

R&S® ZN-Z32/-Z33 Automatic In-line Calibration Modules

Ensuring high accuracy
with thermal vacuum
testing and multiport
measurements



R&S®ZN-Z32/-Z33 Automatic In-Line Calibration Modules At a glance

The R&S®ZN-Z3x in-line calibration units (ICU) provide an automatic system error correction with Rohde & Schwarz network analyzers. In contrast to common calibration units, the R&S®ZN-Z3x remain permanently connected to the test cable, facilitating a recalibration without the need for reconnection of calibration devices by the operator. Controlled via CAN bus, recalibration is possible at any time using a single keystroke in the control software tool.

The in-line calibration units are the only solution that provide reliable and accurate measurements with test systems where it is impossible for the operator to have access to the reference plane, for example, with thermal vacuum chambers (TVAC) in the satellite area.

With multiport applications, the R&S®ZN-Z3x offer the benefit of considerably reduced calibration effort. Easy, periodic recalibration ensures reproducible and consistent measurement uncertainty.

Key facts

- ▀ Calibration update with minimum effort and time
- ▀ Consistently accurate measurements even with systems where the ends of the test cables are not accessible (TVAC)
- ▀ Minimizing recalibration effort and operation errors in multiport systems
- ▀ Minimized down time and reliable, consistent accuracy in production lines
- ▀ Temperature characterization as standard from factory
- ▀ Support for a virtually unlimited number of in-line calibration units, i.e. test ports
- ▀ No further calibration equipment required
- ▀ Three models support up to 8.5 GHz, 40 GHz and 40 GHz TVAC

R&S®ZN-Z32, 10 MHz to 8.5 GHz (for ambient conditions).



R&S®ZN-Z33, 10 MHz to 40 GHz (for ambient conditions - 40 GHz TVAC model similar)



R&S®ZN-Z30 CAN bus control unit (front view).



R&S®ZN-Z30 CAN bus control unit (rear view).

Special features of the R&S®ZN-Z3x

Principle of operation

Following a full N-port system error correction (called initial calibration) the test setup is prepared for a calibration refresh at any time:

- The initial UOSM calibration is to be performed prior to starting a test, e.g. outside the TVAC. Using the open, short and match standards inside the R&S®ZN-Z3x units, just an additional "unknown through" (e.g. using a simple adapter or cable) provides a full system error correction
- Calibration "refresh" is performed by means of a OSM calibration using the standards incorporated inside the ZN-Z3x units, i.e. no through connection, nor user access is required. The device under test (DUT) and test cables can remain in place and undisturbed

Flexibility for high number of test ports

Control is via CAN bus, which supports long distances between the test system and the in-line calibration unit and supports multiple in-line calibration units.

- One R&S®ZN-Z30 CAN-bus controller supports up to 48 ICUs. Several controllers are possible, extending the number of supported ICUs to $n \times 48$
- Maximum cable length to the first unit 40 m

Software for plug & play calibration

The R&S®ZN-Z3ASW application software, installed on the VNA itself or a PC, supports the operator for straight forward operation of a few essential steps:

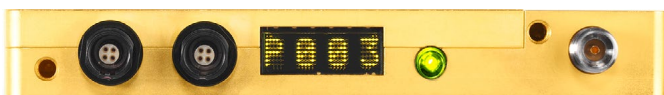
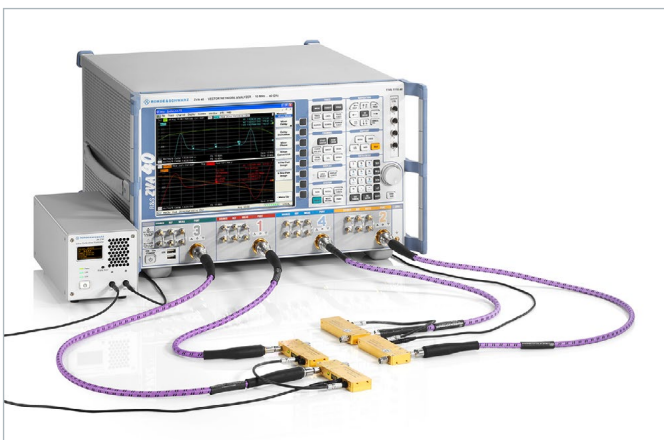
- Registration of the R&S®ZN-Z30 CAN-bus controllers
- Automatic detection of all in-line calibration units and automatic port assignment
- Base calibration and calibration refresh

Features for convenience and reliability

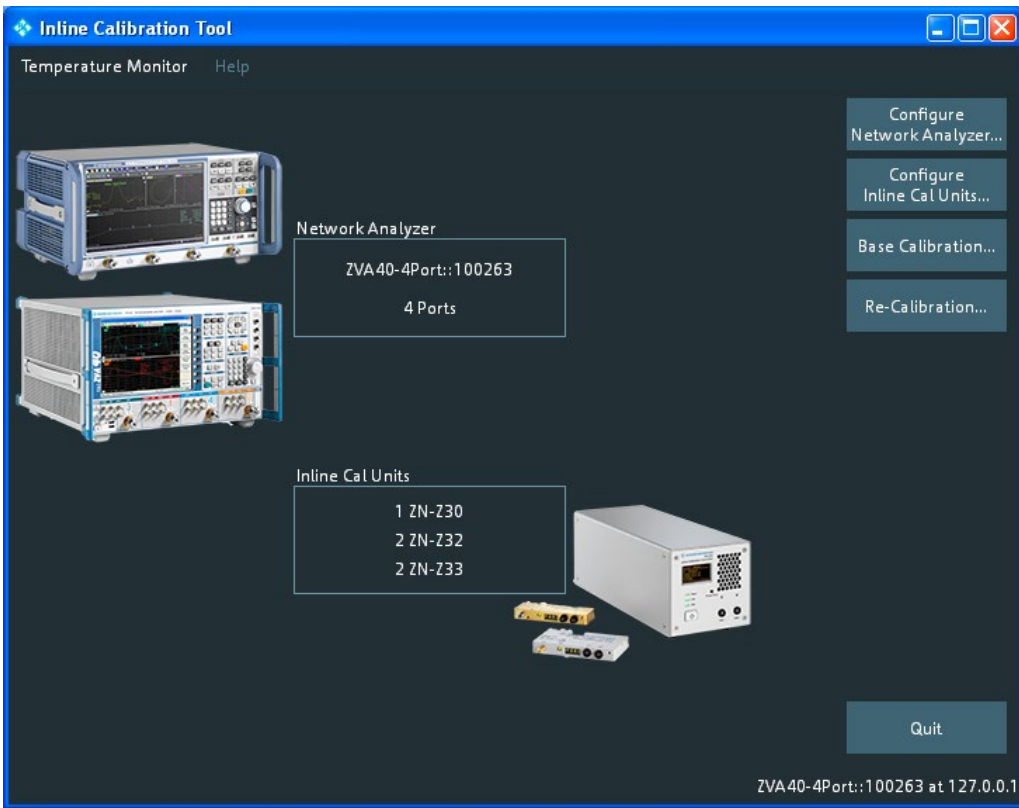
- All models have internally stored temperature characterization (ex factory)
- Built-in temperature sensors provide temperature compensated calibration and temperature monitoring
- The unit's slim design offers beneficial convenience in systems having a high number of test ports close to each other. Even the direct connection to an R&S®ZN-Z84 /-Z85 switch matrix is possible²⁾

¹ Not available with the TVAC model.

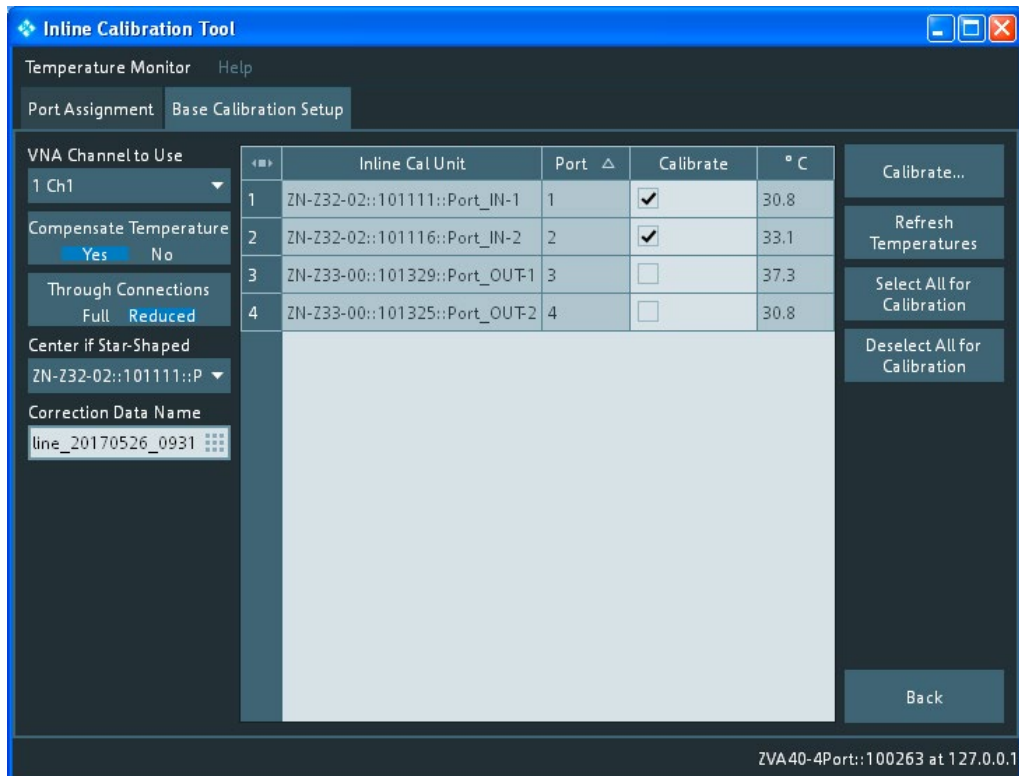
² Adapters required (f-f).



An integrated display¹⁾ provides essential information, such as assigned port number or CAN bus status information.



- The R&S®ZN-Z3ASW application software main dialog offers all essential steps at a glance:
- Definition of the Rohde&Schwarz network analyzer
 - Detection and registration of R&S®ZN-Z30 controllers and all connected R&S®ZN-Z32, R&S®ZN-Z33 inline calibration units
 - Performing the “Base Calibration”
 - Performing the “Re-Calibration”



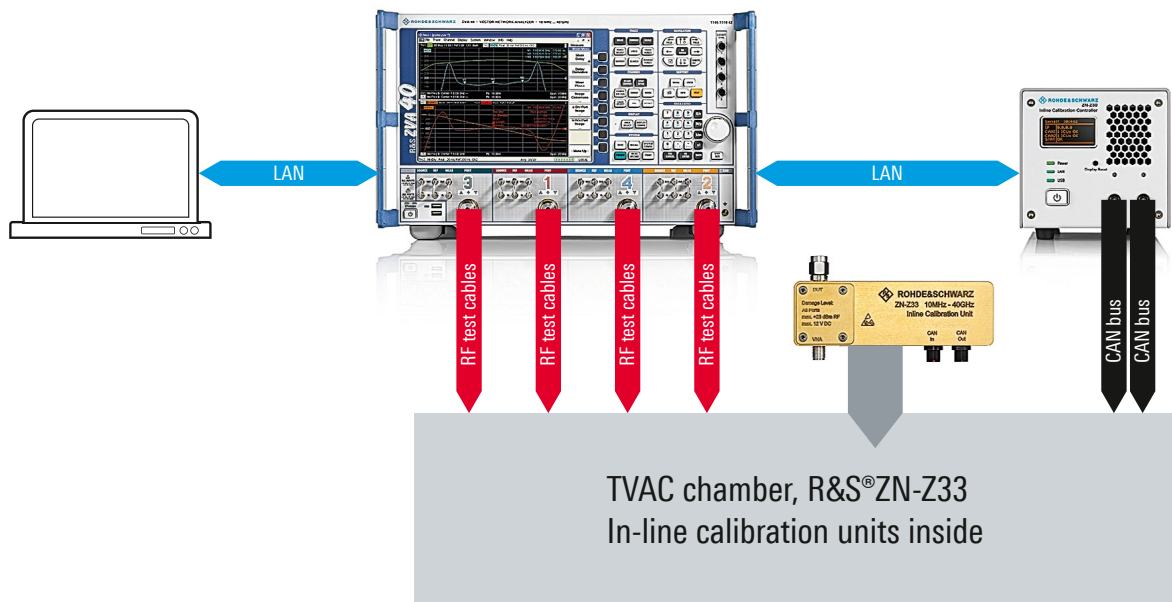
- R&S®ZN-Z3ASW application software calibration dialog:
- Calibration settings like VNA channel, calibration units and ports to be calibrated and selection of temperature compensation
 - Execution of base calibration

Calibration solution for demanding setups

TVAC (satellite) testing

When testing in a thermal vacuum chamber (TVAC), thermal drift effects of the test system components, e.g. RF cables, adapters, switches, or pre-amplifiers, cause the original calibration to become invalid. With the R&S®ZN-Z33 TVAC in-line calibration units permanently connected to the ends of the test cables, a fast calibration update can be applied after each change of the environmental parameters. The factory-based temperature characterization of the units, provides accurate and reliable results in a range as wide as -30°C to $+80^{\circ}\text{C}$.

R&S®ZN-Z33 TVAC system (R&S®ZN-Z3ASW application software installed on PC or VNA)



Multiport device test setups

(Re)connection of coaxial multiport DUTs inevitably leads to movement of the test cables, whose limited phase stability may lead to degraded measurement accuracy. Another contribution arises from repeatability errors with switch matrices. Even using an automatic multiport calibration unit, all ports must be re-connected, which means an elaborate error prone procedure. Using R&S®ZN-Z3x units, selected port groups can be recalibrated with a single key stroke without any reconnection.

Production

The most important requirements for a production line are high throughput and consistent measurement accuracy. For example, recalibration following replacement of a failed RF cable would traditionally have taken considerable

time and been prone to errors. With the R&S®ZN-Z3x units, the down time for a calibration refresh, even on change of a damaged cable, is significantly reduced, from hours to seconds, drastically increasing the efficiency of a production line.

Automated on-wafer test systems

With automated on-wafer probing, the continuous movement of the probe pins causes prolonged flexing of the test cables connecting the VNA to the probes. With time, the finite phase stability of the test cables leads to an increased measurement uncertainty. With an R&S®ZN-Z3x unit inserted between the test cable end and the probe, a periodic and automated calibration update can be performed. Thus, stable and accurate results can be achieved despite the continuous cable movement.



Multiport device test setup – scenario 1 (based on R&S®ZNB true multiport network analyzer).



Multiport device test setup - scenario 2 (based on R&S®ZNB network analyzer, combined with a R&S®ZN-Z84 switch matrix).

Specifications in brief

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In-line calibration unit	R&S®ZN-Z32	R&S®ZN-Z33
Frequency range	10 MHz to 8.5 GHz	10 MHz to 40 GHz
Connector type	SMA male/female	2.92 mm male/female
Nominal input level range	-45 dBm to +10 dBm	-45 dBm to +10 dBm
Effective directivity ¹⁾	> 40 dB	> 36 dB
Effective port match ¹⁾	> 36 dB	> 34 dB
Insertion loss	typ. 1 dB to 3 dB	typ. 3 dB to 5 dB

¹⁾ Initial calibration.

Ordering information

Designation	Type	Order No.
Inline Calibration Unit, 10 MHz to 8.5 GHz Incl. temperature characterization (+5°C to +40°C) Connector types <ul style="list-style-type: none"> ▪ Calibration port: SMA (female) ▪ DUT port: SMA (male) 	R&S°ZN-Z32	1328.7638.02
Inline Calibration Unit, 10 MHz to 40 GHz Incl. temperature characterization (+5°C to +40°C) Connector types <ul style="list-style-type: none"> ▪ Calibration port: 2.92 mm (female) ▪ DUT port: 2.92 mm (male) 	R&S°ZN-Z33	1328.7644.02
Inline Calibration Unit, 10 MHz to 40 GHz TVAC qualified model (w/o display and control button) Incl. temperature characterization (–30°C to +80°C) Connector types <ul style="list-style-type: none"> ▪ Calibration port: 2.92 mm (female) ▪ DUT port: 2.92 mm (male) 	R&S°ZN-Z33	1328.7644.03
Accessory included		
CAN-bus Control Cable (1 ×)	R&S°ZN-CAN025	
Recommended extras		
Application Software for R&S°ZN-Z3x In-line calibration unit controller (free download)	R&S°ZN-Z3ASW	–
Inline Calibration Unit Controller for R&S°ZN-Z32, R&S°ZN-Z33 Support of two CAN bus lines with up to 24 units each. incl. 2 × R&S°ZN-CAN2 CAN-bus control cables	R&S°ZN-Z30	1328.7609.02
CAN-bus Control Cable for in-line calibration modules Length 250 mm	R&S°ZN-CAN025	1339.3622.02
CAN-bus Control Cable for in-line calibration modules Length 2 m	R&S°ZN-CAN2	1339.3639.02
CAN-bus Control Cable for in-line calibration modules Length 10 m	R&S°ZN-CAN10	1339.3645.02
CAN-bus Adapter Cable for in-line calibration modules to extend CAN-bus cable length by connecting R&S°ZN-CANx control cables Length 250mm	R&S°ZN-CANA	1339.3651.02

Service options		
Extended Warranty, one year	R&S°WE1ZN-Z3x	Please contact your local Rohde & Schwarz sales office.
Extended Warranty, two years	R&S°WE2ZN-Z3x	
Extended Warranty, three years	R&S°WE3ZN-Z3x	
Extended Warranty, four years	R&S°WE4ZN-Z3x	
Extended Warranty with Calibration Coverage, one year	R&S°CW1ZN-Z3x	
Extended Warranty with Calibration Coverage, two years	R&S°CW2ZN-Z3x	
Extended Warranty with Calibration Coverage, three years	R&S°CW3ZN-Z3x	
Extended Warranty with Calibration Coverage, four years	R&S°CW4ZN-Z3x	