P R O F E S S I O N A L   T I M I N G

PRECISION TIME BASE - PTB 605

V3.3-E, 26 July 2000

USER'S MANUAL AND TECHNICAL DESCRIPTION

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1. INTRODUCTION

The **PRECISION TIME BASE (PTB) 605** is a compact 16 channel timer that allows for the recording and storage of more than 18,600 times. Controlled by a highly precise laboratory grade thermo-compensated quartz oscillator, the 16 input channels and 3 data output channels (one of them being bi-directional) makes this device the ideal choice for many demanding sports-timing applications in conjunction with PC's and other downstream systems. The timing resolution on the printer port is expressed to $1/10,000^{th}$ / second (.0001) although the PC port allows for full access to the $1/250,000^{th}$ / second (0.00001) The PTB can be triggered from zero or from a pre-selectable time-of-day in the 24 hour format.

The PTB Timer has 3 RS 232 serial data ports, and can be connected directly to a PC (with bi-directional data communications), to a serial printer, and to an information display board, all simultaneously. Through the use of a connected PC, timing calculations and/or results can be channeled back through the PTB to a printer and a display board, all without using more than one serial (COM) port on the PC- a very practical solution for most laptop systems.

The operator can choose to operate the system in ON-LINE or OFF-LINE mode, transferring time data immediately as it is produced or after the timing session is completed. An extensive memory in the PTB stores all times (over 18,600 of them) in a sequential FIFO method with each timing session being assigned a different number. New times generated in a new timing session always start with #1. Up to 128 different timing sessions can be individually stored and recalled.

Each PTB has a unit ID number that is engraved on the unit's chassis and likewise stored in the memory of the device. This ID number is carried on the data stream from the output ports to allow for the use and identification of many separate PTB's if all connected to a networked PC system.

The PTB has minimal hardware controls with all operating parameters adjustable through simple ASCII software commands introduced via the bi-directional RS 232 I/O port. Function keys on the PTB allow for the simple creation of new timing sessions, the clearing of available memory, or to send stored data to a connected printer.

Sophisticated power management allows for the use of on-board alkaline or rechargeable Ni-Cad batteries, or external secondary sources. Power alarms in the form of flashing LED's and messages on the printer and computer data ports warn of approaching battery exhaustion. In the worst case scenario, the PTB automatically shuts itself off and memorizes all times recorded before the batteries completely fail.

TAG Heuer has specifically developed the unique PTB 605 to take full advantage of use with a computerized timing system solution using an attached PC running appropriate timing software. Many specific software systems are available for the PTB, developed either by us or by independent software suppliers for many sports and other applications. Please contact us for a complete list of recent software resources for your PTB 605.

2. TECHNICAL DESCRIPTION

The PTB 605 has the following components.

On the rear panel:

1.   1x   ON-OFF Switch

2.   1x   "Banana" jack for synchronization

3.   4x   "Banana" jacks for inputs 1 to 4

4.   1x   "COMPUTER" 9 Pin Serial RS232 DB-9 connector for data connection to a Computer

5.   1x   " MULTI" 25 Pin DB 25 connector making available all 16 inputs and keypad functions

6.   1x   "DISPLAY" 3.5mm jack for Serial RS 232 data output to a display board

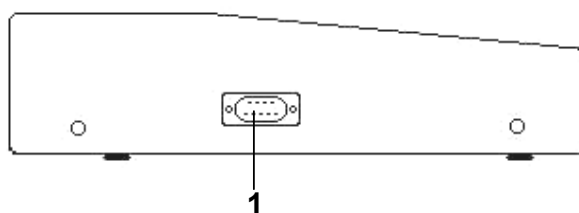**7.**   1x   External POWER and battery charger jack

Rear View
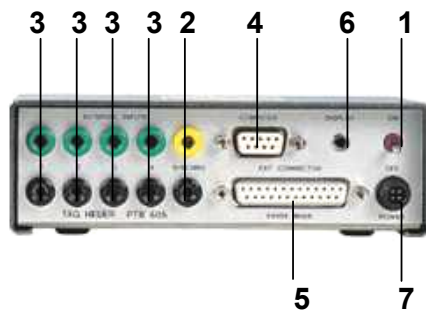
On the right side of the PTB 605:

1   "PRINTER" 9 pin RS 232 Serial data connector for connection to a printer

Lateral view


1

On the top of the PTB 605, a sealed-membrane keyboard featuring:

1. Function Keys:

    a. SESSION   Creates a new timing session
    b. CLEAR   Clears the memory
    c. MEMORY   Outputs memory to a computer and/or Printer
    d. VALID   A safety key - confirms the selection of the preceding
                       Keys

2. 4x   Green LED's that serve as indicators for the activation of inputs 1 to 4

3. 4x   Keys to manually trigger inputs 1 to 4.

4. 4x   Keys to block and unblock external inputs 1 to 4

5. 4x   Red LED's to indicate the blocking status of inputs 1 to 4

6. 1x   LED to indicate the status of ON mode and the state of the batteries
           Green LED = power from batteries, Red LED = External Power

View from Above
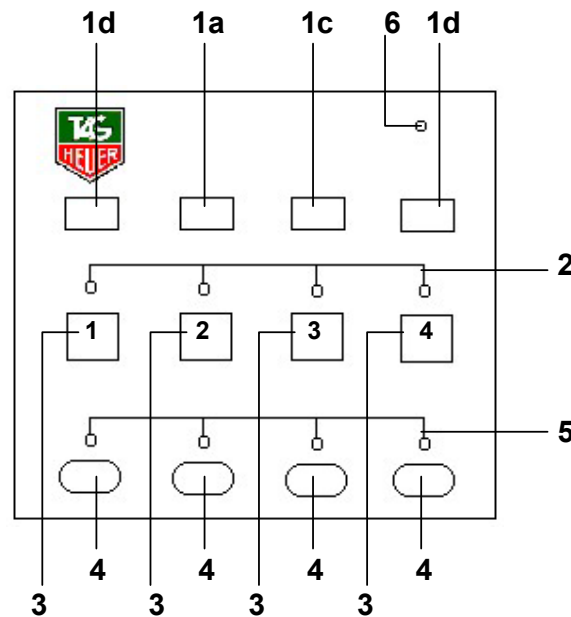
3. ON and OFF MODES

PTB only
Primary power to the PTB is provided by the internal batteries. When the PTB is first turned on, with no external power connected the POWER LED should be Green. If it flashes, the batteries must be replaced, or if they are rechargeable batteries, recharged. Whenever an external power supply is connected to the PTB, the POWER LED turns Red.

PTB 605 + TAG Heuer PTB Printer
External power for BOTH the attached printer and the PTB is furnished via the POWER input jack on the PTB Printer.

It is important to first check the condition of the internal batteries in the PTB using the POWER LED BEFORE connecting the External AC/DC adaptor !

In the OFF mode, a separate internal battery for the RTC circuit (recharged when the PTB is in the ON mode) assures that the date and time-of-day, data in memory, and configuration parameters are preserved for a minimum of 3 months.

When the PTB 605 is switched to the ON position, the following information is printed after the TAG Heuer Logo and likewise sent to the Computer port:

```
PTB 605 N' 1234
22.01.99
SESSION     4
MEMORY FREE  12 447
```

Line 1 indicates the ID number of the device, which corresponds to the chassis serial number.
Line 2 is the date dd.mm.yy
Line 3 indicates the timing session number.

When the PTB is switched on, it creates a new timing session in each case. If 3 previous sessions were resident in the memory, a 4th session is created.

Line 4 indicates the number of lines of memory available for new timing data to be recorded. The total capacity of the PTB 605 is 18,687 times (1 time for each memory line)

The PTB's minimal hardware controls are deliberate. Controlling the PTB's functions and settings is meant to be accessed using a PC and appropriate control software. The sport or application specific software you run on your PC with your PTB should have the ability control all of the parameters of the PTB 605 using the simple ACSII control codes described in Chapter 9 of this manual.

Each PTB 605 is likewise provided with a computer connection cable and TAG Heuer control software on 3½" floppy disks. The disks contain the program **ptb605.exe** which will allow you to interface with the timer and control all functions from your PC or Laptop even if you do not have application specific software.

This **ptb605.exe** program we provide is a useful tool and will allow you to quickly set up and use your PTB as a stand-alone device. It can also be incorporated into your own programming for control of the PTB. In conjunction with the description of **Function Controls** in section 9, you can easily opt to use this control program, or use a control screen of your own design.

4. HYPER TERMINAL ™ (Found in Windows 95)

Most users of Windows ™ products will know that your computer probably has this useful communications application on your hard drive. **Hyper Terminal** may be a limited and rudimentary communications program, but most people have it on their modern PC's and in a pinch it will allow you to communicate and control the PTB 605 from any PC or Laptop even if the ptb605.exe control program we provide is not available to you. Note also that **any** basic communications program (Procom, Xtalk…) will allow you to work with the PTB to control settings and operating parameters using the ASCII codes described in the **Adjusting Parameters** and **Serial String Data Format** sections of this manual.

Once in Hyper Terminal, use the following commands in the pull-down menus to connect to and control the PTB:

To set the transfer Protocol:

```
 FILE
        PROPERTIES
               PHONE NUMBER
                      CONNECT USING
                             DIRECT TO COM1
                                    CONFIGURE
                                           9600
                                           8
                                           None
                                           1
                                           xon / xoff
```

To make it easy to see the text on the screen as it comes in at the selected port:

```
FILE
       SETTINGS
              ASCII SETUP
                     ASCII RECEIVING
                            Append Line Feeds
                            Wrap Line Feeds
```

To save the incoming ASCII data to a specific text file for use later with another program:

```
TRANSFER
       CAPTURE TEXT
              FILE
                     (Specify here a path and file name you wish to use)
                            START
```

Explore the features of HyperTerminal and you will see that you can route data to a printer, and do some formatting that might be helpful in your timing application.

Note: It is essential to send CTRL-Q to the PTB to open the COMPUTER port for serial communications (XON) before ANY data will be available from the PTB605.

5. SYNCHRONIZATION - "TOP" OF TH E MINUTE

When the PTB is first turned on, it defaults to its internal Time of Day as taken from the RTC circuit and is immediately ready for synchronization and then subsequent timing operations. Normally, the first input triggering will occur on the synchronization inputs (yellow/black banana jacks) marked **SYNCHRO** This causes the internal clock of the PTB to begin running from the preset Time of Day (seconds always start from zero)

<div align="center">

SYNCHRO   13:12:00.0000

</div>

The degree of timing precision (here in this example: $1/10,000^{th}$) on the attached printer is selectable in the set-up parameters of the PTB. After synchronization, the SYNCHRO input jacks become disabled. Only if a new timing session is created is a new synchronization possible. Note that one may select a new timing session and retain the previous session's synchronization by starting the new session with an impulse received on any of the external inputs 1 to 16. Synchronization is lost when the PTB is turned off (OFF Mode).

If it is necessary to record the synchronization signal on any of the other inputs from 1 to 16, one can (as our example here uses input #4) connect the input in parallel with the SYNCHRO plugs. On the printer, we would get:

<div align="center">

SYNCHRO   13:12:00.0000
1   4 13:12:00.0000

</div>

Although the PTB uses the date and time-of-day stored in its RTC clock memory as the default synchronization point, it is of course possible to select **any time of day**, including zero, from which to synchronize the internal clock. To access this feature, the attached computer sends the **SET DATE** command and the operator then introduces the selected time.

A synchronization pulse is required after a new time is selected via the computer to effect the time change.

The PTB produces its own very useful **synchronization output reference pulse every minute** via the 25 pin connector. At the "top" of every minute, pins 22 and 23 output an opto-isolated impulse that can be used to trigger and synchronize other timing devices to the exact time of day as the PTB, or for other timing references or controls

Note : Whenever the PTB is turned on, it gets date and time information as permanently managed by its own internal RTC (Real Time Clock) circuit as in most PC's. This RTC circuit is not however anywhere nearly accurate enough to be used as the time-base for actual timing during the PTB's operations. No common RTC Circuit is. After synchronization, **the PTB uses its own highly precise thermally compensated quartz time-base for actual timing**, but this time-base does not manage month and year data. If the PTB is being used in extensive timing operations, it is not recommended to use the **QD** Command (asks for the date and time in the PTB at that particular moment) in any month following the original activation of the PTB, since the date indicated would be incorrect.

6. TIMING

Triggering impulses arriving at the different inputs of the PTB are all numbered sequentially up from 1 to a maximum of 49,999. All time-of-day times are identified along with the external input channel number on which they were generated, ranging from channel 1 to 16, or with M1 to M4 in the case of manual impulses generated by the keypad buttons. Example of printing output:

$$
\begin{array}{rrl}
2 & 4 & 13{:}12{:}16.2345 \\
18 & M3 & 14{:}01{:}00.4693 \\
49{,}999 & 1 & 23{:}59{:}59.9999
\end{array}
$$

Sequential numbering (counting) of times from input channel triggering is increased by one sequential number for each **external** and each **manual** impulse received. A manual impulse for channel 3 (M3) will increase the sequential numbering of times counted for input 3 just the same as an external impulse will, and vice-versa.

7. NEW SESSION

A new timing session is created by simultaneously pressing the keys VALID and SESSION, or by switching the PTB on. In the first case, the PTB will print:

SESSION   5   27.02.99

In the second scenario, the whole initial message is printed:

PTB 605 N' 1234
27.02.99
SESSION   5
MEMORY FREE   12,477

When a new session is created, it is possible to synchronize using the **SYNCHRO** input jacks, or to use the synchronization of the previous session (if not switched off) by triggering any of the timing input channels.

8. MEMORY MANAGEMENT

The PTB can memorize up to 18,687 times. Before the memory becomes completely filled, (with 1000 positions still available) the following message is sent:

MEMORY FULL

If the memory is completely full, one can continue timing without problems, however new times will begin to overwrite the oldest times stored in the memory.

Important : The CLEAR function will erase the entire memory (all times and sessions) and create a new timing session No. 1. Once this has happened, a new synchronization can be effected, or the old synchronization can be used immediately

When a printer is attached to the PTB 605, one can select to print **the amount of available memory** still free **with a touch of the MEMORY key only** (*without* using the VALID key simultaneously).

9. CONTROL FUNCTIONS

The PTB monitors the condition of its internal batteries and/or externally connected power supplies as well as the state of an attached printer. It can be powered by 6 alkaline batteries (for about 60 hours at +20C) or Ni-Cad or Ni-Mh rechargeable batteries (AA size). When the voltage of the installed batteries gets to the point that either charging or replacement is necessary, an indicator lamp (Green LED POWER) **begins to flash** and the following message is printed and sent on the PC port:

<div align="center">

BATTERY LOW

</div>

Once this message is displayed, **the autonomy of the device is now limited to 2 hours at +20 C** if internal batteries are only being used. At the point of absolute battery failure, the device automatically shuts down when timing accuracy and subsequent timing data preservation can no longer be assured. Timing data collected to that point is memorized by the device due to another separate memory battery, and the data to that point is not at risk.

Likewise the PTB monitors the presence and activity of a connected printer, and sends the following messages to a computer:

<div align="center">

PRINTER ON   or   **PRINTER OFF**

</div>

These software generated messages are always sent at the beginning of each timing session or during timing if the status at the printer port changes (printer disconnected, printer turned off, or paper out). In these cases, once the printer state is corrected, all data collected and memorized during the interruption of the printer is then sent to the device for printing.

10. ADJUSTING PARAMETERS

When connected to a PC, a dialogue between the PTB and the connected PC can be exchanged to manage the selectable parameters of the PTB 605. **The default parameters** expressed here can be selected/restored at any time by simply pressing **the VALID key as the PTB 605 is switched on.**

This operation (VALID+ON) is necessary to effect when the PTB has not been used for extended periods, or if the computer cannot send messages to the PTB due to some communications conflict (RS232 protocol, speed, parity…).

Adjustable parameters of the PTB are:

	DEFAULTS
▪ Date and time - using the date format of DD/MM/YY	From memory
▪ Printing Precision	housandth/sec.
▪ Serial port speed	9,600 baud
▪ Input 1 lock-out time after impulse reception	1 second
▪ Input 4 lock-out time after impulse reception	0.5 second
▪ All other Inputs lock-out time after impulse reception	0.5 second
▪ Inputs 5 to 16 blocked	No
▪ DISPLAY ASCII running time 1/100 sec.	Disabled
▪ Buzzer	On

11. SERIAL DATA STRING FORMAT

The PTB has minimal keyboard controls and is intended to be controlled mostly from simple ASCII commands received on the COMPUTER connector port (DB9-M) on the rear panel. This COMPUTER port is bi-directional, thus the cable provided allows for data to be received by and transmitted to the PTB on this one PC COM port.

Connector DB9 **COMPUTER**:

Pin :   Function :
2   Transmit Data   (TX)
3   Receive Data   (RX)
5   Signal Ground
8   DTR (Data Terminal Ready)

Protocol RS232 :   9600 baud, No Parity, 8 data bits, 1 stop bit

The ASCII commands listed below allow you to control the functions of the PTB and adjust all parameters. The port is however controlled using the X-on/X-off protocol. **It is necessary to initialize the COMPUTER port on the PTB by first sending ASCII Character #17, which is CTRL-Q.** Once initialized, the COMPUTER port will send you timing data and settings information as requested, and allow the PTB to accept further ASCII commands being sent by the connected PC. **To close the COMPUTER port, ASCII Character #19, CTRL-S, is used.**

The PTB is provided with a small program that simplifies the initialization and control of the PTB, but is not limited to the use thereof. You may access the data in, and control the use of the PTB using any type of communications software or program of your own design.

ASCII Control Codes - Followed by (Space) and (CR):

CTRL-Q   Opens the PTB COMPUTER port for serial communications (XON)
CRTL-S   Closes the PTB COMPUTER port (XOFF)
QD   Requests date and time stored in PTB
QM   Requests memory capacity status
QP   Requests a list of all PTB parameters as currently configured
BDMY28.02.97 19h24   Sends to PTB a date and time in DMY format
BMDY28.02.97 19h24   Sends to PTB a date and time in MDY format (USA)
D   Resets PTB to default parameters
S   Creates a new timing SESSION
U   Requests PTB to send contents of memory to COMPUTER output port
UA   Requests PTB to send contents of memory to COMPUTER and PRINTER ports
C   Clears the memory of the PTB
PBY   Sets PTB buzzer to sound when inputs are triggered.
PBN   Deactivates PTB buzzer.
PEY   Blocks inputs 5 to 16
PEN   Reactivates inputs 5 to 16
PAS   Running time output from DISPLAY deactivated
PAD   Running time output from DISPLAY port set to send every tenth of second
PD0   Expressed precision on printer set to 1 second.
PD1   Expressed precision on printer set to tenth of a second.
PD2   Expressed precision on printer set to hundredth of a second
PD3   Expressed precision on printer set to thousandth of a second
PD4   Expressed precision on printer set to ten-thousandth of a second

Input "lock-out" time settings.

All PTB timing inputs (1 - 16) can be controlled to ignore (lock-out) impulses that arrive at the inputs for specified periods of time <u>after</u> an original impulse is received. This allows you to ensure that only one (1) impulse per competitor is used when each sensor might send multiple impulses during timing line crossing. The adjustment of this lock-out period is crucial to proper time-keeping and varies from sport to sport due to speeds and sizes of the objects present at the timing sensor points (skiers, cars, horses…)

Inputs are adjustable in 3 blocks:

> **For Channel 1   using the command PL1…**
> **For Channel 4   using the command PL4…**
> **For Channels 2,3,5-16   using the command PL0…**

The selection of which inputs are used for which timing functions should be carefully considered based on the way in which the PTB controls these channel lockout periods. **Only channels 1 and 4 can be controlled more extensively and independently from the other remaining channels (2,3,5-16).** Thus we recommend that channels 1 and 4 be reserved for use with starts and finishes, and that the other channels be used for intermediate or speed trap sensors.

The 3 blocks of timing input channels have 2 possible ranges of lock-out adjustment:

> **0.1 to 9.9 Seconds using PLxD followed by a value**
> **1 to 99 Seconds using PLxS followed by a value**

In addition, two fixed value lock-out times can be selected with the following commands
followed by 00 :

> **.01 with the command :   PLxS00**
> **No Lock Time with the command :   PLxD00**

Examples:

PL1D00   Input 1, no lock-out.
PL1D01 to PL1D99 Input 1 locked out from 0.1 to 9.9 seconds.
PL1S00   Input 1 locked-out for 10 milliseconds (0.010)
PL1S01 to PL1S99 Input 1 locked-out for 1 to 99 seconds
PL4D00   Input 4, no lock-out.
PL4D01 to PL4D99 Input 4 locked out from 0.1 to 9.9 seconds.
PL4S00   Input 4 locked-out for 10 milliseconds (0.010)
PL4S01 to PL4S99 Input 4 locked-out for 1 to 99 seconds
PL0D00   All other inputs, no lock-out.
PL0D01 to PL0D99 Lock-out of all other inputs for 1 to 9.9 seconds
PL0S00   Lock-out all other inputs for 10 milliseconds (0.010)
PL0S01 to PL0S99 Lock-out all other inputs for 1 to 99 seconds

These codes <u>must</u> be followed by a (Space) and carriage return (CR):

Supplementary Information

On receipt of the command QP (request for list of parameters), the PTB in addition sends back to the connected computer an indication on the state of the internal batteries.
BATTERY OK   Battery charge (state) sufficient (OK)
BATTERY LOW   Battery charge (state) insufficient, operation time is compromised.

As the memory approaches a full state (with space remaining for 1000 times), the PTB sends (on COMPUTER and PRINTER ports):

MEMORY FULL

Device Identification

The serial number that is specific to each PTB 605 (in our example: N° 1234) is sent out the COMPUTER port with certain data strings (SESSION, SYNCHRO, Power ON…)
PN1234 followed by a (Space) and carriage return (CR)

12. PRINTER PORT INFORMATION

Description:
The PRINTER port becomes active and data begins to flow when a Ready State is reached as Pin 8 - DTR (Data Terminal Ready) on the PTB is energized from a hardware handshake (cable connection) to, typically, a printer or other serial computer device. Since the PTB itself does not have a DSR (Data Set Ready) pin on it's PRINTER port, the PRINTER Port **must** be controlled by a hardware handshake via an attached serial device. Look for a DSR pin on the printer serial port you wish to attach to the PTB, and connect this to Pin 8 (DTR) on the PTB printer port. Once this hardware handshake is accomplished, all timing data will flow to the printer automatically. **You may also send other data that originates from your computer to the PTB and route it to the printer with special commands that are described in the next section of this manual. (LPOn & LAOf)**

The RS232 data being produced by the PTB is then available on Pin 2 of the DB9, with signal ground on Pin 5. Thus, **a typical cable to access PTB data via the PRINTER port comprises 3 conductors.** The use of stranded, shielded, 22awg cable is recommended.

DB9 Port - PRINTER
Pin   Function
2   Data Signal (Tx)
5   Signal Ground
8   DTR (Data Terminal Ready)

RS232 Protocol   9600, No Parity, 8, 1 Note: **Set printer to GRAPHICS mode.**

Important : **The printer you use must be able to print in Graphics Mode. If this is not available or disabled, when the PTB tries to print the TAG Heuer Logo at the start of a new session, you will get a long list of random characters instead. If this happens, turn the printer off/on and normal characters will now flow to the printer. The TAG Heuer PTB printer enters Graphics Mode automatically.**

The advantage of this configuration is that the PTB only sends data when the printer is in a Ready State. Problems like paper out and power difficulties at the printer end cause the port to shut down and data destined for the printer to be held in a buffer memory until the printer problem is corrected. When the Ready State is restored, the printer port reopens and memorized data collected since the port was closed is released and printed.

Example: Connection to Seiko DPU411 series printers

PTB PRINTER PORT   SEIKO DPU 411 Printer
Cable: Cable:
DB9-M   DB25-M
---   ---
--
Pin   Pin
2   Data Out (Tx)   ——————— 2   Data in
5   Ground   ——————— 7 or 1   Ground
8   DTR   (Data Terminal Ready) ——————— 5   Busy
                                                                6
                                                                20

14

Note: Configure dip switches on Seiko DPU 411 for serial operation at 9600 Baud

SW1	SW2
1 off	1 on
2 on	2 on
3 on	3 on
4 on	4 off
5 off	5 off
6 off	6 off
7 on	
8 on	

13. DISPLAY AND PRINTER PORT MESSAGES

The PTB can be asked to accept data being sent from a connected computer and to route it to the dedicated PTB printer port or any attached display panels or other RS232 device via the display port jack. Most importantly, these communications with multiple devices can be managed with only one serial COM port on your PC. This feature is most certainly a major advantage in creating a compact and versatile system since data logging of what the computer is doing with the times being received, or in fact any relevant data such as net time calculations or classified results, can be printed on the PTB's dedicated printer, thereby eliminating the need for a separate logging printer attached to the computer. It also means that no other COM port on the Computer is needed in order to route information to a display or the printer, a major consideration for **most laptop PC owners who are faced with only 1 serial COM port as standard equipment.**

Data destined for a display or other RS232 device (TV character generator, Announcer Screens) can be sent to the PTB using the sole I/O COM port on your PC, and then routed out back out of the PTB using the 3.5mm RS232 jack provided for this purpose. **Note however that all serial data communications on all ports must operate at the same speed of 9600 baud and that this cannot be modified.**

Any message from the computer can be sent to the PTB in ASCII using the same COM port that accepts the time-of-day data from the PTB since the computer COM port is bi-directional. Protocol speeds must match. Control of what is printed or displayed is simply sent to the PTB in ASCII characters between the commands LPOn_ _ (for printer) and LLOn_ _ (for display). The commands must be followed by two spaces as represented by _ _. **These commands are upper and lower case sensitive, so be careful in your programming.**

Messages destined for the display or printer attached to the PTB must be enclosed between the following commands (Note the presence of **space** characters as denoted by **_ _**):

Printer Port Control (9 pin DB9F on right side of PTB)

LPOn_ _   Beginning of message to be **printed.**

When the PTB is ready to receive text for the printer, it responds with <CR>

When the text message is completed, end the text transmission to the printer with :

LAOf<24> _(10ms)   End of message to be **printed.**

(LAOf, ASCII Code 24 (18h), one space, and wait at least 10ms)

ASCII 24 empties the printer buffer. The 10 ms wait ensures that there is no data collision within the PTB from other sources.

Similarly, data destined for a device such as a display board attached to the PTB's DISPLAY jack is sent between the following commands:

Display Port Control (3.5mm female jack on rear of PTB)

LLOn_ _(10ms)   Beginning of message to be **sent to the display.**

LLOn, 2 spaces, wait of at least 10ms.

Once the message has been sent to the display, the same command as that used to close the transmission to the Printer is used

LAOf<24>_(10ms)   End of message being **displayed.**

These End of Message characters are also sent out the display port so they must be identified so they can be properly ignored.

By **default**, the **running time** is **disabled** on the DISPLAY port jack.

To **activate** the running time at a rate of every 10th of a second, use the **PAD** command

To **inhibit** the running time, use the **PAS** command.

14. SERIAL DATA OUTPUT STRING FORMATS

Information Type	(N,S or T)	1 ASCII Character(s)
Unit ID Number		4
Separator (Space)		1
Sequential Number (1 to 49,999)		5
Separator (Space)		1
Input Channel Number		2
Separator (Space)		1
Hours		2
Separator (:)		1
Minutes		2
Separator (:)		1
Seconds		2
Separator (.)		1
1/100000 sec (.999999)		6
End of String (CR)		1

N= New Session
S= Synchronization
T= Timing Data
R= Running Time

Examples (Serial Data Strings - ASCII,)

New Session with Date:
1234567890123456789012345678901 Total=31 characters
N0000xS002xxxxx28.01.97xPrxOnx(CR)

At Synchronization:
1234567890123456789012345678901 Total=31 characters
S0000xxxxxxxxxx13:12:00.000000(CR)

During Timing:
1234567890123456789012345678901 Total= 31 characters
Txxxxx00008x04x13:12:16.234567(CR)
Txxxxx00003x03x13:12:16.345678(CR)

Manual Time, Channel 2:
1234567890123456789012345678901
Txxxxx00001xM2x13:12:16.234567(CR) Total=31 characters

Serial ASCII Running Time - DISPLAY Output:
1234567890123
Rx12:32:08.4(CR)   Total=13 Characters

15. DB 25 EXT. CONNECTOR PORT INFORMATION

To simplify possibly complex set-up situations, an industry standard DB 25, 25 pin connector is provided on the PTB rear panel to access all inputs and control most functions.

Timing Input channels 1 to 4, and the SYNCHRO input channel are available as banana jack connections on the rear panel of the PTB. For applications where access to all of the PTB's 16 timing Input channels is required, use of the EXT CONNECTOR port is necessary.

A DB 25 connector on the rear panel of the PTB 605 provides for access to all of the 16 timing channels as well as the Synchronization port, Special function keys (SESSION, MEMORY, CLEAR), and other outputs like Top-of-Minute triggering and RS232 data as available on the DISPLAY port.

Pin 18 is the ground pin for all of the timing and sync. inputs, as well as the SESSION, MEMORY and CLEAR functions. Separate grounds are provided on isolated pins for Top-of-Minute triggering and the RS232 data from the DISPLAY port. Be careful to respect these three different ground functions for the correct operation of your connected devices.

Pins 24 and 25 allow you to connect a display board to the DB25 connector rather than via the 3.5mm DISPLAY jack.

Access to the SESSION, MEMORY and CLEAR functions as represented on the DB25 connector are made through shorting pins 19, 20 and 21 to pin 18 (ground). Under no circumstances can any voltage be applied to these pins.

PIN # FUNCTION
1   Timing Channel Input 1
2   Timing Channel Input 2
3   Timing Channel Input 3
4   Timing Channel Input 4
5   Timing Channel Input 5
6   Timing Channel Input 6
7   Timing Channel Input 7
8   Timing Channel Input 8
9   Timing Channel Input 9
10   Timing Channel Input 10
11   Timing Channel Input 11
12   Timing Channel Input 12
13   Timing Channel Input 13
14   Timing Channel Input 14
15   Timing Channel Input 15
16   Timing Channel Input 16
17   Synchronization Input
18   Timing, Sync and Trigger **Ground**
19   SESSION
20   MEMORY
21   CLEAR
22   Top of Minute Output + (Isolated)
23   Top of Minute Output - (Isolated)
24   DISPLAY port RS232 Data output, Signal
25   DISPLAY port RS232 Data output, Ground

16. EXT. POWER CONNECTOR

The PTB is adequately powered by it's own internal batteries, however added operating time and power autonomy protection can be obtained through the use of the POWER connector and an external DC source. It is also possible to charge NiCad Batteries, if installed, via this connector.

Whenever the TAG Heuer Printer is used, the associated external power supply for the printer also provides external power for the PTB timer.

Located on the rear panel of the PTB, this 4 pin connector provides the following functions:

1. Ground
2. Not used
3. 12-18 Vdc in (Min. 100ma)
4. Ni-Cad or NI-MH Battery Charging only (9Vdc - 200ma)

When connected to pin 3, the PTB draws current from the external Vdc source only, bypassing the internal batteries. If this external power is disconnected or exhausted, the PTB continues operation on internal batteries automatically.

(3) 12-18vdc in   (2) Not Used

(4) Battery Charge   (1) Ground
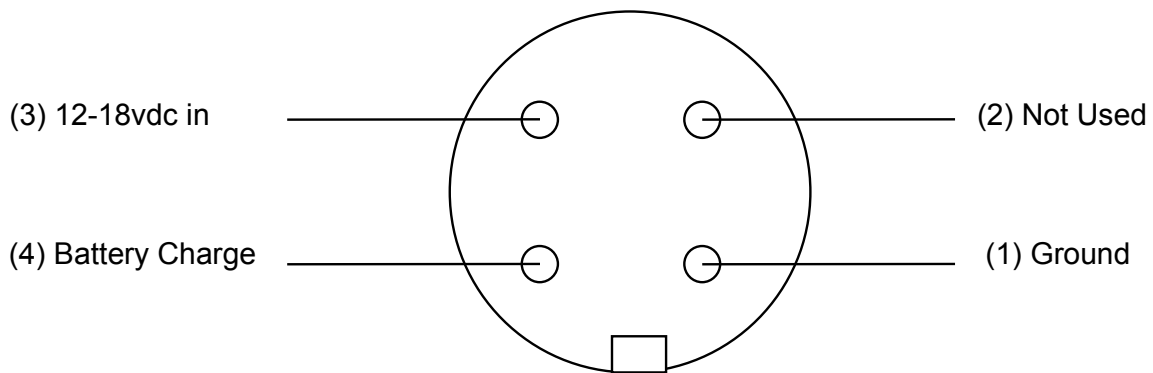
View of POWER jack on rear panel

17. COMMAND MESSAGES SUMMARIES FOR COMPUTER

1.	QUESTIONS
QD	Date and Time
QM	Amount of available memory
QP	List stored parameters in use

2.	SETTING DATE AND TIME
BDMY28.02.97 19h24	sets date and time in DAY/MONTH/YEAR format
BMDY28.02.97 19h24	sets date and time in MONTH/DAY/YEAR format

3.	COMMANDS
D	Resets all parameters to factory defaults
S	Creates a new timing SESSION
U	Dumps memory contents out COMPUTER port
UA	Dumps memory to COMPUTER and PRINTER port
C	Clears memory

4.	SETTING ADJUSTABLE PARAMETERS
PBY	Buzzer on
PBN	Buzzer off
PEY	Inputs 5-16 blocked
PEN	Inputs 5-16 unblocked
PAS	Deactivates running time on DISPLAY port
PAD	Sends running time (10th sec.) on DISPLAY port
PD0	Timing precision on printer: 1 second
PD1	Timing precision on printer: 10th second (0.1)
PD2	Timing precision on printer: 100th second (0.01)
PD3	Timing precision on printer: 1,000th second (0.001)
PD4	Timing precision on printer: 10,000th second (0.0001)

5.   LOCKOUT SETTINGS FOR TIMING INPUTS

Channel 1   blocked for:
PL1D00   No Blocking
PL1D01   to   PL1D99   0.1   to   9.9   seconds
PL1S00   0.010   seconds
PL1S01   to   PL1S99   1   to   99   seconds

Channel 4   blocked for:
PL4D00   No Blocking
PL4D01   to   PL4D99   0.1   to   9.9   seconds
PL4S00   0.010   seconds
PL4S01   to   PL4S99   1   to   99   seconds

Channels 2,3 & 5 to 16   blocked for:
PL0D00   No Blocking
PL0D01   to   PL0D99   0.1   to   9.9   seconds
PL0S00   0.010   seconds
PL0S01   to   PL0S99   1   to   99   seconds

STATUS MESSAGES

QP   List Stored Parameters
                           This QP command requests the PTB to send a complete list of
                           settings. Within the context of this query, the PTB will also send
                           information on the state of the batteries:

BATTERY OK   Battery condition OK

BATTERY LOW   Battery condition compromised - reduced capacity

MEMORY FULL   At any time during normal operation, when the memory
                           capacity fills up to the extent that only 1000 more times can be
                           memorized before the PTB begins to overwrite the oldest time
                           data in memory this message will be sent to the PRINTER and
                           COMPUTER ports

PRINTER ON   Whenever a printer is attached to the PTB and the "Ready"
                           mode (DTR Pin 8 on the PTB PRINTER port) is activated, this
                           message will appear.

PRINTER OFF   Likewise, if the attached printer goes off line, this message
                           will appear

PRINTER AND DISPLAY PORT MESSAGES

Any message from the computer can be sent to the PTB in ASCII using the same COM
port that accepts the TOD data from the PTB. Messages destined for the display or printer
attached to the PTB must be enclosed between the following commands:

LPOn   Beginning of message to be **printed.**
LAOf   End of message being **printed.**

                           Similarly, data destined for a device such as a display board
                           attached to the PTB's DISPLAY port is sent between the
                           following commands:

LLOn   Beginning of message to be **displayed.**
LAOf   End of message being **displayed.**

**These 3 commands must be followed by other characters for proper operation.
Consult Chapter 13 for a thorough description of the operation of these commands.**

TIMER IDENTIFICATION

PN1234   Each individual PTB timer has its serial number imbedded in
certain

                           data strings, such as during power up, with a new SESSION,
                           and SYNCHRO. In this example, unit # 1234 is identified

18. TECHNICAL SPECIFICATIONS

General
High precision Timing Device with 16 channels for up to 128 independent timing sessions. For each session, triggered times are recorded in time-of-day format and numbered in sequential order from 1 to 49,999.

Precision
1/250,000th / sec. Internal and available via **COMPUTER** data port.
1/10,000th / sec. Max. resolution via the **PRINTER** data port, adjustable from between one second to one ten-thousandth of a second.

Inputs
16 Timing Inputs operating in Split mode, identified from 1 to 16 on a DB 25 pin connector. Inputs 1 to 4 are also available on banana jacks with push-button blocking and unblocking control and manual triggering buttons on the keypad. There is one synchronization channel available on the DB 25 or as a banana jack.

Outputs
3 RS232 ports, default protocol speed: 9,600 baud, configured as follows:
1- **COMPUTER** bi-directional serial data port
1- **PRINTER** port
1- **DISPLAY** port with available running time in 10ths /second.

Communication / Control
Recording and display of times accomplished entirely by external devices using appropriate control and timing calculation software. (PC, printer, monitor, etc.)

Function Adjustment Protocol
All timer functions and parameters are adjustable via the serial COM port of a PC connected to the COMPUTER port of the PTB using simple ASCII instructions. (Setting Time-of-Day, precision of timing on printer tapes, session choice, memory discharge and printing, input delays and blocking, etc.) X-on/X-off flow control. The PTB likewise sends information back to a connected PC.

Memory Capacity
18,687 times in up to 128 different timing sessions.

Electronic Construction
Based on RISC processor.

Time Base
Thermally compensated quartz crystal at 16 MHz.
+/- 1ppm accuracy between 15 to 25°C.   +/- 2.5ppm at -30 to +75°C.

Temperature Operating Range (Nominal)
-20° to +70° Celsius

Date/Time
Permanent storage and control of date and time by RTC processor, adjustable via PC.

Controls
By keys (push buttons), via the DB25 pin connector, or ASCII controls via **COMPUTER** port

SESSION + VALID   Creates a new timing session
CLEAR MEMORY + VALID   Clears the Memory
MEMORY + VALID   Print or dumps memory to RS232 ports
MEMORY (alone)   Prints available memory left.

Other
OFF MODE, saves all recorded time data and operating parameters for up to 3 months
Adjustable signaling tone.
Direct Printer control and access if attached to PTB.
Battery condition monitoring with alarm.
"Top-of-Minute" output impulse via opto-coupled connector for external referencing and synchronization of other timing systems.

Power
Internal: 6 x AA Alkaline batteries, or Ni-Cad or Ni-Mh rechargeable
External: 12 to 18 Volts, DC.
RTC :   Independent battery recharged when PTB is ON.

Autonomy – Alkaline Batteries Only
Better than 60 hours at + 20° C. (Ref.: Energizer AA x 6)

Physical Dimensions
163 x 142 x 45 mm
6.5 x 5.5 x 2 inches
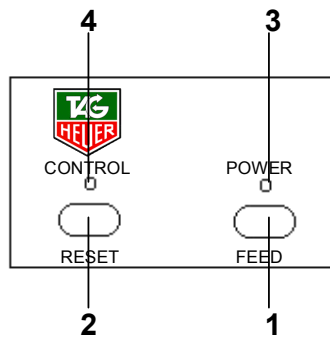Sealed Membrane Keyboard

Weight
1,200 gr.
4 Ounces.

Annexe #1 : PTB Printer

1. Description

The TAG Heuer PTB Printer was specifically designed for use with the PTB 605 as a dependable, quite and quick data preservation companion device. It allows all timing data to be recorded as it is produced or reprinted from the extensive memory of the PTB.

View from Above

Keyboard

1.	FEED Key	Advances the paper, either one line with a momentary touch, or continuously if held longer
2.	RESET Key	Resumes printing activity if printing was stopped due to a problem or paper roll replacement
3.	POWER LED	Glows if power is connected and/or sufficient. Flashes if batteries are compromised
4.	CONTROL LED	Indicates correct operation of the printer (adequate paper, temperature range, power…)

Rear View

Rear Panel

|		
5.	ON-OFF Switch	Turns printer on or off
6.	POWER Jack	Accepts power from external supply for operation and battery charging if necessary.

2. Power Supply

The PTB Printer has its own battery compartment separate to that of the PTB batteries for either alkaline or rechargeable AA cells. Although designed to operate from the battery source alone, it is recommended to use an external supply whenever possible due to the elevated power demands of a thermal printer.

Reminder : When connected to the external power adapter HL605-1, the PTB printer also supplies external power to the PTB timer. In all cases when using external power sources with the PTB or the PTB Printer we urge you to always keep good batteries in both units at all times as a measure of system safety should any external power failure occur.

3. Connecting the PTB Printer to the PTB 605 Timer

The PTB Printer is designed to attach directly to the right side of the PTB 605 through the use of two recessed spring retention screws. This should be done with care. Make sure the Timer and printer are both OFF. When the two units are pressed together, use a small star screwdriver to fasten the two devices securely. Do not over tighten.

Lateral view of screws :
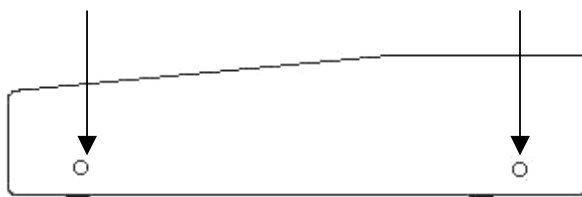
4. Printer Operation

Use the **On/Off Switch** on the rear of the printer to turn on the printer and the POWER LED should glow. If this is not the case, there is a power supply fault (dead or incorrectly inserted batteries, defective external power supply) or an electronics problem. If there is paper in the printer the CONTROL LED will likewise glow. The printer is now ready for immediate use.

Now turn on the PTB timer. The following information will be printed :

PTB 605 N° 1234
28.01.98
SESSION   5
MEMORY FREE   12 477

If the printer is activated during a timing session in progress, all data memorized since the start of the session will be printed

5. Paper Replacement

The paper roll compartment is accessible by clicking open the cover by pressing down on the metal sides of the cover (not the plexiglas). The cover will pop up for removal. Unroll about 3 inches of paper from the new roll. Place the roll behind the printer and align the roll with the paper holder. Using both hands, feed a cleanly cut end of the roll into the entrance of the paper feeder. The printer will automatically detect the presence of the new edge and feed up to the print head (the CONTROL LED will glow). If the paper will not feed, cut a new clean edge and try again. The FEED key allows you to advance the paper roll further if necessary once the printer automatically senses the new paper roll edge being fed in.

Thermal Printer Paper Rolls: (Available through your TAG Heuer agent)
There are two types available :   a) Standard internal roll
                                    b) Larger capacity roll for external mounting using HL605-2

6. Changing Batteries

A battery compartment on the bottom of the printer is accessible by removing two screws. Insert new batteries and make certain that a good contact is established by rotating the batteries once they are installed. The compartment provides a tight fit and making a good contact for each battery when installing them is important. Check operation before reinstalling the compartment cover.

7. Battery Power Management

The POWER LED on the Printer monitors the condition of the batteries when the printer is **FIRST TURNED ON ONLY**. If the POWER LED flashes, batteries must be replaced or recharged. This feature does not function DURING printing however. Further battery condition assessment once timing operation have begun is provided during printing via the CONTROL LED. If the CONTROL LED goes out during operation, the batteries are insufficient to operate the printer and they must be replaced or external power supplied to the printer's Ext POWER connector. When using rechargeable Ni-Cad or Ni-Mh batteries, even with a full charge the POWER LED might flash on powering up due to the inherently lower voltage of these cells. In this case use the CONTROL LED as the power reference check during operation.

8. Notes on PC to PTB Printer Communications

The PRINTER connected to the PTB Timer provides a DTR high state on pin 8 to indicate that it is ready to receive data (READY Mode). This DTR pin voltage state is monitored by the PTB to correctly manage data destined for the printer. It allows the PTB to subsequently route software generated messages out the COMPUTER port such as PRINTER ON and PRINTER OFF to a PC.

This printer generated DTR signal is also routed directly out as an actual voltage state change on the PTB's COMPUTER port on pin 8. An attached PC can thus directly and immediately monitor the readiness of the printer by the voltage state of this pin 8 without having to wait for a software generated message to be sent by the PTB, a valuable data integrity consideration for software system developers who might be using the LPOn functions.

When using WINDOWS applications, this DTR change generates 'EV_CTS' (communication functions of WINDOWS 95 or NT - Kernel32.LIB / Winbase.h).

9. Technical Specifications

Printer

Printing Module :   SEIKO LTP1245
Printer Type :   Thermal matrix
Resolution :   384 dpi
Printing Width :   48 mm.
Printing Speed :   50 mm / second (wow… !)

Paper

30 mm Thermal Paper Roll. Standard
48 mm Optional Roll for external mounting on optional bracket HL 605-2

Power Supply

Internal :   5 x AA Alkaline, Ni-Cad or Ni-Mh Batteries
External :   12 –18 VDC

Autonomy

4500 Printed Lines at +20 C (Ref. : Energizer AA x 6)

Dimensions – Construction
Thermally lacquered stainless steel. 104 x 142 x 45 mm.
Sealed Membrane Keypad

Weight

1,000 gr.