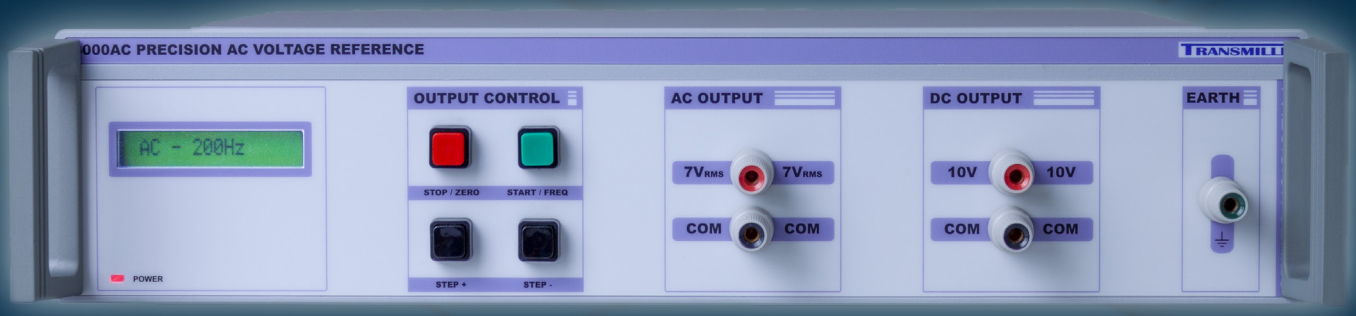
TRANSMILLE
SOLUTIONS IN CALIBRATION




# TRANSMILLE 3000AC AC VOLTAGE REFERENCE

## OPERATION MANUAL

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Version 2.0 - 21st August 2020

# Warranty

Transmille guarantees this product to be free from defects in material and workmanship under normal user for a period of one (1) year from the date of shipment. This warranty does NOT cover any required re-calibration/adjustment or standard maintenance actions. This warranty extends only to the original end purchaser and does not apply to fuses, batteries, external cables or to the product if it has been modified, misused, altered or has been subjected to mishandling or misuse.

Transmille's obligation to warranty is limited to repair or replace the product after return to an authorized Transmille service centre within the warranty period and is subject to Transmille's investigation determining that the fault is not caused by misuse, alteration or through mishandling.

If failure occurs, send the product via pre-paid freight, to the service centre as informed by Transmille with a description of the fault only after receiving confirmation from Transmille. At Transmille's option, either repairs will be performed or a replacement unit of similar condition and age will be provided.

Transmille will return the product to the end customer or local distributor via pre-paid freight (with exception of any customs clearance fees).

Transmille accept no responsibility for damage during return shipping for warranty service.

# Contents

## Introduction

The 3000AC Provides laboratories with a high accuracy DC and LF Reference which can be maintained in house through use of a high resolution digital multimeter and a voltage reference (such as the 3000ZR). This reference allows laboratories to perform interim checks on their equipment to maintain confidence on AC measurements between calibration cycles

## Key Features

- **7.07V RMS (10V Peak) AC Output, available at 15Hz, 60Hz, 200Hz and 1kHz Frequencies**
- **10V DC Output**
- **Calculable AC Voltage output, traceable to DC Voltage via a multimeter and DC Voltage Reference**

## Available Accessories

The 3000AC has a full range of complimentary accessories to assist with getting the best out of the Instrument. Accessories include:

- **A Soft Carry Case for hand carried transit (3000AC-SCASE)**
- **A Hard Transit case, laser cut with storage areas for leads and accessories for shipping via courier (3000AC-TCASE)**
- **Options for Rack Mount configuration (RACKTRAY)**

# Basic Operation

## Front Panel


The 3000AC Front Panel consists of a display confirming the current state of the instrument, 4 keys to modify the settings of the instrument, a set of terminals for the AC Output, a Set of terminals for the DC output and an Earth connection terminal

## Display and Power Indication

The left hand side of the 3000AC provides the user with feedback of the current setting. The 2 Operation modes are Free running (i.e. the AC output is active and generating a quasi sine wave at the requested frequency) and DC Step, in which the numbered step is output and a DC level is present at the AC Output Terminals

## Output Control

The output control buttons provide manual access to functions of the 3000AC. These buttons are used when the 3000AC is not being used under remote control (Note - Transmille do not advice trying to perform the AC Characterisation step by hand as this will take an excessive amount of time and key presses when this process can be automated in any programming environment)

## Output Terminals

**Warning**

**To avoid electrical shock, injury of death, never touch any lead connected (or terminal) to the instrument unless certain that no dangerous voltages are present.**

The output terminals of the 3000AC are provided as 4mm binding posts, capable of accepting 4mm banana style connectors, spade connections and bare wire.

Take care to only finger tighten connections, excessive force or tools should not be used to avoid damage

## Rear Panel

## Power Inlet, Fuses & Voltage Selector

The power inlet of the 3000AC is on the left hand side of the rear of the unit. The power inlet accepts a 3 pin C13 cable.

Below the power inlet is a fuse holder that holds the mains fuses for the unit and also provides voltage selection.

The units ON/OFF switch is contained within the integrated power inlet.

**Warning : When replacing the fuse holder ensure that the orientation is for the appropriate mains input voltage. Failure to do so could result in damage to the instrument**

**Note : Any mains cable connected to the 3000AC should have its earth pins connected to ground. Failure to do so could result in damage to the instrument**

## RS232 Interface

The Instruments RS232 interface for remote control over RS232 / Serial.

Note : The Instrument uses a straight through RS232 connection. The instrument will not communicate if a Null Modem cable is used

The Baud rate is fixed at 9600, and uses 8 data bits with no parity

# Theory of operation

The 3000AC uses a high resolution audio DAC which is controlled via a PIC to generate 256 discrete steps of an AC Sine wave, going between +10V and -10V, generating an approximate 7.07V quasi sine wave.

The DAC can be stopped at any point, allowing a measurement of each DC Voltage step to be measured, squared, and then added to the squares of all measurements, divided by the number of steps (256) and then the square root taken.

The long term stability of the DAC and voltage reference does not need to be considered, as the intended use of the instrument is as a check standard, and to be checked against a suitable 8.5 digit multimeter (with a total DC Voltage uncertainty of less than 10ppm on the 10V Range) at the time of use.

When automated the AC Characterisation process takes no more than 30 minutes, and can be used to calculate the AC Output to better than 20ppm. The total accuracy of the output is dependant upon the measurement uncertainty of the DC Voltage steps, any short term drift of the 10V Reference (less than 0.5ppm across the time of use and within a stable environment) and any glitches/step errors in the DAC. Glitches/Step Errors often cancel each other out depending on the position of the sine wave (rising or falling) and are also quite insignificant in the total uncertainty of the output.

# Calculating the AC Value

Measure each DC Step as a DC Voltage and record in a spreadsheet for future use. To obtain the RMS value of the AC output, perform the following calculation

$$V_{\mathrm{rms}} = \sqrt{\frac{1}{n}\sum_{i=1}^{n} V_i^{\,2}} = \sqrt{\frac{V_1^{\,2} + V_2^{\,2} + \cdots + V_n^{\,2}}{n}}$$

Where $Vx^2$ is each of the 256 DC Steps (0 through 255), where the x is the DC step of the measurement, and n is the number of steps in the waveform, 256. Taking the square root of this value will provide the RMS value of the output, which is nominally 7.07V (10V pk)

# Front Panel Operation

**Note - This mode of operation is recommended for changing FREQUENCY of the AC Output ONLY. Where possible the measuring of the DC Step should be automated**

## Starting / Stopping the AC Output

Pressing the GREEN ‘START / FREQ’ key on the front will start the AC output if the unit was previously in DC Step mode

Pressing the RED ‘STOP / ZERO’ key on the front will stop the AC Output and set the DC ‘0’ Step

## Changing AC Frequency

When the instrument is in AC mode the display will show ‘AC -’ and then the frequency that is presently set. To change the frequency, press the GREEN ‘START / FREQ’ button to step through the different frequencies available (15Hz, 60Hz, 200Hz and 1kHz)

## Changing DC Step

To change the DC Step, first place the instrument into DC mode by pressing the Red ‘STOP / ZERO’ button. The screen will display ‘DC - Step 0’. Then use the BLACK ‘Step +’ or ‘Step -’ buttons to move to the next or previous step

# Remote Operation

All commands should be followed with CARRIAGE RETURN (ASCII 13)

## Querying ID

| | |
|---|---|
| *IDN?<CR> | Responds with TRANSMILLE,3000AC,<SERIAL NUMBER>,<FIRMWARE VERSION> |

## Setting The Frequency

The AC Frequency is set using the following commands

| | |
|---|---|
| 1<CR> | 15Hz |
| 2<CR> | 60Hz |
| 3<CR> | 200Hz |
| 4<CR> | 1kHz |

## Stopping the Waveform

| | |
|---|---|
| S<CR> | Stops the waveform and sets DC Step 0 |

## Advancing the DC Step

| | |
|---|---|
| X<CR> | Advance 1 Step |
| Y<CR> | Advance 10 Steps |
| Z<CR> | Advance 64 Steps |

# ABOUT US

We truly believe in offering Solutions in Calibration, offering bespoke solutions for calibration laboratories and manufacturers across the globe. Our mission statement is not just a phrase, it is our design and support philosophy, offering support and advice that cannot be found elsewhere with a friendly atmosphere.

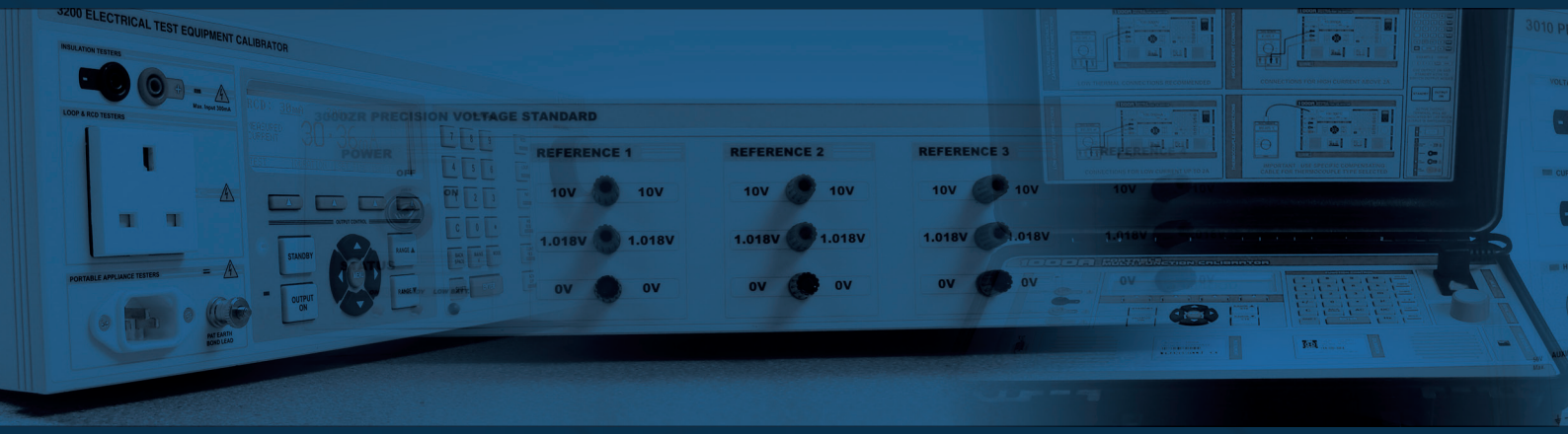
Transmille was founded in 1997 as a commercial calibration service, and soon after began to develop and manufacture a range of electrical calibration products and software to answer a growing requirement for solutions to common problems. Following this small beginning, Transmille has worked year on year to provide unique equipment and software to benefit calibration laboratories and manufacturers across the globe.

Ever since releasing the very first products Transmille have continued to innovate and develop new products for the metrology community, from world first products such as the 2100 Electrical Test Equipment calibrator, through to the worlds lowest cost multi product calibrator the 1000 series.

Transmille now produce over 600+ calibration instruments per year, shipping instruments to customers ranging from National Standards Laboratories and manufacturers through to small calibration test houses around the world.

An unrivalled commitment to quality and innovation drives Transmille forwards, with a dedicated design and support team in house with a combined experience of over 60 years in manufacture and design of electrical calibration products and software.

With local distributors across the globe, we can offer one to one personalised support, no matter how large or small the customer.

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