed through ROM-A and ROM-C to the connector block or to ROM-B and can be taken off there on the BNC sockets.



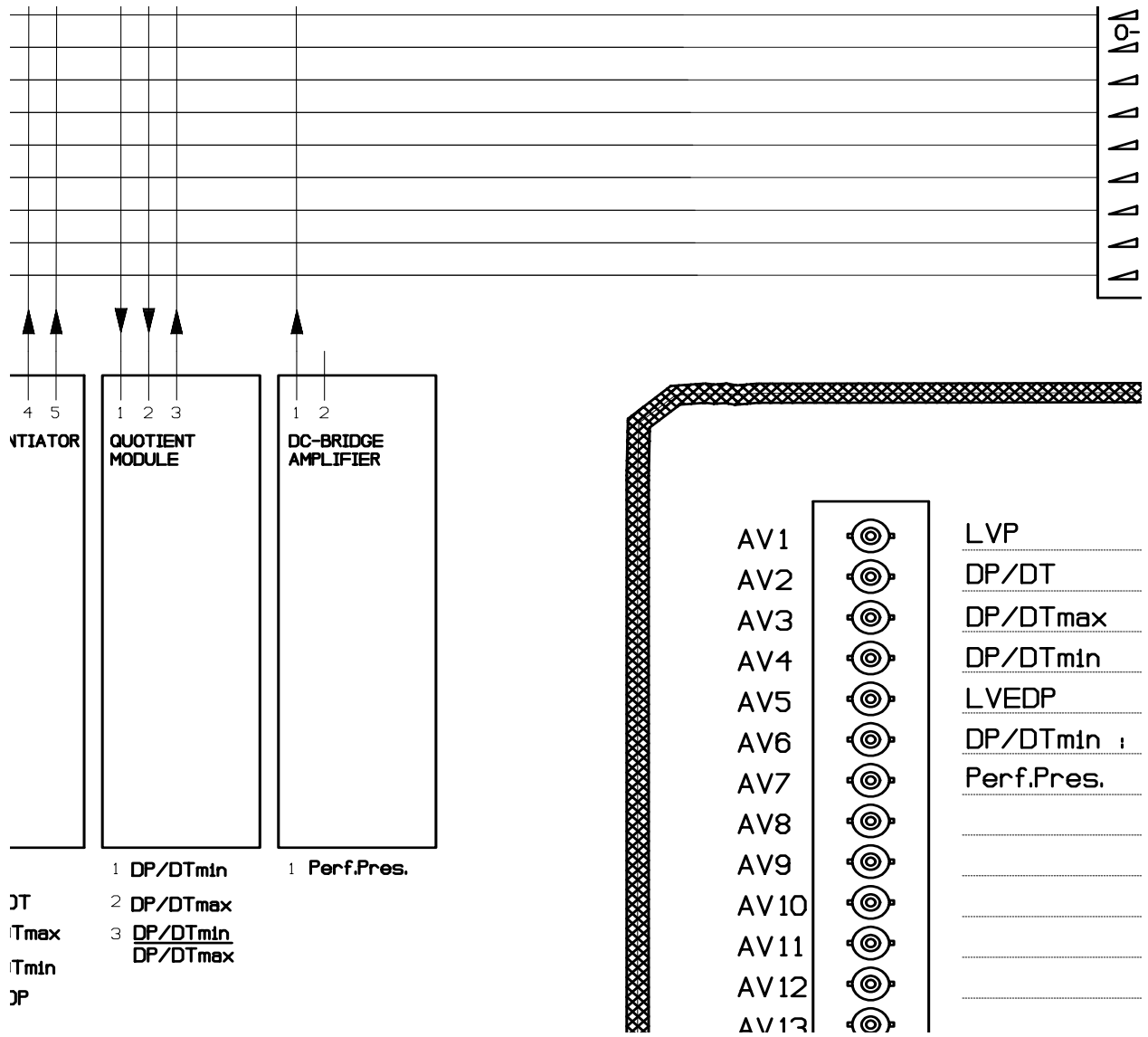


Fig. 5: Analogue signal lines AV1 to AV16

### 13. Options ROM-B and ROM-T

The Recorder Output Module consists of the following sub-modules:

- ROM-A Type 670/1 (Adjust module)
- ROM-C Type 670/2 (Connector module) with connector block

The following additional modules are available as options:

- ROM-B Type 670/3 (Module BNC connectors 1-8)
- ROM-B Type 670/4 (Module BNC connectors 9-16)
- ROM-T Type 670/5 (Trigger I/O module)

#### Option ROM-B

ROM-B consists of a front panel 8E wide (40.4 mm) which carries 8 BNC sockets. Two of these modules are required to take out all 16 channels through BNC sockets. These two ROM-B modules are installed on the back of the housing next to the module ROM-C and linked to the latter through a ribbon cable.

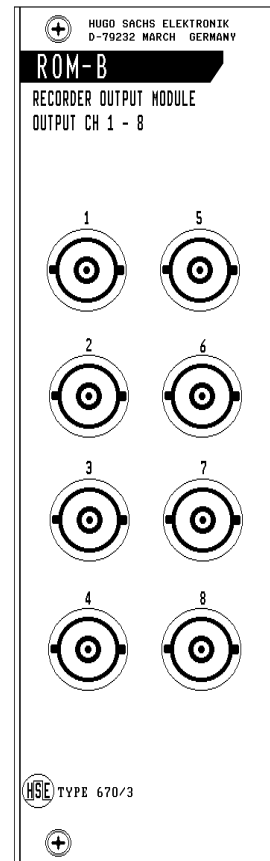


Fig. 6: ROM-B

## Option ROM-T

The ROM-T (trigger I/O) consists of a front panel 4E wide (20.2 mm) which carries 4 BNC sockets. The upper two BNC sockets (1 and 2) serve as trigger outputs, the lower two BNC sockets (3 and 4) as trigger inputs. The ROM-T is linked through a ribbon cable to the module ROM-A which carries the trigger circuit.

### Trigger outputs, BNC sockets OUT 1 and OUT 2:

Here it is possible to trigger an external unit, such as an oscilloscope, from a PLUGSYS module. Modules with trigger output are e.g. the Heart Rate Module HRM Type 669, the Differentiator DIF Type 664, the Max-Min Module MMM Type 668 and the Programmable Stimulator PSM Type 676.

On these modules the trigger lines TRIG1 to TRIG4 can be selected through jumpers. It is important to ensure that a particular trigger line is not selected twice. If a trigger line is used, the selection should be noted in the bus line diagram in the handbook.

**Note:** Only the trigger lines TRIG1 and TRIG2 are taken outside as trigger outputs. The trigger output signal is an open collector TTL signal (0 - 5 V) which is active on LOW. A pull-up resistor of 2.2 kOhm is already fitted.

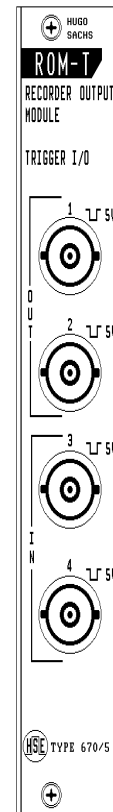


Fig. 7: ROM-T

### Trigger inputs, BNC sockets IN 3 and IN 4:

The lower two BNC sockets (3 and 4) serve as trigger inputs. A TTL or CMOS input signal can be fed in through these two BNC sockets to the trigger lines TRIG3 and TRIG4. This offers the possibility to trigger a PLUGSYS module from outside.

Modules with trigger inputs are e.g. the Max-Min Module MMM Type 668, the Programmable Stimulator PSM Type 676 and the Integrator INT Type 665.

**Note:** Only the trigger lines TRIG3 and TRIG4 are provided as external trigger inputs. The trigger input signal can be a TTL or CMOS signal. All trigger inputs are dynamic and react to a negative flank. The flank slope should be at least 10 V/sec.

14. Installation of modules ROM-A, ROM-C, ROM-B and ROM-T

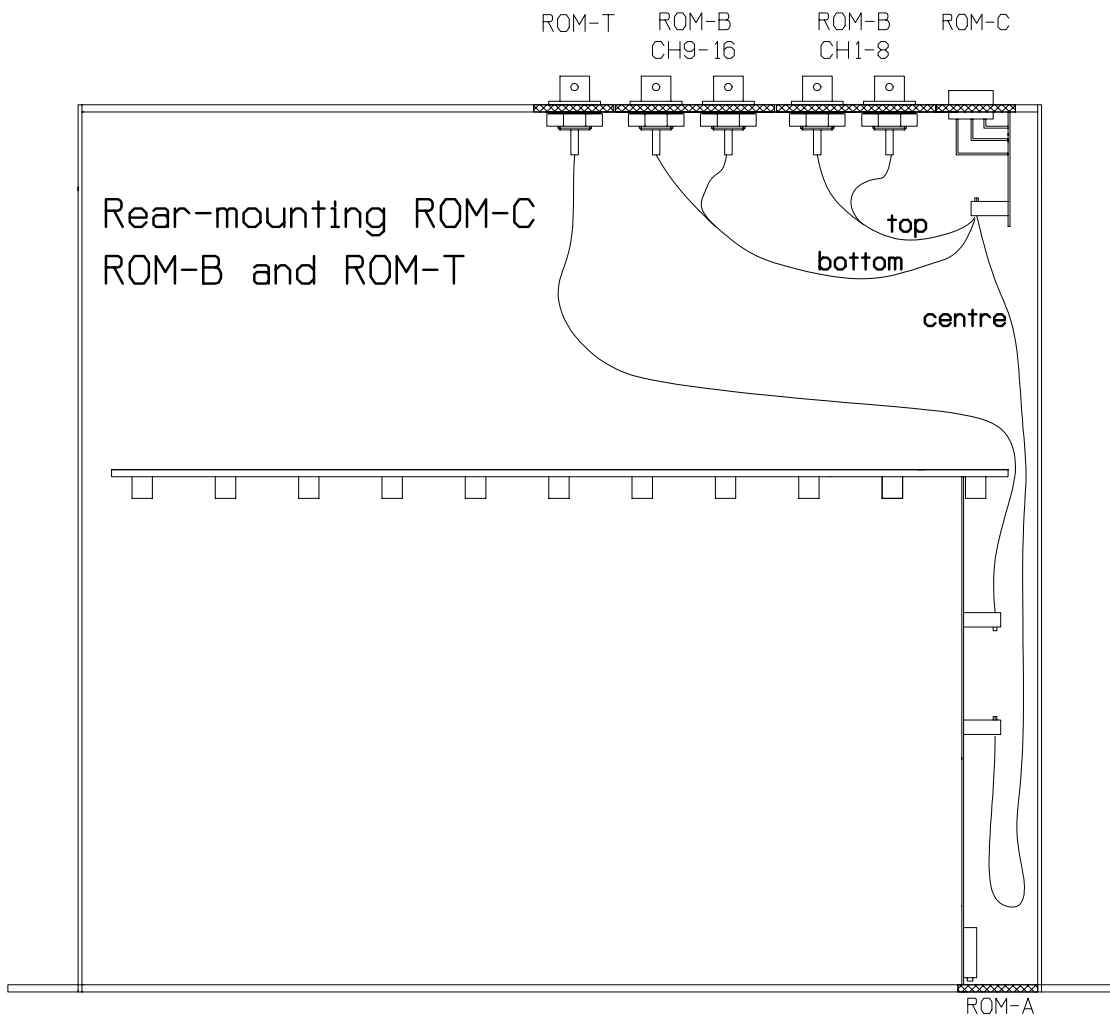


Fig. 8: Installing ROM-A, ROM-C, ROM-B and ROM-T in a rack housing



## 15. CE Declaration of Conformity



This product and accessories conform to the requirements of the Low-voltage Directive 73/23 EEC as well as the EMC Directive 89/336 EEC and are accordingly marked with the CE mark. For conformity to the standards during operation it is essential that the details in the instructions provided are observed.

## 16. Technical data

|                        |   |
|------------------------|---|
| Inputs                 | AV-1 to AV-16 analogue output signals of the function modules, directly connected to the PLUGSYS system bus. The input impedance is 100 kOhm and the signal amplitude $\pm 10$ Volt.<br><br>The MUX-OUT signal (analogue multiplex output) passes through an impedance converter as recorder output to a BNC socket on the front panel. The input impedance is 100 kOhm and the signal amplitude $\pm 10$ Volt. |
| Amplitude adjustment   | The signal output levels are adjustable through trimmers on the ROM-A within the range 0 to $\pm 10$ Volt.  |
| Signal outputs AV 1-16 | centrally through 50-pin output connector on the ROM-C. The output lines are run through a common cable (approx. 3 m long) to a connector block with 16 BNC sockets. The output impedance is 100 Ohm.   |
| Filter                 | All output signals are filtered in the ROM-A. The frequency limit of the low-pass filter is 3 kHz.  |
| Output MUX-OUT         | The BNC socket "MUX-OUT" on the front panel carries the analogue multiplex signal of the function module selected with the MUX key. The output impedance is approx. 100 Ohm.  |
| Supply                 | 5 Volt 300 mA from PLUGSYS system bus   |
| Ambient conditions:    | Operating temperature: 10 to 40°C Relative<br>humidity: 20 to 80%, no condensation<br>Storage temperature: -20 to +60°C   |

## Mechanical data

|            |   |
|------------|---|
| Dimensions | 2 sub-modules, 19 inch rack system,<br>width 4E (20.2 mm)<br>height 3U (127.5 mm)<br>depth Euroboard (220 mm)<br><br>Module ROM-A is fitted on the front of the housing. Module ROM-C is fitted on the back of the housing. |
|------------|---|

|             |  |
|-------------|--|
| Connector   | DIN 41612, 96-pin VG   |
| Weight      | 250 g  |
| Accessories | connector block (16 BNC output sockets)<br>5 output cables<br>Operating Instructions |

**Note:** the output unit for splitting the output signals on BNC sockets is available in two versions:

- (a) connector block version with approx. 3 m cable for connection to the ROM-C

width 4.5 cm  
height 6 cm  
length 32 cm  
weight 1.2 kg

- (b) version with 16 BNC sockets on the back of the housing. 2 front panels, each with 8 BNC sockets. Designation ROM-B (BNC)

width 2 x 8E (2 x 40.4 mm)  
height 3U (127.5 mm)

These 16 BNC sockets are installed on the back of the housing next to the module ROM-C.