

R&S[®] ZN-Z3x Inline Calibration System User Manual




1177.6381.02 – 03

This manual describes the Inline Calibration System R&S®ZN-Z3x, comprising the following components:

- R&S®ZN-Z30 "Inline Calibration Controller", order no. 1328.7609.02
- R&S®ZN-Z32 "Inline Calibration Unit 8.5 GHz", order no. 1328.7638.02
- R&S®ZN-Z33 "Inline Calibration Unit 40 GHz", order no. 1328.7644.02
- R&S®ZN-Z33 "Inline Calibration Unit 40 GHz, Var. 03 (TVAC)", order no. 1328.7644.03
- R&S®ZN-CAN025 "CAN-bus control cable (baked out), 0.25 m", order no. 1339.3622.02
- R&S®ZN-CAN2 "CAN-bus control cable (baked out), 2 m", order no. 1339.3639.02
- R&S®ZN-CAN10 "CAN-bus control cable (baked out), 10 m", order no. 1339.3654.02
- R&S®ZN-CANA "CAN-bus adapter cable (baked out), 0.25 m", order no. 1339.3651.02

The software contained in this product uses several valuable open source software packages. For information, see the "Open Source Acknowledgment" on the user documentation CD-ROM (included in delivery).

Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol, e.g. R&S®ZN-Z3x is abbreviated as R&S ZN-Z3x

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1 Introduction

The measurement accuracy of a Vector Network Analyzer (VNA) heavily depends on a careful user calibration. Any deviation of the test setup after the calibration process inevitably produces errors. In case of a massive system error correction (e.g. if long RF cables with high damping or switch matrices are used), those deviations can lead to strongly altered measurement results. Especially in remote scenarios such as multipoint measurements, a re-calibration using traditional calibration kits or calibration units is a costly and time consuming process.

The Rohde & Schwarz Inline Calibration System R&S ZN-Z3x allows re-calibrating a running measurement setup without mechanically changing the measurement setup. For each DUT port an Inline Calibration Unit (ICU) is inserted between the corresponding VNA test port and the DUT. The ICU remains within the signal path throughout the measurement (low-loss through path) and, on request of the VNA, performs a full one-port calibration (OSM) in-situ.

In order to perform full multipoint measurements an initial calibration of the system has to be done.



Figure 1-1: Inline Calibration Unit

Control connections are established via a central Inline Calibration Controller (ICC) with

- 2 CAN bus interfaces towards the ICUs
- LAN and USB interface for remote control



Figure 1-2: Inline Calibration Controller

With respect to control, the ICC shall act as the master for the connected ICUs. However, in order to avoid unnecessary polling of data that might not have changed (e.g. the temperature of the ICUs) the ICUs themselves are able to send data autonomously. The CAN protocol supports this kind of multi-master operation.

1.1 System Overview

An Inline Calibration System R&S ZN-Z3x consists of an Inline Calibration Controller R&S ZN-Z30 (order no. 1328.7609.02) and one or more Inline Calibration Units R&S ZN-Z32/Z33, interconnected via CAN bus.

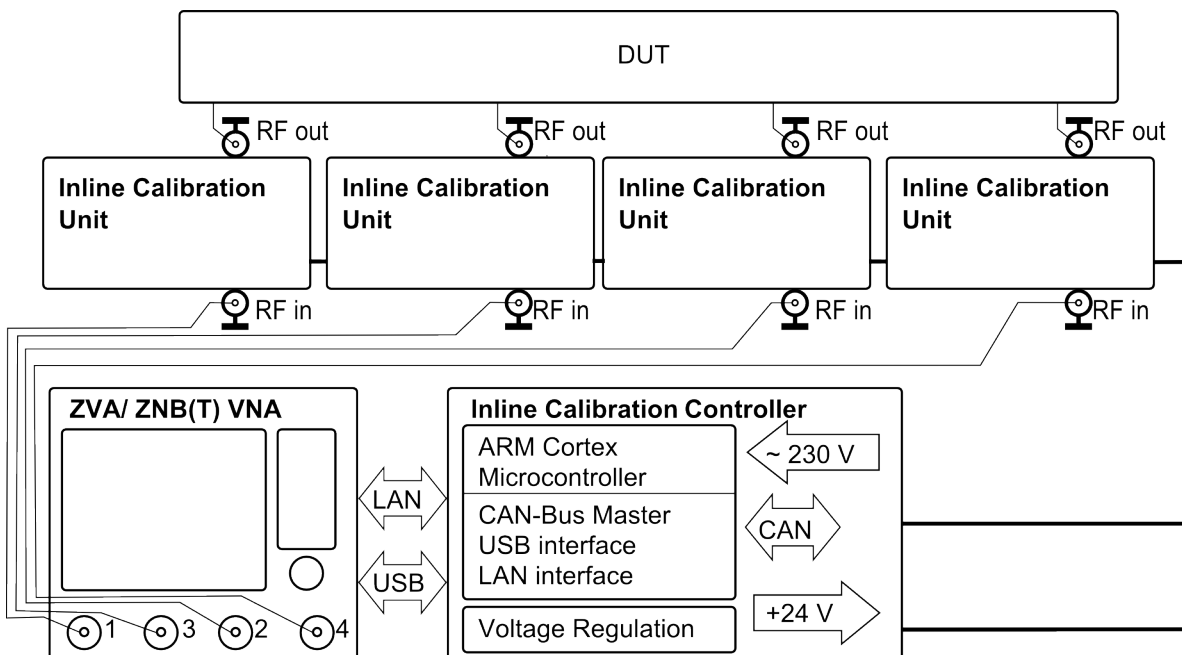
Table 1-1: Inline Calibration Units

Product Number	Name	Order No.
R&S®ZN-Z32	RF Inline Calibration Unit, 10 MHz to 8.5 GHz	1328.7638.02
R&S®ZN-Z33	MW Inline Calibration Unit, 10 MHz to 40 GHz	1328.7644.02
R&S®ZN-Z33 Var. 03 (TVAC)	MW Inline Calibration Unit, 10 MHz to 40 GHz	1328.7644.03



CAN bus systems are well established in automotive environments and have proven a high degree of robustness.

The Inline Calibration Controller (ICC) offers two CAN bus interfaces and is able to control and power supply up to 24 Inline Calibration Units per CAN bus. The ICC itself can be controlled via LAN or USB.



For technical details see the R&S ZN-Z3x data sheet.

1.2 About this Manual

The user manual contains the "getting started" chapters as well as descriptions of all instrument functions and of the remote control of the instrument. In addition, it contains notes on preventative maintenance for the R&S ZN-Z3x and on troubleshooting on the basis of the warnings and error messages that the instrument emits.

The user manual is organized into the following chapters:

- Putting the Instrument into Operation
- Application
- Operation (via Remote Control)
- Maintenance
- Appendix

The most recent version is always available on the [Internet](#).

2 Putting the System into Operation

An Inline Calibration System R&S ZN-Z3x consists of a Inline Calibration Controller R&S ZN-Z30 and one or more Inline Calibration Units R&S ZN-Z32/Z33.

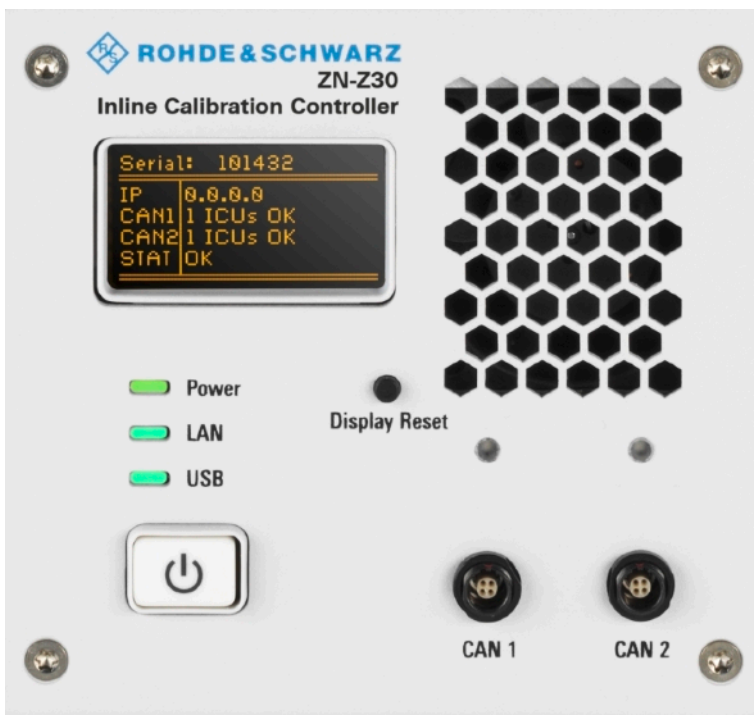
The sections below describe how to put the system into operation and how to establish the required control connections between the system components. General notes are provided to ensure safety while operating the system.

2.1 Inline Calibration Controller Tour

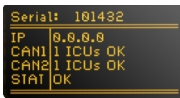
This chapter shows all control elements and connectors on the front and rear panel of the Inline Calibration Controller R&S ZN-Z30.

2.1.1 Front Panel

The front panel of the Inline Calibration Controller is shown on the photo below. Brief explanations on the controls and connectors can be found on the following pages.



Mini display



The R&S ZN-Z30 offers an OLED status display which provides the following information:

- serial number
- IP-address
- CAN bus 1,2: number of connected Inline Calibration Units, bus status (see [ICC:CAN<bus>:GET:STATE?](#) on page 36)
Note that in certain error states the ICC may not be able to detect the number of connected ICUs.
- Status of Inline Calibration Controller: "OK" or "Error 6" (configuration corrupted)



If "STAT | Error 6" persists the Inline Calibration Controller has to be returned to Rohde & Schwarz service.

Display Reset



The Display Reset key deactivates the screensaver.

Status LEDs



- Power: green = ready, red = standby; see [Chapter 2.3.4, "Turning the ICC On and Starting"](#), on page 17
- LAN: green = OK, red = not OK or booting
- USB: green = connected, red = not connected

Standby key



The key serves two purposes:

- Toggle between standby and ready state; see [Chapter 2.3.4, "Turning the ICC On and Starting"](#), on page 17.
When the instrument is powered up it comes up in ready state.

- Shut down the instrument; see [Chapter 2.3.5, "Switching the ICC Off"](#), on page 18.

CAN 1,2



Two independent CAN bus interfaces for control connection and power supply of Inline Calibration Units, see [Chapter 2.4, "Connecting ICUs"](#), on page 18.

The CAN bus voltage supplied by the R&S ZN-Z30 is +24 V with a maximum current of 1.8 A. The Inline Calibration Units will report an error if the supply voltage is too low (e.g. due to excessive bus length).

Table 2-1: CAN 1,2 pin assignment

Contact	Description	Value Range
1 (northwest)	CAN_HIGH	0 ... +5.5 V
2 (southwest)	CAN_LOW	0 ... +5.5 V
3 (southeast)	+24 V supply voltage	0 ... +24.5 V
4 (northeast)	Ground	0 V

The color of the LED above the connectors indicates the state of the respective CAN bus:

- red: bus not working (e.g. no Inline Calibration Unit connected) or in error state
- blue: bootloader mode (temporary state)
- pink: calibration data alignment between Inline Calibration Units and Inline Calibration Controller (temporary state)
- green: error-free operation

2.1.2 Back Panel

The back panel of the Inline Calibration Controller is shown on the photo below. Brief explanations on the controls and connectors can be found in [Table 2-2](#).

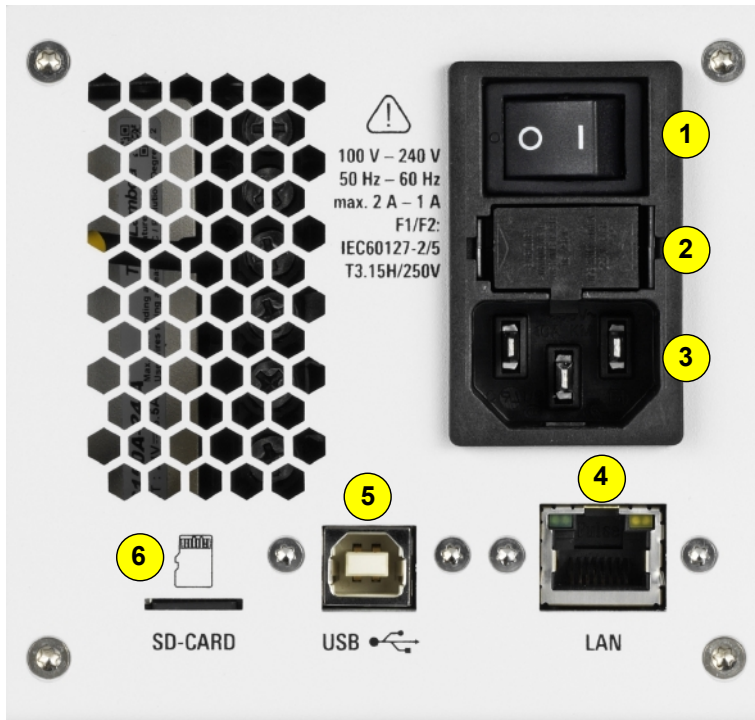


Table 2-2: Back panel elements

Index	Label	Description
1	O I	Power switch
2		Fuse drawer (see Chapter 5.2, "Replacing Fuses" , on page 47)
3		AC power connector
4	LAN	RJ-45 connector to integrate the instrument to a LAN, primarily for remote control purposes.
5	USB	Type B (slave) high speed USB connector for remote control of the R&S ZN-Z30.
6	SD-CARD	<p>Micro SD card slot.</p> <p>The R&S ZN-Z30 offers a Micro SD-Card slot to provide a mass storage device for characterization data gathered from the connected ICUs. This way the slow process of copying characterization data from a ICU to the ICC via CAN-bus (data rate 250 kBit/s) is only needed with the first usage of a new ICU with a dedicated ICC.</p> <p>The characterization data on the SD-Card can be accessed either via LAN (using the Inline Calibration Controller's FTP-server) or by utilizing the USB interface via the ZN-Z3x User tool (ZN-Z3x User Tool).</p> <p>Note: The SD card has to be formatted to FAT32.</p>

See the R&S ZN-Z3x Data Sheet for interface specification details.

2.2 Inline Calibration Unit Tour



VNA/DUT

RF connectors, 50 Ω , male/female

- SMA for R&S ZN-Z32
- 2.92 mm (K) for R&S ZN-Z33



It is recommended to use a suitable torque wrench when fastening the RF cables on the test port connectors.

NOTICE

Maximum input levels

The maximum input levels at all test ports according to the data sheet must not be exceeded.

In addition, the maximum input voltages of the other input connectors at the rear panel must not be exceeded.

CAN In/Out

"CAN in" and "CAN out" connect the Inline Calibration Unit to a CAN bus (see [Chapter 2.4, "Connecting ICUs"](#), on page 18). The first is for the direction towards the Inline Calibration Controller, the latter can be used to connect other Inline Calibration Units; see [Chapter 2.4, "Connecting ICUs"](#), on page 18.

Port Display

In error-free operation this displays the test port number to which the Inline Calibration Unit is connected and which is assigned using `ICU:SET:PORT<no>`. If an error occurs, E<error code> will be displayed alternating with the test port number.

Table 2-3: Inline Calibration Unit Errors

Error code	Error description
001	CAN bus error
002	Memory read/write error
003	Temperature error
004	24 V error Do not connect any further Inline Calibration Unit R&S ZN-Z32/Z33, otherwise the calibration precision (effective system data) can no longer be guaranteed
005	8 V error Calibration functionality degraded
006	5 V error CAN bus functionality degraded, risk of system error

Start Cal

Button with integrated LED, allowing to start a calibration sweep.

The button is armed using the SCPI command `ICU:CAL:START`. Its current state can be read using `ICU:SHOW:BUtton:STATE?`.

2.3 Preparing the System

This section covers the basic steps to set up the Inline Calibration System R&S ZN-Z3x and to put it into operation.

⚠ WARNING**Risk of injury and instrument damage**

The instrument must be used in an appropriate manner to prevent electric shock, fire, personal injury, or damage.

- Do not open the instrument casing.
- Read and observe the "Basic Safety Instructions" delivered as a printed brochure with the instrument.

In addition, read and observe the safety instructions in the following sections. Notice that the data sheet may specify additional operating conditions.

NOTICE**Risk of instrument damage due to inappropriate operating conditions**

Specific operating conditions are required to ensure accurate measurements and to avoid damage to the instrument. Observe the information on appropriate operating conditions provided in the basic safety instructions and the instrument's data sheet.

NOTICE**Instrument damage caused by electrostatic discharge**

Electrostatic discharge (ESD) can damage the electronic components of the instrument and the device under test (DUT). Electrostatic discharge is most likely to occur when you connect or disconnect a DUT or test fixture to the instrument's test ports. To prevent electrostatic discharge, use a wrist strap and cord and connect yourself to the ground, or use a conductive floor mat and heel strap combination.

⚠ CAUTION**Safety precautions**

Be absolutely sure to follow the instructions in the sections below to prevent injury to people or damage to the system components. This is particularly important the first time that you use the instrument. In addition, be sure to observe the general safety notes at the beginning of this manual.

2.3.1 Unpacking the ICC

The Inline Calibration Controller is delivered in a cardboard box. Proceed as follows to unpack its contents:

1. Remove the instrument from its packaging and check the shipment for completeness by comparing it with the shipping document and the accessory lists for the various items.
2. Remove the protective covers made of corrugated cardboard from the front and rear of the instrument.
3. Check the instrument for any damage. If there is any damage, immediately contact the shipping company that delivered the instrument. In this case, be absolutely certain that you keep the cardboard box and packing materials.

The delivery comprises two CAN bus control cables R&S ZN-CAN2 (2 m length), a power cable, a USB cable and the Software and User Documentation CD-ROM.

**Packing materials**

We recommend that you retain the packaging. It is advisable to keep the original packing material in order to prevent control elements and connectors from being damaged if the instrument has to be transported or shipped at a later date.

2.3.2 Setting up the System

The Inline Calibration Controller is designed for indoor use and can be set up on a level surface in a horizontal position.

2.3.3 Connecting the ICC to the AC Power Supply

Use the supplied power cable to connect the Inline Calibration Controller to the AC power supply.

⚠ CAUTION

Danger of electric shock

The Inline Calibration Controller complies with the specifications for the EN61010-1 protective class, which means that it can only be connected to a power outlet that has a protective contact.

2.3.4 Turning the ICC On and Starting

Switch the power switch on the back panel to I.



The power switch has two positions:

- 0: The Inline Calibration Controller is disconnected from the AC supply.
- I: The Inline Calibration Controller is receiving power from the AC supply.

When the instrument receives power from the AC supply it immediately starts loading the firmware (mini display: "ZN-Z30 <firmware version>") and performs a self-test.

In standby state press the [Standby key](#) to start the instrument.

As soon as the firmware is successfully loaded, the instrument is ready for operation and can be remotely controlled via USB and LAN.

2.3.5 Switching the ICC Off

To switch the R&S ZN-Z30 off, proceed as follows:

1. Press the **Standby key** on the front of the instrument.
The instrument switches to standby mode; only the POWER (standby) button remains active.
2. To disconnect the instrument completely from the AC supply, switch the power switch on the rear of the instrument to 0.
3. Disconnect the power cable at the AC power supply.

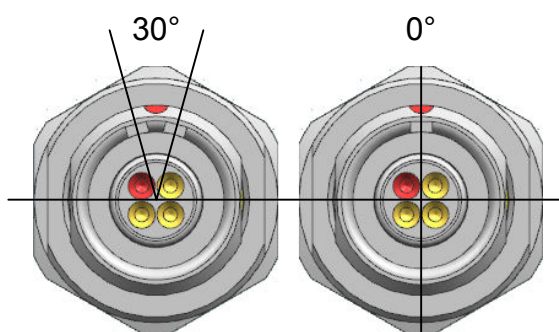
2.3.6 Function Check

The R&S ZN-Z30 automatically monitors the most important instrument functions when it is turned on.

2.4 Connecting ICUs

Per CAN bus interface up to 24 Inline Calibration Units can be connected in line, with a maximum total cable length of 40 m. CAN bus termination is provided by the last Inline Calibration Unit in the respective line.

The connectors are mechanically coded to prevent false connections (e.g. to connect CAN1 with CAN2):



CAN 1 and CAN 2 at the Inline Calibration Controller and CAN **Out** at the Inline Calibration Unit are coded with 30°, CAN **In** at the Inline Calibration Unit is coded with 0°. Each Inline Calibration Unit is shipped with a CAN bus control cable

R&S ZN-CAN025 (0.25 m length, one end coded 30°, the other coded 0°); other cable lengths and couplers can be ordered separately.

Table 2-4: CAN bus control cables / adapters

	Order no.	Cable length	Connector types	Connector coding
R&S ZN-CAN025	1323.8759.02	0.25 m	male / male	30° / 0°
R&S ZN-CAN2	1323.8742.02	2 m		
R&S ZN-CAN10	1323.8736.02	10 m		
R&S ZN-CANA	1323.8720.02	0.25 m	female / female	

2.5 Connecting External Devices

The R&S ZN-Z30 is equipped with different interfaces for establishing a remote control connection.

NOTICE

EMI Suppression

To suppress electromagnetic interference (EMI), the instrument may only be operated when it is closed and all covers are in place. The instrument's EMC rating is specified on the data sheet.

To prevent influences that cause disturbances, the following conditions must be adhered to:

- Use suitable double-shielded cables.
- Don't use any USB cables that are longer than 1 m.
- Only use USB devices that maintain the permitted EMC values.
- For the LAN connection, use CAT6 or CAT7 RJ-45 cables (LAN, Ethernet)

2.5.1 USB

If required, connect the USB connecting cable to the USB type B (slave) port on the rear panel. With direct connection to a master device, a connecting cable A-B (plug type A onto plug type B) must be used.

2.5.2 LAN

The connection to the LAN is made using a commercially available RJ-45 cable via the LAN interface on the back of the instrument.

NOTICE

Possible disturbance of network operation

Only insert or remove the network cable when the instrument is turned off. That is the only way to ensure reliable detection of the network connection and avoid faults during operation of the instrument.

The network interface works with an 100 Mbit/s IEEE 802.3u Ethernet. The TCP/IP network protocol and the associated network services are preconfigured. In order to exchange data in a local area network (LAN), it must be possible to address each connected computer or instrument via a unique IP address or a hostname.

By default, every R&S ZN-Z30 is assigned a hostname `ZNZ30X<serial number>`.

2.5.2.1 Networks with DHCP

The R&S ZN-Z30 is preconfigured to use the dynamic host configuration protocol (DHCP). In such networks, the R&S ZN-Z30 is automatically assigned a free IP address.

2.5.2.2 Static IP Configuration

With static IP configuration, the static IP configuration data are usually provided by the network administrator. They can be activated on the R&S ZN-Z3x using remote control.

2.5.2.3 Point-to-Point Connections

Establishing a simple network – a LAN connection between an R&S ZN-Z30 and a computer without integration into a larger network – requires assignment of an IP address for the R&S ZN-Z30 and the computer. The 192.168.xxx.yyy IP addresses are available for this. The values for xxx and yyy range from 1 to 254; the subnet mask length is 24 or higher. The IP address for the gateway must also be specified, but it is not of significance in this case.

3 Application

The Inline Calibration System R&S ZN-Z3x is an innovative solution for in-situ VNA recalibration. Each Inline Calibration Unit (ICU) contains calibration standards that are electronically switched when a calibration is performed. The calibration kit data for these standards are stored in the Inline Calibration Unit, so that the analyzer can calculate the error terms and apply the calibration without any further input.

Automatic calibration is generally faster and more secure than manual calibration, because:

- There is no need to connect several calibration standards manually. The number of connections to be performed quickly increases with the number of ports.
- Invalid calibrations due to operator errors (e.g. wrong standards or improper connections) are almost excluded.
- No need to handle calibration kit data.
- The internal standards don't wear out because they are switched electronically.

Advantages of in-situ recalibration:

- Switch and connector repeatability errors can be removed (at least for reflection measurements)
- Errors due to cable movements and thermal effects of cables, connectors and adapters can be removed
- The time intervals for complete calibrations can be expanded
- An operator is only needed for the initial calibration process (performing the connection of the Inline Calibration Units)
- Accuracy improvements for massive system error correction due to high damping (e.g. long RF-cables, switch matrices)
- Calibration and recalibration is possible for a wide temperature range (10°C to 50°C)
- Production test measurements with close device tolerances
- Measurement of low loss devices
- Faster multiport system recalibration
- Recalibration without direct access to the reference plane



This manual only gives a brief introduction to the Inline Calibration System's connection and use. For detailed information on remote operation refer to the forthcoming Rohde & Schwarz Application Note.

3.1 Inserting the ICUs into the Signal Path

Each Inline Calibration Unit offers two RF connectors:

- The female **VNA** connector is used to establish an RF connection to the VNA (using cables, step attenuators, etc.)
- The male **DUT** connector is used to establish an RF connection to the DUT; it should be connected **directly to the DUT**



Every cable, adapter etc. between the Inline Calibration Unit and the DUT will be treated as a part of DUT, because the reference plane of the calibration is shifted to the DUT Port of the Inline CalU.

3.2 Connecting the ICUs to the ICC

See [Chapter 2.4, "Connecting ICUs"](#), on page 18.

3.3 Calibration Accuracy

To ensure an accurate calibration consider the following:

- Avoid using adaptors between Inline Calibration Unit and DUT
- After connecting the Inline Calibration Units to the Inline Calibration Controller, allow for a sufficient warm-up time before starting the calibration

4 Operation

The Inline Calibration System R&S ZN-Z3x is completely remote-controlled, with the Inline Calibration Controller R&S ZN-Z30 providing the management interface. Apart from the [Display Reset](#) button on the Inline Calibration Controller and the [Start Cal](#) button on the Inline Calibration Unit it does not provide any means for manual control.

The PWR LED on the front panel of the Inline Calibration Controller indicates the standby state of the controller, the USB and LAN LEDs indicate whether a connection is established via the corresponding interface.

The Inline Calibration Controller R&S ZN-Z30 is equipped with a 128x64 monochrome OLED-Display that displays the following information:

- The serial number of the instrument.
This is displayed for identification purposes, which is particularly important if multiple Inline Calibration Controllers are used.
- The current IP address
- The state of the two CAN busses
- The operational state of the instrument. This can be either
 - OK if the instrument is error-free or
 - ERROR <error code> with the error code of the last occurred error.



To prevent the display from burn-in, it is automatically switched off after a certain time (screensaver functionality). Use the [Display Reset](#) key to reactivate the display.

The following sections describe the steps and commands required for remote control of the Inline Calibration System.

In [Chapter 4.1, "Basic Information on Remote Control"](#), on page 26 you will find information on setting up the Inline Calibration Controller for remote control and on the available interfaces and protocols. You will also find a brief description of the status register. The remote control commands are explained in detail in [Chapter 4.2, "Remote Control Commands"](#), on page 29.

4.1 Basic Information on Remote Control

This chapter contains basic information on remote control of the Inline Calibration System R&S ZN-Z3x. It contains instructions for setting up the Inline Calibration Controller R&S ZN-Z30 for remote control.

4.1.1 Interfaces and protocols

The Inline Calibration Controller ("the instrument" for short) has different interfaces for remote control. The following table provides an overview:

Table 4-1: Remote control interfaces and protocols

Interface	Comments
Local Area Network (LAN)	The LAN port is located at the backplane of the instrument. The LAN interface supports a RAW TCP/IP protocol at port 5025. For details see Chapter 4.1.1.2, "LAN Interface" , on page 27
USB	On the back of the instrument, there is a type B USB interface (slave) for communication with the master device. For details see Chapter 4.1.1.3, "USB Interface" , on page 28.

Standard Commands for Programmable Instruments (SCPI)

For remote control of the instrument, commands in line with the SCPI standard are used. The syntax of commands that are not included in that standard still follows the SCPI rules. The instrument supports SCPI version 1999 (Standard Commands for Programmable Instruments). The SCPI standard is built on the foundation of the IEEE 488.2 standard, and it aims to standardize instrument-specific commands, error handling and status register. For further information on SCPI concepts and definitions, please refer to the book "Automatic Measurement Control – A tutorial on SCPI and IEEE 488.2" by John M. Pieper, R&S order number 0002.3536.00.



This description of the remote control functionality assumes that you have a knowledge of programming and understand how to operate the controller. You will find detailed information on syntax and on the interface commands in the SCPI descriptions mentioned above.

4.1.1.1 Commands and Responses

Commands are messages that the controller sends to the instrument. They operate the instrument functions and request information. The commands are divided into types based on two criteria:

- On the basis of the effect that they have on the instrument
 - **Setting commands** control instrument settings, such as resetting the instrument, or entering setting values.
 - **Query commands** make output data for the remote control, for example for identifying the instrument or for querying a setting's value. Queries have a question mark ? at the end of the setting command.
- On the basis of how they are defined in the IEEE 488.2 and SCPI standards:
 - **Common commands** are precisely defined with regard to their function and syntax in the IEEE 488.2 standard. These commands are identical for all instruments, and they refer to functions such as the management of the standardized status register, resetting and self-testing.
 - **Instrument-dependent commands** are for functions that depend on the characteristics of the specific instrument, such as frequency setting. Many of these commands have also been standardized by the SCPI Consortium. Such commands are labeled "SCPI compliant" in the command reference. Commands without the SCPI label are instrument-dependent, however, their syntax follows the SCPI rules, as allowed by the standard.

Responses are messages that the instrument transmits to the controller after a query command. Responses contain measurement results, instrument settings or status information on the instrument.

You will find detailed descriptions of the commands for controlling the Inline Calibration System R&S ZN-Z3x in [Chapter 4.2, "Remote Control Commands"](#), on page 29.

4.1.1.2 LAN Interface

The Inline Calibration Controller R&S ZN-Z30 is equipped with a LAN interface to enable integration into a local area network (LAN). This interface consists of a connector, a network card, and protocols.

For remote control via the network, the controller and the R&S ZN-Z30 must be connected via the LAN interface to a common network that uses the TCP/IP network protocol. They are connected using commercially available RJ-45 cables.

The TCP/IP network protocol and the network services associated with it are pre-configured on the instrument.

To establish the connection, you need the instrument's IP address or computer name.

Socket Communication

An alternative way for remote control of the Inline Calibration System is to establish simple network communication using sockets (also referred as "Raw Ethernet communication").

The simplest way to establish a socket communication to the Inline Calibration Controller is to connect to the built-in Telnet server. A Telnet client is part of every operating system and supports communication with the server on a command-by-command basis. For better utilization and to enable automation by means of programs, user-defined sockets can be programmed.

Socket connections are established on a specially defined port. The socket address is a combination of the IP address or the instrument's host name and the number of the port configured for remote control. All Inline Calibration Controllers use port number 5025 for this purpose. The port is configured for communication on a command-to-command basis and for remote control by a program.

FTP

The characterization data on the Micro SD Card of the Inline Calibration Controller can be managed via the R&S ZN-Z30's FTP server. This server is listening on TCP port 21 and is preconfigured for anonymous FTP (user name "anonymous").

4.1.1.3 USB Interface

For remote control via USB, connect the controller (master) to the type B USB connector on the back panel of the R&S ZN-Z30.

Remote control of the Inline Calibration System requires the dynamically linked library `icdll.dll` on the controller. This dll is installed with the the ZN-Z3x User (see [Chapter 6, "ZN-Z3x User Tool"](#), on page 51).

USB address

To establish a USB connection, you need

- the **vendor ID** `0x0AAD` (for Rohde & Schwarz)

- the R&S ZN-Z30's **product ID** 0x17B and
- the Inline Calibration Controller's 6-digit serial number, which can be read from the mini display or the label on the back of the particular R&S ZN-Z30).

4.1.2 Status Reporting System

The status reporting system stores all information on the instrument's current status and on the errors that have arisen. This information is stored in the status register and in an error output queue.

4.2 Remote Control Commands

This chapter describes all the commands that are relevant for remote control of the Inline Calibration System R&S ZN-Z3x. The "List of Commands" at the end of the manual contains all commands in alphabetic order.



Tips and tricks for operation ...

- **The use of upper and lower case letters** designates the long and short forms of a command: `SET:LAN:SNMask = SET:LAN:SNM`
- **Text parameters** are separated from the header by a space. They follow the strict syntax rules for keywords.
- Results are returned as ASCII strings terminated with `<CR><LF>` (ASCII 13 followed by ASCII 10)
- On successful execution of a command that otherwise does not return a result, a confirmation `0, "OK"<CR><LF>` is returned.

4.2.1 Inline Calibration Controller

ICC or system related commands.

4.2.1.1 ICC – General Functions

Commands for identification and general operation of the connected Inline Calibration Controller (ICC).

Remote Control Commands

*IDN?	30
*RST	30
*SERial?	30
ICC:SET:CLOCK	31
ICC:WRITE:SETTINGS	31

***IDN?**

Returns the identification string of the R&S ZN-Z30.

Return values:

<ID_Str> ROHDE&SCHWARZ,ZN-Z30,<serial>,<fw version>, where
 <serial> is the 6 digit serial number (see SAP label on the backplane)
 <fw version> is the installed firmware version in "xx.yy" dotted decimal notation (xx: major version; yy: minor version)

Usage: Query only

Manual operation: See ["Identification String"](#) on page 54

***RST**

Sets the system to a defined default state.

Usage: Event

***SERial?**

Returns the serial number of the R&S ZN-Z30.

Return values:

<Value> 6 digit serial number, see mini display and SAP label on the backplane

Usage: Query only

Manual operation: See ["Identification String"](#) on page 54

ICC:SET:CLOCK

Sets date and time at the Inline Calibration Controller.

Note that the R&S ZN-Z30 doesn't have a battery and hence date and time have to be set after every power off.

Parameters:

<TimeStamp> A timestamp in the 32 bit coded format described in the table below.

Usage: Event

Table 4-2: Timestamp format

Bits	Description
0–4	Seconds divided by 2 (0–30)
5–10	Minute (0–59)
11–15	Hour (0–23)
16–20	Day of month (1–31)
21–24	Month (January = 1, ..., December = 12)
25–31	Years since 1980 (= current year - 1980).

ICC:WRITE:SETTINGS

Writes the current (LAN) settings to the internal flash memory of the Inline Calibration Controller. These settings are loaded during instrument startup.

Usage: Event

Manual operation: See "[Write all settings to ZN-Z30 \(permanent\)](#)" on page 57

4.2.1.2 ICC – LAN Interface

The following commands get/set the LAN properties of the Inline Calibration Controller R&S ZN-Z30.



Modified LAN settings are not applied until `ICC:INIT:LAN` is executed. To make the changes permanent, use `ICC:WRITE:SETTINGS` to write the current LAN settings to the Inline Calibration Controller.

<code>ICC:SET:LAN:HOST:NAME</code>	32
<code>ICC:SHOW:LAN:HOST:NAME?</code>	32
<code>ICC:SHOW:LAN:MAC:ADDRESS?</code>	32
<code>ICC:SHOW:LAN:DHCP?</code>	33
<code>ICC:SET:LAN:DHCP:ON</code>	33
<code>ICC:SET:LAN:DHCP:OFF</code>	33
<code>ICC:SET:LAN:GW</code>	33
<code>ICC:SHOW:LAN:GW?</code>	33
<code>ICC:SET:LAN:IP</code>	34
<code>ICC:SHOW:LAN:IP?</code>	34
<code>ICC:SET:LAN:SNMask</code>	34
<code>ICC:SHOW:LAN:SNMask?</code>	34
<code>ICC:SET:LAN:DNSADDR</code>	35
<code>ICC:INIT:LAN</code>	35

ICC:SET:LAN:HOST:NAME <HostName>

ICC:SHOW:LAN:HOST:NAME?

Sets/queries the hostname.

If the R&S ZN-Z30 uses DHCP (`ICC:SET:LAN:DHCP:ON`) and the DHCP server supports DHCP Option 12, the R&S ZN-Z30 can also be reached via this host-name.

Note that modified LAN settings are not applied until `ICC:INIT:LAN` is executed.

Parameters:

<HostName> The LAN hostname string (max. 20 characters).
 The default hostname is `ZNZ30X<serial>`.

Manual operation: See "[Hostname](#)" on page 57

ICC:SHOW:LAN:MAC:ADDRESS?

Queries the LAN MAC address.

Return values:

<MACAddress> The LAN MAC address is in the format
xx-xx-xx-xx-xx-xx, e.g. 00-40-9D-25-EE-0C.

Usage: Query only

ICC:SHOW:LAN:DHCP?

Queries whether DHCP is enabled.

Return values:

<DHCP> 1: DHCP is enabled
 0: DHCP is disabled (static IP configuration)

Usage: Query only

Manual operation: See "[IP Setting](#)" on page 56

ICC:SET:LAN:DHCP:ON
ICC:SET:LAN:DHCP:OFF

Enables/disables dynamic host configuration.

Note that modified LAN settings are not applied until [ICC:INIT:LAN](#) is executed.

Usage: Event

Manual operation: See "[IP Setting](#)" on page 56

ICC:SET:LAN:GW
ICC:SHOW:LAN:GW?

Sets/queries the LAN default gateway.

Setting a default gateway is only possible with static IP configuration ([ICC:SET:LAN:DHCP:OFF](#)). Otherwise the calibration unit answers with a "Deactivate DHCP first!"

Note that modified LAN settings are not applied until [ICC:INIT:LAN](#) is executed.

Parameters:

<GWIP> The IP address of the default gateway in dotted decimal format, e.g. 192.168.1.2.

Manual operation: See "[IP address / Subnet Mask / Standard Gateway](#)" on page 56

ICC:SET:LAN:IP**ICC:SHOW:LAN:IP?**

Sets/queries the LAN IP address.

Setting an IP address is only possible with static IP configuration ([ICC:SET:LAN:DHCP:OFF](#)). Otherwise the calibration unit answers with a "Deactivate DHCP first!"

Note that modified LAN settings are not applied until [ICC:INIT:LAN](#) is executed.

Parameters:

<IpAddr> The LAN IP address in dotted decimal format, e.g. 10.114.12.1.

Manual operation: See "[IP address / Subnet Mask / Standard Gateway](#)" on page 56

ICC:SET:LAN:SNMask**ICC:SHOW:LAN:SNMask?**

Sets/queries the LAN subnet mask.

Setting a subnet mask is only possible with static IP configuration ([ICC:SET:LAN:DHCP:OFF](#)). Otherwise the calibration unit answers with a "Deactivate DHCP first!"

Note that modified LAN settings are not applied until [ICC:INIT:LAN](#) is executed.

Parameters:

<SnMask> The LAN subnet mask in dotted decimal format, e.g. 255.255.255.0.

Manual operation: See "[IP address / Subnet Mask / Standard Gateway](#)" on page 56

ICC:SET:LAN:DNSADDR

Sets the DNS server.

This is only possible with static IP configuration (`ICC:SET:LAN:DHCP:OFF`). Otherwise the calibration unit answers with a "Deactivate DHCP first!"

Note that modified LAN settings are not applied until `ICC:INIT:LAN` is executed.

Parameters:

<IpAddr> The LAN IP address of the DNS server in dotted decimal format, e.g. 10.114.12.1.

Usage: Setting only

ICC:INIT:LAN

Activates the previously configured LAN settings (DHCP, IP address, subnet mask, default gateway).

Use the `ICC:WRITE:SETTINGS` command to persist the LAN settings.

Usage: Event

Manual operation: See "Apply LAN Settings (nonpermanent)" on page 57

4.2.1.3 ICC – CAN Bus

The following commands get/set the CAN bus properties of the Inline Calibration Controller R&S ZN-Z30.

<code>ICC:CAN<bus>:RST</code>	35
<code>ICC:CAN<bus>:APP:START</code>	36
<code>ICC:CAN<bus>:BOOTloader:START</code>	36
<code>ICC:CAN<bus>:GET:STATE?</code>	36
<code>ICC:GET:ID</code>	38
<code>ICC:GET:LIST?</code>	38

ICC:CAN<bus>:RST

Resets the related CAN bus and all connected Inline Calibration Units. The connected Inline Calibration Units come up in bootloader state.

Suffix:

<bus> 1 or 2
 Number of the related CAN bus

Usage: Event

ICC:CAN<bus>:APP:START

Broadcasts the "application start" command to connected Inline Calibration Units.

This requires the CAN Bus to be in bootloader mode (after a `ICC:CAN<bus>:RST` command).

Suffix:

<bus> 1 or 2
 Number of the related CAN bus

Usage: Event

ICC:CAN<bus>:BOOTloader:START

Initiates bootloading of firmware to connected Inline Calibration Units.

Note that firmware updates on a R&S ZN-Z32/Z33 are only possible in bootloader state.

Suffix:

<bus> 1 or 2
 Number of the related CAN bus

Usage: Event

ICC:CAN<bus>:GET:STATe?

Queries the state of the related CAN bus

Suffix:

<bus> 1 or 2
 Number of the related CAN bus

Return values:

<code> CAN bus status code (decimal representation; see table below),

Remote Control Commands

<progress> CAN bus data transfer progress in percent (e.g. transfer of factory characterization data)

<err_count> CAN bus error counter

Usage: Query only

Table 4-3: CAN bus status codes

Status code	Mini display	Description
0	-	OFF state (e.g. at startup of the Inline Calibration Controller)
1	Bootload	Bootloader mode This is active (in all related Inline Calibration Units) as soon as the supply rail of one CAN bus is activated or after the command <code>ICC:CAN<bus>:BOOTloader:START</code> is executed
2	OK	Operational mode Use <code>ICC:CAN<bus>:APP:START</code> to get Inline Calibration Units from bootloader mode to operational mode
3	Busy progress <x>%	Busy state, transfer of characterization data in progress In this state further SCPI-Commands accessing the related CAN bus are blocked; if such a SCPI-command arrives an error code is returned
33	Imax err	Overcurrent state This state is attained if an overcurrent is detected on the supply rail of the related CAN bus. The supply rail is switched off.
49	Boot fail	Bootloader fail state Some Inline Calibration Units on the related CAN bus did not acknowledge to have deleted their programm memory.
50	TX err	Transmit error counter out of range
51	RX err	Receive error counter out of range
52	Calkit err	Transfer of characterization data failed If this error persists, reformat the SD card inserted at the R&S ZN-Z3x to FAT32.

ICC:GET:ID

Initiates the identification of all connected Inline Calibration Units; triggers a broadcast on both CAN busses.

The CAN buses must neither be in bootloader mode nor in busy state.

Usage: Event

Manual operation: See "[Update ID List](#)" on page 55

ICC:GET:LIST?

Lists the IDs of all connected Inline Calibration Units

Return values:

<IDs> A comma-separated list of Inline Calibration Unit IDs (see "[ICU_ID](#)" on page 38).

Usage: Query only

Manual operation: See "[R&S ZN-Z32/Z33 ID List](#)" on page 55

4.2.2 Inline Calibration Unit

Commands related to a single ICU.

**ICU_ID**

In all these commands a particular ICU is referred to by a unique ID. This ICU_ID consists of

- the prefix **2** for units R&S ZN-Z32, or **3** for units R&S ZN-Z33
 - the unit's serial number in hexadecimal representation
-

For example, the ICU_ID of an Inline Calibration Unit R&S ZN-Z33 with serial number 100017 (= 0x186B1) is 3186B1.



The ICUs connected to the Inline Calibration Controller can be discovered via [ICC:GET:ID](#) and [ICC:GET:LIST?](#).

4.2.2.1 ICU Properties

Commands to set/get the properties of an individual Inline Calibration Unit (ICU).

The ICUs connected to the Inline Calibration Controller can be discovered via `ICC:GET:ID` and `ICC:GET:LIST?`.

<code>ICU:SHOW:STATE?</code>	39
<code>ICU:SHOW:TEMP?</code>	40
<code>ICU:SHOW:VAR?</code>	40
<code>ICU:FWVersion:READ?</code>	40
<code>ICU:SECure:ERASe</code>	41

`ICU:SHOW:STATE? <ICU_ID>`

Queries the state of the related Inline Calibration Unit.

The result is a composite string of the form `ICU <ICU_ID> status: <code>, <progress>%`, e.g. `ICU 3186b6 status: 0, 0%`

Parameters:

`<ICU_ID>` ID of a connected Inline Calibration Unit (see "`ICU_ID`" on page 38)

Return values:

`<code>` Decimal status code as described in the table below

`<progress>` Progress of a calkit transmission in percent

Usage: Query only

Table 4-4: Inline Calibration Unit status codes

Status code	Description
0	No error
1	CAN Bus Receive Error
2	CAN Bus Transmit Error
64	24 V error Do not connect any further Inline Calibration Unit R&S ZN-Z32/Z33, otherwise the calibration precision (effective system data) can no longer be guaranteed
65	13 V error Calibration functionality degraded

Status code	Description
66	5 V error CAN bus functionality degraded, risk of system error
70	Calkit error Calkit data unavailable or unreadable
80	Temperature error, Risk of damaging the device

ICU:SHOW:TEMP? <ICU_ID>

Queries the last temperature reported by the related ICU

Parameters:

<ICU_ID> ID of a connected Inline Calibration Unit (see "ICU_ID" on page 38)

Return values:

<temp> ICU temperature in degrees Celsius, e.g. 29.5

Usage: Query only

ICU:SHOW:VAR? <ICU_ID>

Queries the hardware variant of the related ICU.

Parameters:

<ICU_ID> ID of a connected Inline Calibration Unit (see "ICU_ID" on page 38)

Return values:

<variant> The last two digits of the related ICU's order number (XXXX.XXXX.XX; see Table 1-1)

Usage: Query only

ICU:FWVersion:READ? <ICU_ID>

Queries the firmware version of the related ICU.

Parameters:

<ICU_ID> ID of a connected Inline Calibration Unit (see "ICU_ID" on page 38)

Return values:

<fw_version> Firmware version of the related ICU

Usage: Query only

ICU:SECure:ERASe <ICU_ID>

Sanitizes the flash memory of the related ICU (i.e. securely erases the user block of data) or queries the sanitization state.

Parameters:

<ICU_ID> ID of a connected Inline Calibration Unit (see "ICU_ID" on page 38)

4.2.2.2 ICU Calibration

Commands to perform a calibration.

ICU:SET:PORT<no> <ICU_ID>

Assigns port number <no> to the related Inline Calibration Unit

Suffix:

<no> Port number

Parameters:

<ICU_ID> ID of a connected Inline Calibration Unit (see "ICU_ID" on page 38)

ICU:CAL:OPEN <ICU_ID>**ICU:CAL:SHORT** <ICU_ID>**ICU:CAL:MATCH** <ICU_ID>**ICU:CAL:THROUGH** <ICU_ID>

Connects the VNA port of the related Inline Calibration Unit to its built-in OPEN, SHORT or MATCH calibration standard or establishes the low-loss through path between VNA and DUT port.

Note that for the initial calibration, a THROUGH standard between the DUT ports of different Inline Calibration Units has to be connected externally.

Parameters:

<ICU_ID> ID of a connected Inline Calibration Unit (see "ICU_ID" on page 38)

Usage: Event

ICU:CAL:START <ICU_ID>

ICU:CAL:STOP <ICU_ID>

Starts/stops the calibration logic at the related Inline Calibration Unit (see [ICU:SHOW:BUtton:STATE?](#)):

- Issuing `ICU:CAL:START` in "IDLE" (or "TRIGGERED") state puts the "Start Cal" button of the related Inline Calibration Unit into "ARMED" state (LED blinking)
- Issuing `ICU:CAL:STOP` in "TRIGGERED" (or "ARMED") state puts the "Start Cal" button of the related Inline Calibration Unit into "IDLE" state

Parameters:

<ICU_ID> ID of a connected Inline Calibration Unit (see "ICU_ID" on page 38)

Usage: Event

ICU:SHOW:BUtton:STATE? <ICU_ID>

Queries the state of the related Inline Calibration Unit's Start Cal button (see "[Start Cal](#)" on page 14).

The following graphic shows the possible state transitions:

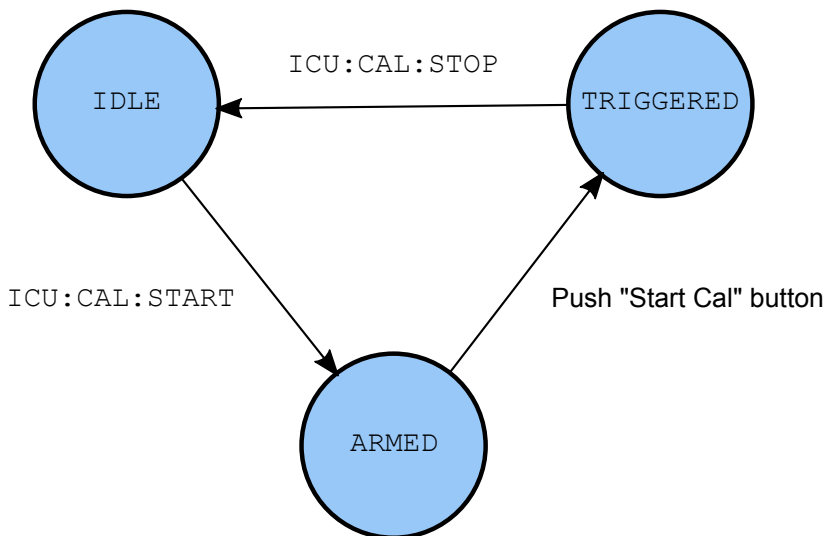


Figure 4-1: "Start Cal" button state transitions

The intended use case is a calibration step requiring user interaction, for example if a THROUGH standard has to be connected between the related Inline Calibration Units.

A remote control application should send the `ICU:CAL:START` command and then poll the button state to take the appropriate actions when the user presses the "Start Cal" button (i.e. when the "TRIGGERED" state is observed). Finally it should send the `ICU:CAL:STOP` command to go back to "IDLE" state.

Parameters:

<ICU_ID> ID of a connected Inline Calibration Unit (see "ICU_ID" on page 38)

Return values:

<response> 0, "IDLE"
 1, "ARMED": Waiting for the user to press the "Start Cal" button
 2, "TRIGGERED": "Start Cal" button was pressed in "ARMED" state

Usage: Query only

4.2.2.3 ICU Characterizations

Commands to handle factory and user characterization data.

ICU:CALKIT:FACT:READ <ICU_ID>

Reads the factory characterization (factory calkit file) from the flash memory of the related Inline Calibration Unit to the SD-Card of the Inline Calibration Controller.

Caching of factory characterization data over the comparatively slow CAN bus connection (max. data rate 1 MBit/s) is initiated automatically

- when the respective ICU is connected to the ICC for the first time
- if the ICC detects that the factory characterization data on the ICU have changed (e.g. after recalibration at Rohde&Schwarz service)

Using `ICU:CALKIT:FACT:READ` it can also be triggered manually.

On the SD-card of the ICC the calkit files of a particular ICU are maintained as zip archives in the directory `<ICU_ID>`. From there they can be downloaded via FTP.

The factory calkit file is named `Factory.zip`, the user calkit files are named `User1.zip`, `User2.zip`, ... (see [ICU:CALKIT:USER:WRITE](#) on page 45).

Parameters:

`<ICU_ID>` ID of a connected Inline Calibration Unit (see "[ICU_ID](#)" on page 38)

Usage: Event

Manual operation: See "[Read Factory Characterization R&S ZN-Z32/Z33](#)" on page 55

ICU:CALKIT:USER:READ <ICU_ID>

Reads the user characterization data (i.e. all user calkit files) from the flash memory of the related Inline Calibration Unit to the SD-Card of the Inline Calibration Controller.

On the SD-card of the ICC the calkit files of a particular ICU are maintained as zip archives in the directory `<ICU_ID>` (see "[ICU_ID](#)" on page 38). From there they can be downloaded via FTP.

The factory calkit file is named `Factory.zip`, the user calkit files are named `User1.zip`, `User2.zip`, ... (see [ICU:CALKIT:USER:WRITE](#) on page 45).

Parameters:

<ICU_ID> ID of a connected Inline Calibration Unit (see "ICU_ID" on page 38)

Usage: Event

Manual operation: See "Read User Characterization R&S ZN-Z32/Z33" on page 55

ICU:CALKIT:USER:WRITE <Dest_UckitFile>

Writes a user calkit file from the SD-Card of the Inline Calibration Controller to the flash memory of the related Inline Calibration Unit.

If for some reason the user calkit file can't be transferred to the ICU, a "Calkit err" ([status code 52](#)) is displayed at the ICC.

If the ICU runs out of storage space for user characterization data, a "Memory read/write error" ([error code 002](#)) is displayed at the ICU. Use [ICU:CALKIT:USER:DELeTe](#) to delete existing user characterizations and free the required storage space.

Note

- Before uploading the calkit file to the ICC via FTP, it must be packed to a zip archive named according to DOS 8.3 filename conventions.
- On the SD card of the ICC, the zip archive must be placed in the related ICU's dedicated directory <ICU_ID> (see "ICU_ID" on page 38).
- On the ICU the available user characterization files are maintained as User1.zip, ..., User<N>.zip. The original zip file name is lost.

Parameters:

<Dest_UckitFile> String identifying the related ICU and the calkit file to be written. It is composed of the ICU_ID (see "ICU_ID" on page 38), an @, and the name of an existing user calkit zip file (e.g. "3186B1@new_ucal.zip").

Usage: Event

Manual operation: See "Write User Characterization R&S ZN-Z32/Z33" on page 56

ICU:CALKIT:USER:DELeTe <Src_UCKitNo>

Deletes one of the user characterization files `User1.zip`, ..., `User<N>.zip` from the flash memory of the related Inline Calibration Unit (see [ICU:CALKIT:USER:WRITE](#) on page 45).

Parameters:

<Src_UCKitNo> String identifying the related ICU and the user calkit file to be deleted. It is composed of the ICU_ID, an @, and the user calkit number.

Note: After the deletion, the remaining user cal kits on this ICU are renumbered automatically.

Usage: Event

5 Maintenance

5.1 Inline Calibration Unit Recharacterization

The Inline Calibration Units R&S ZN-Z32/Z33 need to be recharacterized in intervals of one year. Other maintenance work is essentially limited to cleaning the Inline Calibration System components and replacing fuses in the Inline Calibration Controller.



Irregular recharacterization may cause deviations from specified data

The technical information provided in the data sheet can be only guaranteed if the Inline Calibration Units R&S ZN-Z32/Z33 are recharacterized in regular intervals. The recharacterization interval should not exceed one year.

5.2 Replacing Fuses

The Inline Calibration Controller R&S ZN-Z30 is protected by two fuses (IEC60127 T3.15H / 250 V, stock no. 0099.6729.00), located in the fuse drawer below the AC power switch on the rear panel.

⚠ WARNING

Risk of electric shock

The fuse is part of the main power supply. Therefore, handling the fuse while power is on can lead to electric shock. Before opening the fuse holder, make sure that the instrument is switched off and disconnected from all power supplies.

Always use fuses supplied by Rohde & Schwarz as spare parts, or fuses of the same type and rating.

To replace the fuses

1. Use a small screwdriver to bend the small clamps on both sides of the fuse drawer inward so that you can lift the fuse drawer out of its slot.
2. Exchange the fuses.
3. Push the drawer back into the slot.

5.3 Cleaning

⚠ CAUTION**Danger of electric shock**

Before cleaning the Inline Calibration Controller R&S ZN-Z30, make sure that it is switched off and that it is disconnected from all power supplies. Before cleaning a Inline Calibration Unit, disconnect it from any RF or CAN bus cable.

NOTICE**Instrument damage caused by cleaning agents**

Cleaning agents contain substances such as solvents (thinners, acetone, etc.), acids, bases, or other substances. Solvents can damage the front panel labeling, plastic parts, or screens, for example.

Never use cleaning agents to clean the outside of the instrument. Use a soft, dry, lint-free dust cloth instead.

5.4 Service work

Replacing modules and ordering spare parts is described in the service manual. There you will also find all the ID numbers required for ordering spare parts.

In addition, the service manual contains information on troubleshooting, repairs and replacing modules.

5.5 Packing and storage

The storage temperature for the R&S ZN-Z3x is specified in the data sheet. When storing for longer periods, protect the calibration system components from dust.

Prior to transport or shipping, pack the calibration system components just as they were originally packed. The protective covers guard the controls and connections against damage. The anti-static packaging film prevents undesired electrostatic charges.

If you no longer have the original packaging, employ a sturdy cardboard box of a suitable size. Ensure that there is enough padding to keep the respective system component from slipping around inside the package. Wrap it in anti-static film to protect it against electrostatic charging.

6 ZN-Z3x User Tool

The ZN-Z3x User can be found on the User Documentation CD-ROM that is shipped with the R&S ZN-Z30. It offers the following functions:

- Connect to one or more Inline Calibration Controllers R&S ZN-Z30 via USB
- For each of the connected R&S ZN-Z30:
 - Read its identification parameters (serial number, firmware version)
 - Send SCPI commands and read the responses
 - Read and modify LAN Settings
 - Show the number of attached Inline Calibration Units R&S ZN-Z32/Z33
- For each of the Inline Calibration Units R&S ZN-Z32/Z33 attached to one of the connected R&S ZN-Z30:
 - Show its serial number, firmware version and temperature
 - Read the factory characterization data of the ICU from the SD card of the ICC
 - Read user characterization data from the ICU
 - Write user characterization data to the ICU
- Update the firmware of an Inline Calibration Unit R&S ZN-Z30 and/or its attached Inline Calibration Units R&S ZN-Z32/Z33

6.1 Software Installation

The "ZN-Z3x User" tool can be installed on any PC running Windows 7 or higher.

In addition to the requirements imposed by the operating system (e.g. see [Windows 7 system requirements](#)), you will need a spare USB port to establish a physical connection to the Inline Calibration Controller.

Installation of the software is completely self-explanatory: run the `znz3x_Setup.msi` and follow the instructions of the installation wizard.

If not already available on the target PC, the wizard attempts to install the R&S ZN-Z USB BULK driver, which requires administrative privileges.

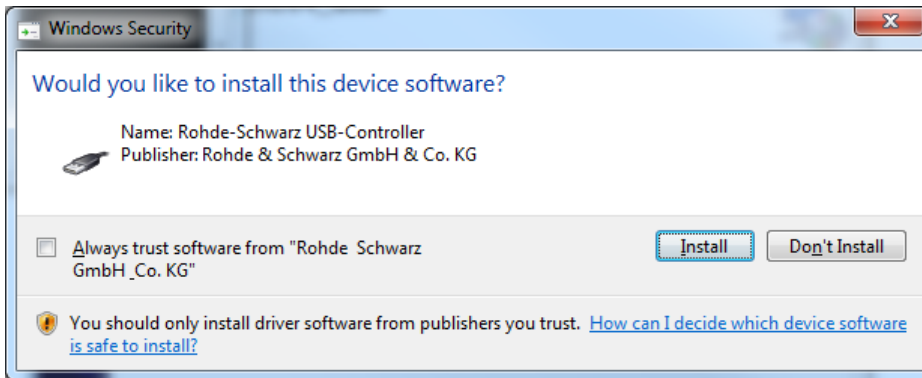
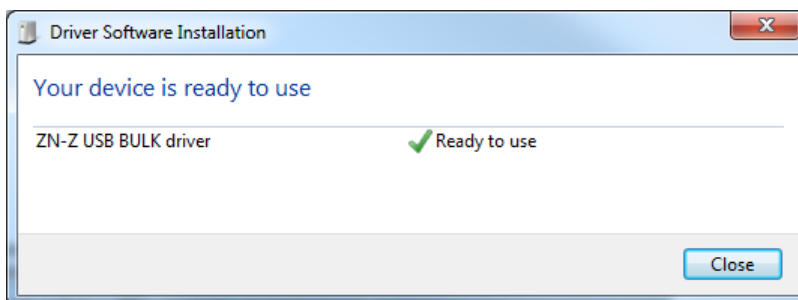


Figure 6-1: USB device driver installation

6.2 Getting Started

1. Start the R&S ZN-Z30 as described in [Chapter 2.3.4, "Turning the ICC On and Starting"](#), on page 17.
2. Connect the R&S ZN-Z30 via USB, as described in [Chapter 2.5.1, "USB"](#), on page 20.

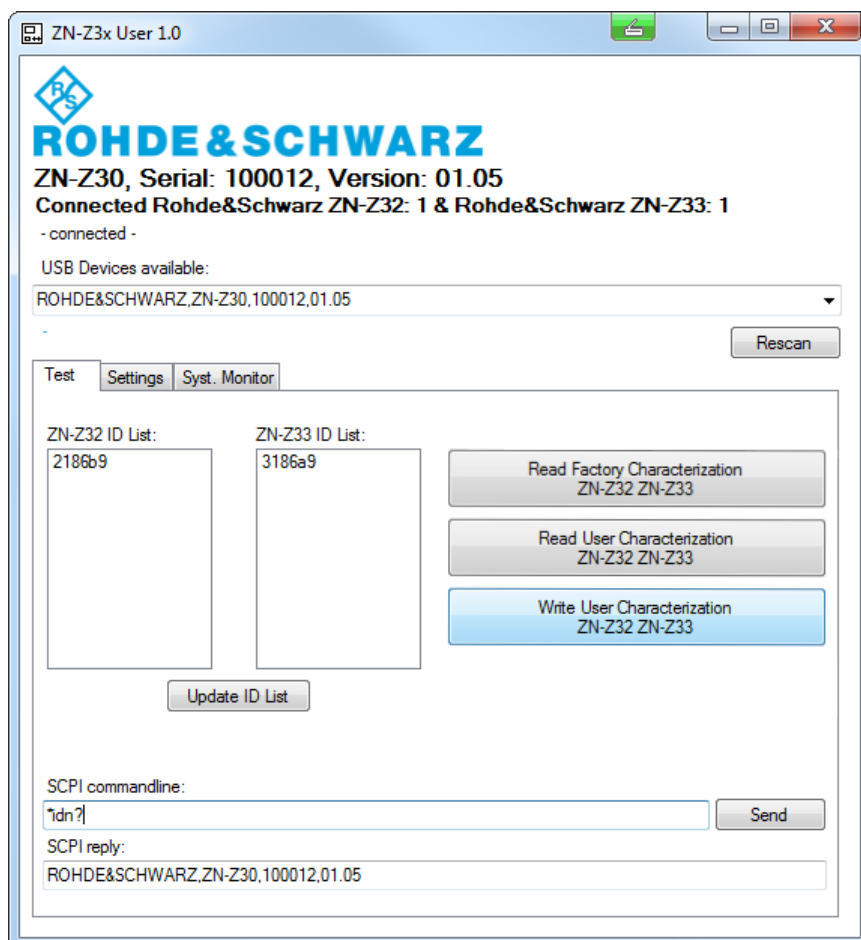
When first connected to a particular USB port, the R&S ZN-Z30 is auto-detected by the operating system:



3. Select "All Programs > Rohde-Schwarz > ZN-Z3x > ZN-Z3x User" from the Windows Start menu.

Result

The "ZN-Z3x User" tool is started, and automatically connects to the detected R&S ZN-Z30.



6.3 Device Panel

The panel above the tabs allows to select one of the connected R&S ZN-Z30 and displays its basic properties (serial number, firmware version, number of connected Inline Calibration Units R&S ZN-Z32/Z33).



After Inline Calibration Controllers have been connected or disconnected, the list of available devices must be updated manually using the "Rescan" button.



ROHDE & SCHWARZ

ZN-Z30, Serial: 100012, Version: 01.05

Connected Rohde&Schwarz ZN-Z32: 1 & Rohde&Schwarz ZN-Z33: 1

- connected -

USB Devices available:

ROHDE&SCHWARZ.ZN-Z30.100012.01.05

Rescan

Identification String

The line of text below the colored Rohde&Schwarz logo identifies a connected R&S ZN-Z30 by the following string:

ZN-Z30, Serial: <serial number>, Version: <FW version>

Remote command:

*IDN?

*SERial?

Connected R&S ZN-Z32/Z33

This line of text lists the number of connected Inline Calibration Units (after pressing the [Update ID List](#) button in the [Test Tab](#)).

USB Devices available / Rescan

Allows to select one of the detected Inline Calibration Controllers.

USB Devices available:

ROHDE&SCHWARZ.ZN-Z30.100012.01.05

Rescan

Use the "Rescan" button to refresh the list of detected Inline Calibration Controllers and to retrieve their properties.

6.4 Test Tab

The "Test" tab allows to display the properties of the Inline Calibration Units connected to the selected Inline Calibration Unit. Furthermore it allows to send SCPI commands to the R&S ZN-Z30 and to receive the command responses, if any.

Test

ZN-Z32 ID List: 2186b9	ZN-Z33 ID List: 3186a9	Read Factory Characterization ZN-Z32 ZN-Z33
		Read User Characterization ZN-Z32 ZN-Z33
		Write User Characterization ZN-Z32 ZN-Z33
Update ID List		
SCPI commandline: *tdn?		Send
SCPI reply: ROHDE&SCHWARZ,ZN-Z30,100012,01.05		

R&S ZN-Z32/Z33 ID List

Display the hexadecimal IDs of the Inline Calibration Units connected to the selected R&S ZN-Z30 (after pressing the [Update ID List](#) button).

Remote command:

`ICC:GET:LIST?`

Update ID List

Starts the identification of all Inline Calibration Units connected to the selected R&S ZN-Z30 and refreshes the [R&S ZN-Z32/Z33 ID List](#).

Remote command:

`ICC:GET:ID`

Read Factory Characterization R&S ZN-Z32/Z33

Reads the factory characterization data of the related Inline Calibration Units (from the SD card of the selected R&S ZN-Z30) and saves them to a user-defined folder.

Remote command:

`ICU:CALKIT:FACT:READ`

Read User Characterization R&S ZN-Z32/Z33

Reads the user characterization data of the related Inline Calibration Units (from the flash memory of the ICU) and saves them to a user-defined folder.

Remote command:

`ICU:CALKIT:USER:READ`

Write User Characterization R&S ZN-Z32/Z33

Reads the factory characterization data of the related Inline Calibration Units (from the SD card of the selected R&S ZN-Z30) and saves them to a user-defined folder.

Remote command:

`ICU:CALKIT:USER:WRITE`

6.5 Settings Tab

The "Settings" tab allows to modify the LAN settings of the selected Inline Calibration Controller R&S ZN-Z30. Furthermore it allows to perform a firmware update on the R&S ZN-Z30 itself or on its connected Inline Calibration Units.

The screenshot shows the "Settings" tab interface. It is divided into two main sections: "LAN Settings" and "ZN-Z3x Firmware Update".

LAN Settings:

- IP Setting:** Two radio buttons are present: "DHCP" (selected) and "Fixed IP".
- IP Address:** Text input field containing "10.114.0.245".
- Subnet Mask:** Text input field containing "255.255.255.0".
- Standard Gateway:** Text input field containing "192.168.1.1".
- Hostname:** Text input field containing "ZNZ30X100012".
- Buttons:**
 - "Apply LAN settings (nonpermanent)"
 - "Restore Factory Defaults (nonpermanent)"
 - "Write all settings to ZN-Z30 (permanent)"

ZN-Z3x Firmware Update:

- "Update ZN-Z30"
- "Update ZN-Z32/33"

IP Setting

Select "DHCP" if the R&S ZN-Z30 shall receive its IP configuration via DHCP or "Fixed IP" if the IP configuration shall be assigned manually.

Use [Write all settings to ZN-Z30 \(permanent\)](#) to make the changes persistent.

Remote command:

`ICC:SHOW:LAN:DHCP?`

`ICC:SET:LAN:DHCP:ON`

`ICC:SET:LAN:DHCP:OFF`

IP address / Subnet Mask / Standard Gateway

Manual IP configuration (for "Fixed" [IP Setting](#)).

Use [Write all settings to ZN-Z30 \(permanent\)](#) to make the changes persistent.

Remote command:

```
ICC:SHOW:LAN:IP?
```

```
ICC:SET:LAN:IP
```

```
ICC:SHOW:LAN:SNMask?
```

```
ICC:SET:LAN:SNMask
```

```
ICC:SHOW:LAN:GW?
```

```
ICC:SET:LAN:GW
```

Hostname

Gets/sets the R&S ZN-Z30's hostname (20 characters).

Use [Write all settings to ZN-Z30 \(permanent\)](#) to make the changes persistent.

Remote command:

```
ICC:SHOW:LAN:HOST:NAME?
```

```
ICC:SET:LAN:HOST:NAME
```

Apply LAN Settings (nonpermanent)

Activates the (modified) LAN settings on the selected R&S ZN-Z30.

Use [Write all settings to ZN-Z30 \(permanent\)](#) to make the changes persistent.

Remote command:

```
ICC:INIT:LAN
```

Restore Factory Defaults (nonpermanent)

Restores the LAN and LED settings to their default values and activates them.

Use [Write all settings to ZN-Z30 \(permanent\)](#) to make the changes persistent.

Write all settings to ZN-Z30 (permanent)

Writes the current (LAN) settings to the flash memory of the Inline Calibration Controller. These settings are loaded during instrument startup.

Remote command:

```
ICC:WRITE:SETTINGS
```

Update R&S ZN-Z30 / Update R&S ZN-Z32/Z33

Opens a file browser that allows to select a firmware file (*.bin) and to initiate the firmware update for the related device(s).

6.6 System Monitor Tab

The "System Monitor" tab displays the IDs, temperatures and firmware versions of the Inline Calibration Units connected to the selected R&S ZN-Z30.

The screenshot shows the "System Monitor" tab interface. It contains two data tables and an "Update" button. The left table is titled "ZN-Z32 Data:" and the right table is titled "ZN-Z33 Data:". Both tables have three columns: "ID", "Temperatur...", and "FW Version".

ID	Temperatur...	FW Version
2186b9	27.1°C	1.01

ID	Temperatur...	FW Version
3186a9	54.5°C	1.01

Use the "Update" button to retrieve the latest monitoring results from the selected Inline Calibration System.

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