

Operating Instructions

for the

PLUGSYS[®] module

TCM Timer Counter Module Typ 686

(Version 1.1 Printed: July 9, 2012 / from Ser. No. 91001)

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1 General description

The HSE Timer Counter Module (**TCM**) Type 686 is a product of HUGO SACHS ELEKTRONIK - HARVARD APPARATUS GmbH, Gruenstrasse 1, D-798232 March-Hugstetten, Germany

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It is a time or event counter module designed for the HSE PLUGSYS system and has been developed mainly for use with the HSE Ventilation Control Module (**VCM**). In this application the **TCM** generates a signal which induces the **VCM** to produce a deep inspiration during the next respiratory cycle. This signal can be produced in the **VCM** at set time intervals (non-synchronised signal) using an internal quartz timer, or after a set number of events (synchronised signal) using the number of respiratory cycles on the **VCM**.

This output signal can also be processed by other PLUGSYS modules or can trigger other operating conditions.

2 Construction

The Timer Counter Module (**TCM**) Type 686 is a module of the HSE PLUGSYS measuring system. It occupies a width of 4E in the 19 inch housing (4E = 4 x 5.08 mm = 20.32 mm = 1 slot width). The connections to the module are made through a 96-pin VG connector to the internal PLUGSYS system bus and form the link (analogue/digital) to the other modules of the system and also to the PC through appropriate interfaces.

The **TCM** uses no dangerous voltages and does not require its own power supply since it draws the necessary supply (+5 V d.c.) from the power supply of the basic housing. It does not require any special supply within the PLUGSYS system and can therefore be inserted into any free slot.

The TCM can only be operated in an HSE PLUGSYS housing. Within this housing in can be used in any combination with other HSE PLUGSYS modules. It must not be used on non-PLUGSYS bus systems which might have similar VG bus connectors as this might damage the **TCM** or the other system; the HSE PLUGSYS system has its own bus definition (see the bus diagram).

3 Installation and fitting in position

The HSE Timer Counter Module (**TCM**) can be inserted in any free slot of the HSE PLUGSYS housing since it does not require any special supply and operates only on +5 V d.c. (**TTL**).

Before fitting it into position in the housing all jumpers and links have to be configured to meet your requirements so that it functions correctly in conjunction with the other modules. It is important that only those connections which are actually required are placed on the appropriate bus lines and that unnecessary jumpers are placed in the parking positions provided; this avoids unnecessary links and prevents possible side effects on other modules (see page 9 ff)

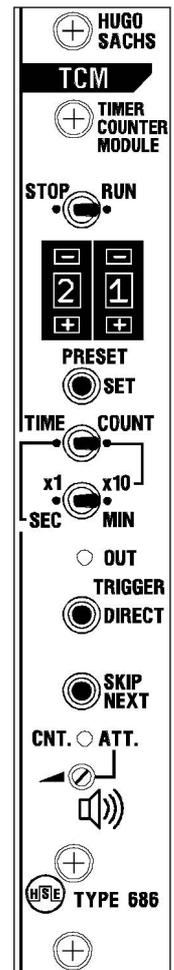


Fig. 1

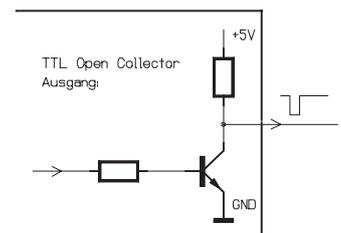


Fig. 2

The HSE modules cannot be damaged through incorrect positioning of the jumpers (e.g. several outputs on a single bus line); all digital system outputs which can be configured (no analogue outputs are used in this module) are arranged as **TTL** open collector outputs (see Fig. 2). In some cases it may even be desirable to provide logic links for several outputs so that several outputs can trigger the same input of another module.

When you have made all these connections correctly and entered them in the bus diagram of the PLUGSYS housing you can fit the module in position. You insert the circuit board into the top and bottom guide rails at the particular slot and slide the module towards the back until the 96-pin connector engages. The module can then be secured in the housing with the Phillips head screws supplied. To withdraw the module the operations are performed in the reverse order; a certain amount of force is required to disengage the 96-pin connector.

4 Test/starting up

When you have set the jumpers correctly on the circuit board and fitted the module in the PLUGSYS housing you can start up the system and test the **TCM**.

To do this you set the switch TIME/COUNT to TIME,
 the switch SEC/MIN to SEC,
 the 2-position digit switch PRESET to 20 and the STOP/RUN switch to RUN.

The **yellow LED** at the lower part of the front panel should now flash every second. After 10 seconds this LED becomes permanently ON and should go dark briefly every second. You then hear a short beep every second (synchronised with the LED going dark briefly) provided the loudness control of the electronic beep has not been turned fully anticlockwise. At the end of these last 10 seconds there is a brief flash of the **green LED TRIGGER OUT** which indicates the output pulse.

The indication of the counting pulses and of the output pulse through LEDs is used because of the very small mechanical size of the module in which it has not been possible to provide a decimal output of the internal counter reading.

The beep and the "dark flashes" of the LED indicate the last 10 seconds (in the TIME mode) or the last 10 input pulses of the count (in the COUNT mode) in order to warn of the next output pulse. This is done for the following reason: In many experiments it is undesirable at certain times to carry out a particular action. In the **TCM** the user is warned by the beep that an output pulse will be produced shortly. If desired it can be cancelled at any time using the SKIP NEXT key; after pressing this key the next output pulse is simply omitted and output pulses start again at the following one.

Please note that this function cannot be cancelled once the SKIP NEXT key has been pressed, except if you switch one of the following controls: STOP/RUN, PRESET, SET, TIME/COUNT, x1/x10 SEC/MIN; operation of any of these controls does however reset the internal counter to the beginning! Irrespective of the internal counter it is always possible at any time to produce an output trigger pulse by operating the TRIGGER DIRECT key.

If the TIME mode does not operate in accordance with the above description you should first check the switch positions indicated above. It is also possible that the internal SYNC jumper has been set; this may cause the **TCM** to be reset by other modules and interfere with the TIME function. Set the SYNC jumper to its parking position (see description of the jumpers, Fig. 4, page ?).

If the **TCM** is still not operating correctly there may be a hardware problem (for suitable suggestions see: Problems/faults, page 13).

In the TIME mode you can extend the time range by setting the selector switch SEC/MIN to MIN. The time setting is then measured in minutes and the range is extended from 00-99 seconds to 00-99 minutes (0 - 5940 seconds).

In the TIME mode the Perfusion Pressure Control Module **TCM** is not synchronised to the other modules and operates from its own quartz-controlled timer.

If you want to use the HSE Timer Counter Module (**TCM**) as counter and synchronised to other PLUGSYS modules you need only set the switch TIME/COUNT to the COUNT position and the 2-digit selector switch PRESET (00-99) to the required number of counting pulses. The counting range can be extended by setting the switch x1/x10 to position x10; this extends the range to a total of 990 pulses, with the smallest count being 10 pulses. When operating in this mode you must however be sure that the jumper row TRIGGER IN on the circuit board of the **TCM** uses the same trigger bus line as the trigger output line of your other module which generates the counting pulses.

5 Setting the functions

The individual functions of the HSE Timer Counter Module (**TCM**) together with the appropriate settings will now be described in detail.

The details in square brackets "[]" refer to the corresponding items in the next section Controls and to Fig. 3.

5.1 Time mode

The TIME mode of the **TCM** allows the user to trigger a certain action in another module at particular time intervals, corresponding to a non-synchronised operating mode.

In the TIME mode the **TCM** operates with a quartz-controlled timer which counts down to "00" after the time has been set, and then resets its counter back to the preset value. A brief output pulse is produced on reaching "00".

In this mode it is important that the internal jumper for the output pulse in the **TCM** (TRIGGER_OUT) is set to the same bus line (TRIG1/2/3/4) as the input to the other module.

The TIME mode is switched on by setting the switch TIME/COUNT [4] to TIME.

5.1.1 Time setting

The time interval between the output pulses produced is set using the 2-digit decimal selector switch PRESET [2] on the front panel (00-99). The timing range can be switched from seconds to minutes with the selector switch SEC/MIN [5]. The result is a timing range from 01 to 99 seconds in 1-second steps, or from 01 to 99 minutes (5940 seconds) in 1-minute steps.

Each time the selector switch [2] or the switch [5] is operated the internal counter of the **TCM** is set directly to the preset value. It is therefore unnecessary to enter the count with the key SET [3].

When the selector switch [2] is set to "00" a continuous output signal (0 V) is produced irrespective of the timing range setting on [5]; this is taken by some modules to represent a continuous ON. Generally modules respond only to signal changes (flanks) and a continuous signal cannot be interpreted correctly by these modules.

5.1.2 Time indication

The mechanical dimensions of the **TCM** did not permit incorporation of a decimal time indication and a count indicator CNT. has therefore been fitted. This consists of a yellow LED CNT./ATT. [9] at the lower part of the front panel. In the TIME mode this LED flashes briefly every second to indicate that the **TCM** is operating correctly.

5.1.3 Pulse warning

The TCM incorporates a special ATTention function in order to warn of an output pulse. This function is indicated visually by the LED CNT./ATT. [9] and audibly through the built-in sounder (beep).

The pulse warning comes into action when the internal timer drops below 10 seconds. The LED CNT./ATT. is switched on and from now onwards this LED goes dark once every second in order to continue indication of the counting function. In addition to this "dark flash" a short beep is produced which can be adjusted with a spindle trimmer [10] to be more or less loud or completely off. This trimmer should only be adjusted with the screwdriver supplied or some other suitable one (width 3 mm max.).

5.1.4 SKIP NEXT function

It is possible at any time to suppress the next output pulse using the key SKIP NEXT so that the intended triggering of the other module can be prevented in certain situations. Please note that this decision cannot be reversed. The status is reset only when the internal counter reaches "00" (at which no output pulse is produced). When this key has been pressed, and unless another key/switch is operated, the output of pulses only starts again with the following pulse.

However, it is possible at any time and irrespective of other switch positions to produce an output trigger pulse using the key TRIGGER DIRECT [7],

5.1.5 Switching the TCM on or off

The complete function of the **TCM** can be switched off at any time with the toggle switch STOP/RUN [1]. The internal counter is always reset to the set value of the digit switch when switching from STOP to RUN.

5.2 COUNT mode

The COUNT mode of the **TCM** permits the user to trigger a particular action of another module at intervals controlled by events; this represent synchronised operation.

In the COUNT mode, events are counted down inside the **TCM** in a preset counter; at the end of the count a brief output pulse is produced and the counter is reset automatically.

In this mode it is important to ensure that the internal jumper for the output pulse inside the TCM (TRIGGER_OUT) is set to the same bus line (TRIG1/2/3/4) as the input of the module to be triggered. In addition the jumper TRIGGER_IN in the **TCM** must be set to the same bus line (TRIG1/2/3/4) which is selected in the module providing the counting events.

To switch on the COUNT mode the switch TIME/COUNT [4] must be set to COUNT.

5.2.1 Count preset

The count setting for the number of counted input pulses between the generated output pulses is set on the 2-digit decimal selector switch PRESET [2] on the front panel (00 - 99). The counting range can be extended with the switch x1/x10 [5] by the corresponding factor. This results in a counting range of 01 to 99 events in 1-pulse steps, or 010 to 990 events in 10-pulse steps.

Each time the selector switch [2] or the toggle switch [5] is operated the internal counter of the **TCM** is set directly to the preset value. It is not necessary the enter the count separately with the SET key [3].

On setting "00" on the preset counter [2] a continuous output signal (0 V) is produced irrespective of the counter setting on [5]; this is interpreted by certain modules as continuous ON. The modules generally respond only to signal changes (flanks) and a continuous signal cannot be interpreted correctly by these modules.

5.2.2 Count indication

The mechanical dimensions of the **TCM** did not permit incorporation of a decimal time indication and a count indicator CNT. has therefore been fitted. This consists of a yellow LED CNT./ATT. [9] at the lower part of the front panel. In the COUNT mode this LED flashes briefly every second to indicate that the **TCM** is operating correctly.

5.2.3 Pulse warning

The **TCM** incorporates a special ATTention function in order to warn of the output pulse. This function is indicated visually with the LED CNT./ATT. [9] and audibly through the built-in sounder (beep).

The pulse warning comes into action when the internal counter counts the last 10 input pulses. The LED CNT./ATT. is switched on and from now onwards this LED goes dark once on each input pulse in order to continue indication of the counting function. In addition to this "dark flash" a short beep is produced which can be adjusted with a spindle trimmer [10] to be more or less loud or completely off.

This trimmer should only be adjusted with the screwdriver supplied or some other suitable one (width 3 mm max.).

5.2.4 SKIP NEXT function

It is possible at any time to suppress the next output pulse using the key SKIP NEXT so that the intended triggering of the other module can be prevented in certain situations. Please note that this decision cannot be reversed. The status is reset only when the internal counter reaches "00" (at which no output pulse is produced). When this key has been pressed, and unless another key/switch is operated, the output of pulses only starts with the following pulse.

However, it is possible at any time and irrespective of other switch positions to produce an output trigger pulse using the key TRIGGER DIRECT [7].

5.2.5 Switching the TCM on or off

The complete function of the TCM can be switched off at any time with the toggle switch STOP/RUN [1]. The internal counter is always reset to the set value of the digit switch when switching from STOP to RUN.

6 Controls

6.1 STOP/RUN

[1] Toggle switch to switch all functions of the HSE Timer Counter Module (TCM) on and off. STOP: stops the internal timer or internal event counter and blocks the trigger output signal. RUN: starts the internal timer or internal event counter and sets the time/event counter to the preset value on the decimal digit switch [2].

6.2 PRESET

[2] Decimal digit switch (00 - 99) to preset the timing or counting to the required value. The units and tens can be increased [+] and decreased [-] with the small keys above and below the indication. On each changeover the internal timer or event counter is set automatically to the selected value. At the setting "00" the trigger output is permanently ON!

6.3 SET

[3] This key sets the internal timer or event counter immediately to the preset value.

6.4 TIME/COUNT

[4] Toggle switch to operate the TCM as timer or event counter. TIME: timer. The count can be changed with [5] to minutes or seconds. COUNT: event counter. The count can be changed with [5] by the factor x1 or x10. On each changeover the counter is reset immediately to the preset count.

6.5 SEC/MIN x1/x10

[5] Toggle switch to apply a factor to the internal time/event counter and thus extend the counting range. In the TIME mode it switches between seconds and minutes (00 - 99 seconds / 00 - 99 minutes). In the count mode it changes between

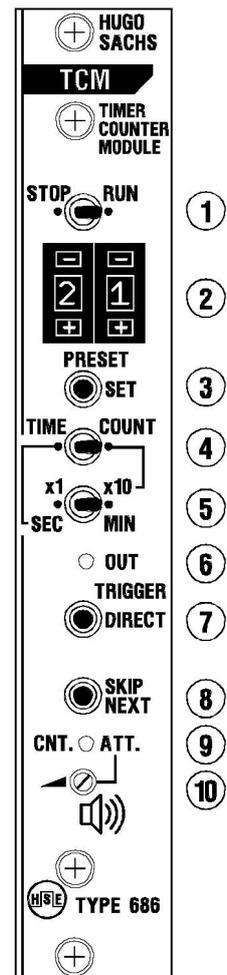


Fig. 3

00 - 99 and 000 - 990 counting pulses. On each changeover the counter is reset immediately to the preset count.

6.6 TRIGGER OUT

[6] Indicator (green LED), lights up with each output pulse: at the end of the set time / at the completion of the set counting pulses / on continuous trigger (00).

6.7 TRIGGER DIRECT

[7] Key for producing a trigger output pulse at any time and without affecting the internal counter.

6.8 SKIP NEXT

[8] Key operated at any time to omit the next trigger output pulse generated by the **TCM**. In other respects the counter continues running normally. The audible warning system which warns of the output pulse during the last ten pulses is switched off. This function cannot be cancelled by the keys and is only reset after the internal counter has run down. Operating this key has no other effect on the internal counter count.

6.9 CNT./ATT.

[9] Indicator (yellow LED) to indicate the counting pulses. This LED flashes briefly once every second (TIME) or at each input pulse (COUNT). On reaching the last ten counting pulses the LED switches to ON and goes dark briefly on each counting pulse in order to warn of the next output pulse. At the same time the audible warning is switched on (see [10])

6.10 ATT.

[10] Spindle trimmer to adjust the loudness of the audible warning before the next output pulse (during the last ten input pulses). Clockwise rotation: increase loudness. Anticlockwise rotation: reduce loudness. Anticlockwise against stop - off. This trimmer is operated with the screwdriver supplied or with some other suitable screwdriver (width 3 mm max.).

7 Internal jumpers

7.1 Trigger input/output

The interface to the other PLUGSYS modules on the **TCM** goes through the so-called trigger lines (TRIG1 - TRIG4, see bus diagram on page 15). They can be used on every module as input and/or output and carry **TTL** logic level (0, +5 V d.c.). The **TCM** can utilise both variants: as input [J4] for the event count and as output [J3] to trigger certain operating states after a particular time or after a certain number of input pulses. In this connection it is important that the correct signal from the correct module is used as input to the **TCM** and that the output signal generated is wired through the correct trigger line to the correct module. The position of the jumpers is shown in Fig. 4 .

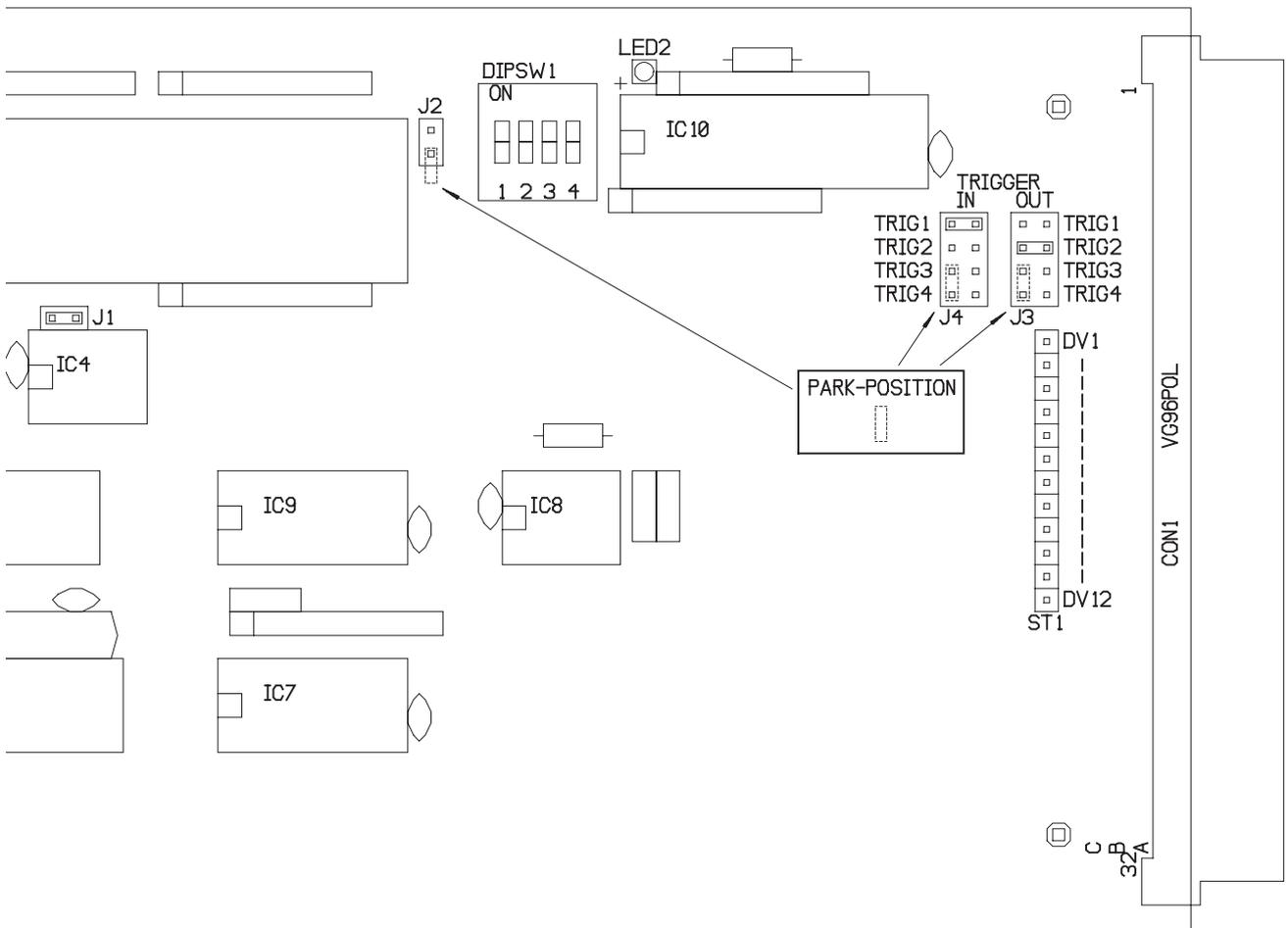


Fig. 4

7.2 Description of the jumpers

- J1:** RESET jumper, links the "watchdog timer" to the CPU. Must only be removed for testing during servicing and has no function during normal operation of the TCM, but must be plugged in!
Normal jumper position: set.
- J2:** SYNC jumper. If this jumper is set there is a simple synchronisation of the TCM to the input signal. This means that the internal clock is reset to the preset time as soon as an input pulse is present. When this jumper is in position the **TCM** should only be operated in the TIME mode. Normal jumper position is the parking position (see Fig. 4, page 9).
- J3:** TRIGGER OUT jumper. This connects one of the bus lines TRIG1 - TRIG4 to the output signal generated by the **TCM** (after the internal counter has run down). The jumper position must be aligned with the input of the PLUGSYS module to be triggered by the **TCM**.
- J4:** TRIGGER IN jumper. This connects one of the bus lines TRIG1 - TRIG4 and selects from these signals the trigger source. The jumper position must be aligned with the output of the module whose TRIGGER OUT signal is to be used as counting pulse in the **TCM** (only in the COUNT mode of the **TCM**). If this jumper is in the parking position the COUNT mode of the **TCM** cannot be selected.

7.3 Example of a jumper configuration

In order to illustrate the function of the jumpers an example of a jumper configuration is given below. The arrangement consists of a PLUGSYS system fitted with an HSE Ventilation Control Module (**VCM**) Type 681 and an HSE Timer Counter Module (**TCM**). The **VCM**, like the **TCM**, has connections to the TRIGGER lines of the PLUGSYS bus:

- (1) **TRIG-IN** (DEEP INSPIRATION IN): if this signal is applied to the **VCM** the next cycle triggers a deep inspiration.
- (2) **TRIG-OUT1** (EXPIRATION/INSPIRATION): this signal produces the off/on respiration cycle (+5 V= expiration/0 V= inspiration).
- (3) **TRIG-OUT2** (DEEP INSPIRATION OUT): produces a signal output during the deep inspirations.

The following jumpers must be set:

- on the VCM:**
- (1) TRIG-IN (DEEP INSP IN) on position TRIG2 as input signal from the **TCM**.
 - (2) TRIG-OUT1 (EXP/INSP) on position TRIG1 as output signal to the **TCM**.
 - (3) TRIG-OUT2 (DEEP INSP OUT) as parking position "NC".
- on the TCM:**
- (1) TRIGGER IN on position TRIG1 as input signal from the **VCM**.
 - (2) TRIGGER OUT on position TRIG2 as output signal to the **VCM**.

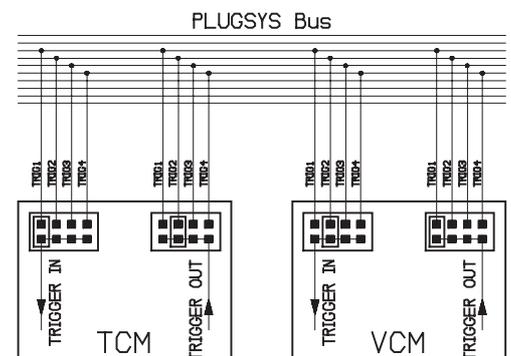


Fig. 5

The positions of the jumpers in the **VCM** can be taken from the Operating Instructions of the **VCM**. The positions on the **TCM** are explained in detail in the section "Trigger input/output" on page 9 and in Fig. 4.

After these settings the **TCM** can be used in the **TIME** mode to produce in the **VCM** a deep inspiration at preset time intervals (non-synchronised). And in the **COUNT** mode of the **TCM** the **VCM** performs a deep inspiration after a preset number of normal respiratory cycles (synchronised).

8 Example of TIME- and COUNT-Mode for VCM

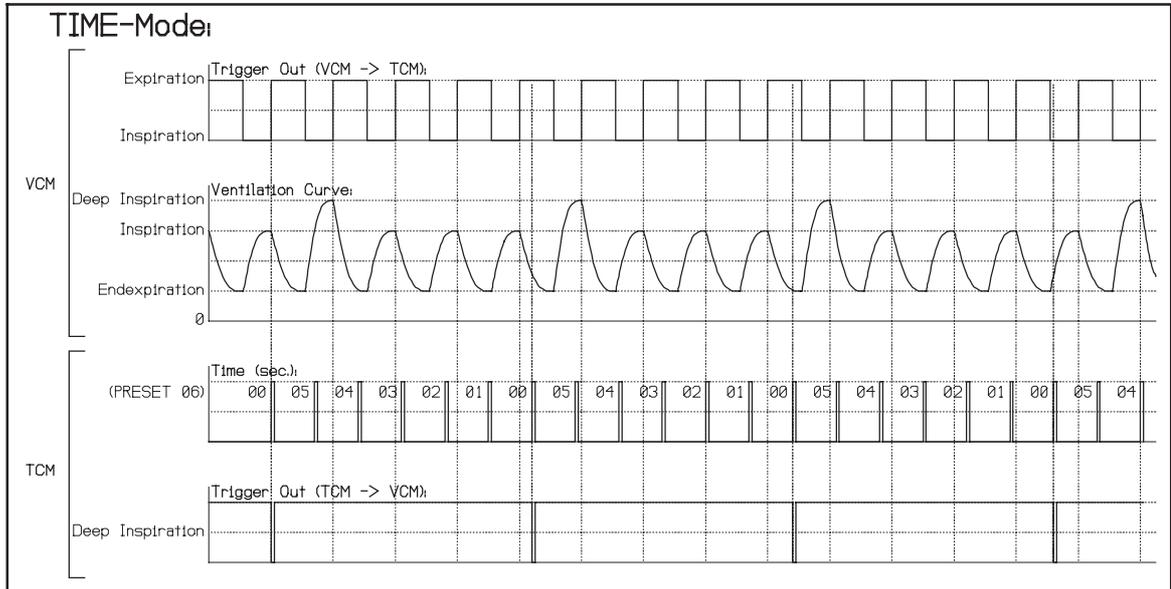


Fig. 6

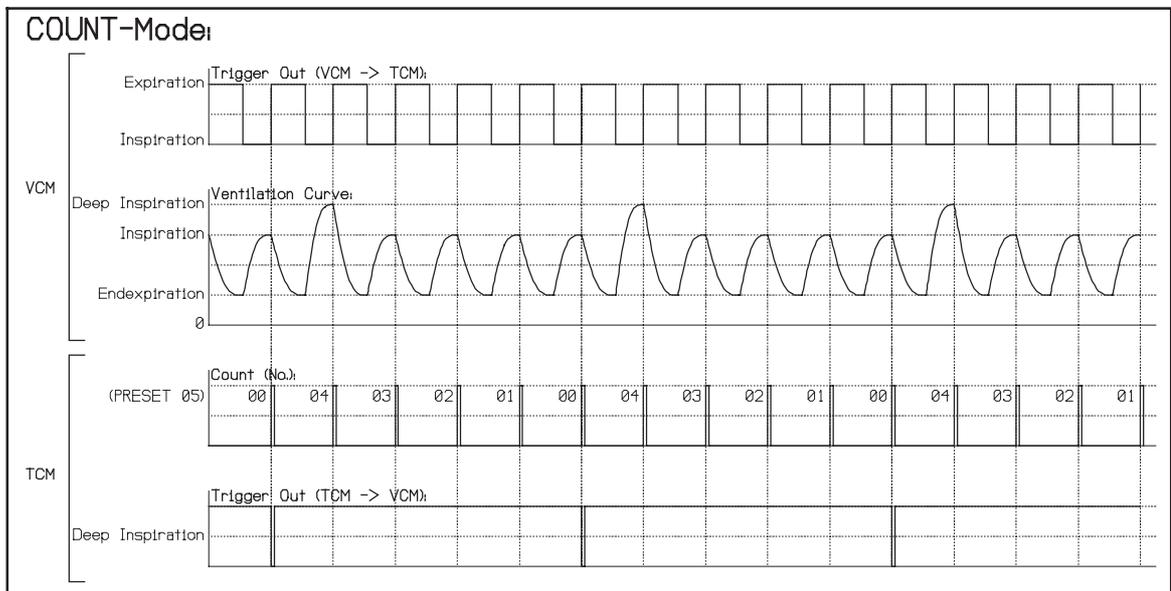


Fig. 7

9 Software interface

It is also possible to generate a DIRECT trigger pulse from a PC/XT/AT/286/386/486 (IBM or compatible, preferably an HSE Process Controller), and thus trigger other PLUGSYS modules which do not have their own PC interface. This does however require a suitable software, an **ICI** Type 659 and a **BI** Type 657. The corresponding card address can be set on the 4-way DIP switch DIPSW1 on the circuit board (see Fig. 4 on page 9) according to the following table:

Addr.	SW-1	SW-2	SW-3	SW-4
00	ON	ON	ON	ON
01	ON	ON	ON	OFF
02	ON	ON	OFF	ON
03	ON	ON	OFF	OFF
04	ON	OFF	ON	ON
05	ON	OFF	ON	OFF
06	ON	OFF	OFF	ON
07	ON	OFF	OFF	OFF
08	OFF	ON	ON	ON
09	OFF	ON	ON	OFF
10	OFF	ON	OFF	ON
11	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON
13	OFF	OFF	ON	OFF
14	OFF	OFF	OFF	ON
15	OFF	OFF	OFF	OFF

10 Problems/faults

In case of faulty operation of the instrument please check first the switch positions and the jumper positions. Also check the jumpers on the other modules in case they affect the TCM (through jointly used bus lines, see also section "Installation and fitting in position" on page 3, 4). If the problem persists please check the basic functions of the TCM as in section "Test/starting up" on page 3, 4. If this does not help please do not try to repair the unit yourself as it does not contain any components which can be rectified by the user. Please contact us. Try to describe the problem; important points include the operating mode of the module, the position of the switches and jumpers on the TCM as well as on the other modules of the PLUGSYS system.

In such a case contact us at the following address:

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www.harvardapparatus.com

We shall then be happy to deal with your problem.

11 Maintenance and servicing

The HSE Timer Counter Module (TCM) Type 686 requires no special maintenance. It contains no batteries or cells which are subject to rapid ageing. It is advisable to ensure adequate cooling of the module, i.e. the ventilation slits in the housing (top and bottom) must not be obstructed.!

To clean the unit please use a dry or slightly moistened cloth. No moisture must enter the interior of the unit, and in particular the switches and keys, since this may lead to corrosion at the switch contacts, interference with operation and also actual damage.

12 Connections of the PLUGSYS system bus

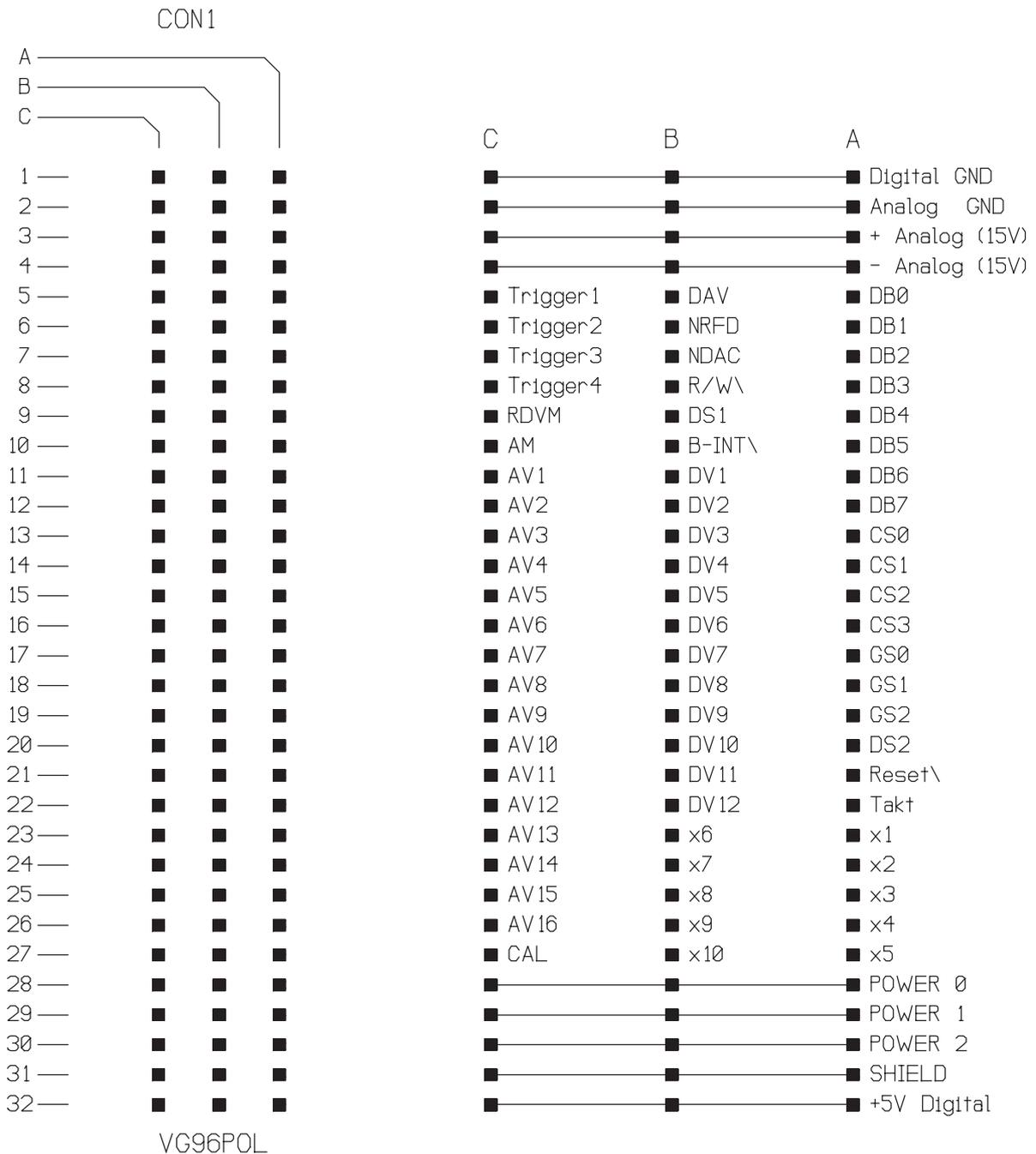


Fig. 8

13 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.

14 Technical data of the TCM

Dimensions:	19 inch module	width 4 E (20.1 mm) height 3 U (128.4 mm) depth Euroboard (220 mm)
Weight:	300 g	
Connector:	DIN 41612, 96 pin VG	
Accessories:	4 internal jumpers, screwdriver, Operating Instructions	
Supply:	+5 Volt / 400 mA from the PLUGSYS system bus	
Mode selection:	time counter (TIME) 00 - 99 seconds / 00 - 99 minutes event counter (COUNT) 00 - 99 pulses / 000 - 990 pulses pulse warning visual and audible	
Input:	TRIGGER IN (TTL) selected TRIG1 - TRIG4 through internal jumpers	
Output:	TRIGGER OUT (TTL) selected TRIG1 - TRIG4 through internal jumpers	
Ambient conditions:	operating temperature:	15 to 40 °C
	relative humidity:	20 to 80 %, no condensation
	storage temperature:	-20 to 60 °C