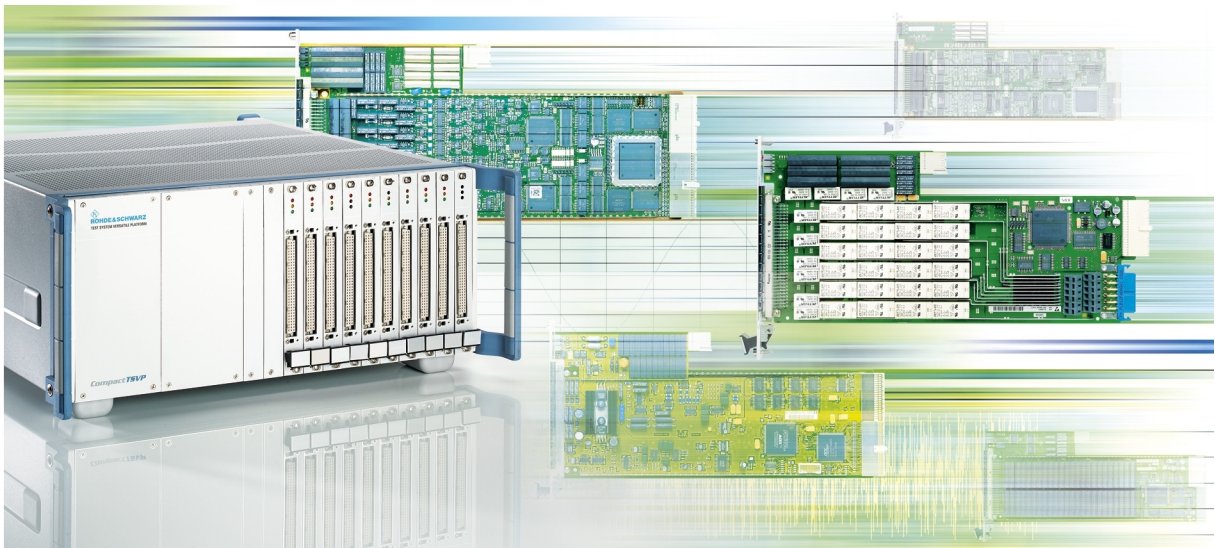# R&S®TS-ISC
TSVP In-System Calibration
User Manual

1505280212
Version 13

ROHDE & SCHWARZ

Make ideas real

This manual describes the following R&S articles:

- R&S®TS-ISC In-System Calibration Kit (1505.2502.02)
- R&S®TS-PCAL2 Rear-I/O Module for In-System Calibration (1505.2519.02)
- R&S®TS-PKISC Cabling Set for In-System Calibration (1505.2560.02)
  The cabling set includes:
  - R&S®TS-PCALA calibration adapter
  - R&S®TS-PCALB calibration adapter
  - R&S®TS-PCALC calibration adapter
  - R&S®TS-PKL cable for connecting the adapters to the external multimeter

Contents

1 Safety information (multilingual)

This option or accessory is designed for a specific Rohde & Schwarz product. Multilingual safety information is delivered with the product. Follow the provided installation instructions.

Esta opción o este accesorio están diseñados para un producto Rohde & Schwarz concreto. El producto va acompañado de información de seguridad en varios idiomas. Siga las instrucciones de instalación puestas a disposición.

Diese Option oder dieses Zubehör ist für ein bestimmtes Rohde & Schwarz Produkt vorgesehen. Mit dem Produkt werden mehrsprachige Sicherheitsinformationen geliefert. Befolgen Sie die mitgelieferten Installationsanweisungen.

Cette option ou cet accessoire est conçu pour un produit Rohde & Schwarz spécifique. Des informations de sécurité multilingues sont fournies avec le produit. Suivez les instructions d'installation fournies.

Questa funzione opzionale o accessoria è progettata per un prodotto Rohde & Schwarz specifico. Con il prodotto sono fornite informazioni sulla sicurezza in formato multilingue. Seguire le istruzioni di installazione allegate.

Esta(e) opção ou acessório foi concebida(o) para um produto específico da Rohde & Schwarz. Serão fornecidas informações de segurança multilingues com o produto. Siga as instruções de instalação fornecidas.

Αυτή η προαιρετική επιλογή ή εξάρτημα έχει σχεδιαστεί για συγκεκριμένο προϊόν Rohde & Schwarz. Μαζί με το προϊόν παρέχονται πληροφορίες ασφαλείας σε πολλές γλώσσες. Ακολουθήστε τις παρεχόμενες οδηγίες εγκατάστασης.

Din l-għażla jew aċċessorju huma mfassla għal prodott Rohde & Schwarz speċifiku. L-informazzjoni multilingwi dwar is-sikurezza hija pprovduta mal-prodott. Segwi l-istruzzjonijiet ipprovduti għall-installazzjoni.

Deze optie of dit accessoire is ontwikkeld voor een specifiek product van Rohde & Schwarz. Het product wordt geleverd met veiligheidsinformatie in meerdere talen. Volg de meegeleverde installatie-instructies.

Denne mulighed eller tilbehørsdel er designet til et specifikt Rohde & Schwarz produkt. En flersproget sikkerhedsanvisning leveres sammen med produktet. Følg de medfølgende installationsanvisninger.

Detta tillval eller tillbehör är avsett för en särskild produkt från Rohde & Schwarz. Säkerhetsinformation på flera språk medföljer produkten. Följ de medföljande installationsanvisningarna.

Tämä vaihtoehto tai lisävaruste on suunniteltu tietylle Rohde & Schwarz -yrityksen tuotteelle. Tuotteen mukana on toimitettu monikieliset turvallisuusohjeet. Noudata annettuja asennusohjeita.

Dette alternativet eller ekstrautstyret er utformet for et spesifikt Rohde & Schwarz produkt. Flerspråklig sikkerhetsinformasjon leveres med produktet. Overhold installasjonsveiledningen som følger med.

See valik või lisaseade on mõeldud konkreetsele Rohde & Schwarz tootele. Tootega on kaasas mitmekeelne ohutusteave. Järgige kaasasolevaid paigaldusjuhiseid.

Šī opcija vai piederums ir izstrādāts īpaši Rohde & Schwarz produktam. Produktam pievienota drošības informācija vairākās valodās. Ievērojiet sniegtos uzstādīšanas norādījumus.

Ši parinktis ar priedas skirti konkrečiam Rohde & Schwarz gaminiui. Su gaminiu pateikiama saugos informacijos keliomis kalbomis. Laikykitės pateikiamų montavimo nurodymų.

Þessi auka- eða fylgibúnaður er hannaður fyrir tiltekna Rohde & Schwarz vöru. Öryggisupplýsingar á mörgum tungumálum fylgja með vörunni. Fylgið meðfylgjandi uppsetningarleiðbeiningum.

Tá an rogha nó an oiriúint seo ceaptha le haghaidh táirge Rohde & Schwarz sonrach. Cuirtear eolas sábháilteachta ilteangach ar fáil leis an táirge. Lean na treoracha suiteála a thugtar.

Эта опция или принадлежность предназначена для конкретного продукта Rohde & Schwarz. В комплект поставки продукта входят инструкции по технике безопасности на нескольких языках. Соблюдайте прилагаемые инструкции по установке.

Ця опція або приладдя призначені для конкретного виробу Rohde & Schwarz. Інструкції з техніки безпеки кількома мовами постачаються разом із виробом. Дотримуйтеся наданих інструкцій зі встановлення.

Ta opcja lub akcesorium jest przeznaczone do określonego produktu Rohde & Schwarz. Dostarczany produkt zawiera informacje w wielu językach dotyczące bezpieczeństwa. Należy postępować zgodnie z dostarczonymi instrukcjami instalacji.

Tato varianta nebo příslušenství je určeno pro konkrétní produkt Rohde & Schwarz. S produktem jsou dodávány vícejazyčné bezpečnostní informace. Řiďte se přiloženými pokyny k instalaci.

Táto verzia alebo príslušenstvo je navrhnutá pre špecifický výrobok Rohde & Schwarz. S výrobkom sa dodávajú viacjazyčné bezpečnostné pokyny. Riaďte sa dodanými pokynmi na inštaláciu.

Ta možnost ali dodatek je zasnovan za določen izdelek podjetja Rohde & Schwarz. Izdelku so priložena varnostna navodila v več jezikih. Upoštevajte priložena navodila za namestitev.

Ezt a beállítást vagy tartozékot egy adott Rohde & Schwarz termékhez tervezték. A termékhez többnyelvű biztonsági információt mellékelünk. Kövesse a mellékelt szerelési utasításokat.

Тази опция или аксесоар са проектирани за специфичен продукт на Rohde & Schwarz. Многоезикова информация за безопасност се доставя с продукта. Следвайте предоставените инструкции за монтаж.

Ova opcija ili oprema namijenjena je za određeni proizvod tvrtke Rohde & Schwarz. Uz proizvod su dostavljene sigurnosne napomene na više jezika. Pratite isporučene upute za ugradnju.

Ova opcija ili pribor je dizajniran za određeni Rohde & Schwarz proizvod. Proizvodu su priložene sigurnosne informacije na više jezika. Slijedite priložena uputstva za instalaciju.

Ova opcija ili dodatni pribor je projektovan za određeni Rohde & Schwarz proizvod. Bezbednosne informacije na više jezika se isporučuju uz proizvod. Sledite dostavljena uputstva za instalaciju.

Această opțiune sau acest accesoriu a fost conceput pentru un produs specific Rohde & Schwarz. Informațiile multilingve privind siguranța sunt livrate împreună cu produsul. Urmați instrucțiunile de instalare furnizate.

Ky opsion ose aksesor është krijuar për një produkt specifik Rohde & Schwarz. Bashkë me produktin jepen edhe informacionet e sigurisë në shumë gjuhë. Ndiqni udhëzimet e dhëna të instalimit.

Оваа опција или додаток се наменети за одреден производ на Rohde & Schwarz. Со производот се испорачани повеќејазични безбедносни упатства. Следете ги дадените упатства за инсталација.

Bu opsiyon veya aksesuar, belirli bir Rohde & Schwarz ürünü için tasarlanmıştır. Çok dilli güvenlik uyarıları ürünle birlikte teslim edilir. Size sağlanan kurulum talimatlarına uyun.

Şu opsiýa ýa-da esbap Rohde & Schwarz anyk önüm üçin niýetlenilen. Dürli dildäki howpsuzlyk barada maglumat önüm bilen bile üpjün edilýär. Üpjün edilen gurnama ugrukdyrmalaryny ýerine ýetiriň.

इस विकल्प या एक्सेसरी को एक विशेष Rohde & Schwarz उत्पाद के लिए डिज़ाइन किया गया है. उत्पाद के साथ बहुभाषी सुरक्षा जानकारी दी जाती है. प्रदान किए गए इंस्टालेशन अनुदेशों का पालन करें.

本选件或附件专门设计用于特定的 Rohde & Schwarz 产品。产品随附多种语言版本的安全资讯。谨遵文件中的安装说明。

本オプションアクセサリは、特定の Rohde & Schwarz 製品向けに設計されています。多言語で記載された安全情報が製品に付属します。付属のインストール手順に従ってください。

이 옵션 또는 액세서리는 특정 Rohde & Schwarz 제품용으로 설계되었습니다. 제품과 함께 다국어로 작성된 안전 정보가 제공됩니다. 함께 제공된 설치 지침을 따르십시오.

本選配或配件專門設計用於特定的 Rohde & Schwarz 產品。產品隨附多種語言版本的安全資訊。遵守文件中的安裝說明。

Tùy chọn hoặc phụ kiện này dành riêng cho một sản phẩm Rohde & Schwarz cụ thể. Thông tin an toàn đa ngôn ngữ được cung cấp kèm theo sản phẩm. Thực hiện theo hướng dẫn lắp đặt kèm theo.

ตัวเลือกหรืออุปกรณ์เสริมนี้ออกแบบมาสำหรับผลิตภัณฑ์ Rohde & Schwarz โดยเฉพาะ โดยจะมีการจัดส่งข้อมูลด้านความปลอดภัยหลายภาษามาให้พร้อมกับผลิตภัณฑ์ ปฏิบัติตามคำแนะนำในการติดตั้งที่ให้ไว้

Pilihan atau aksesori ini direka bentuk untuk produk Rohde & Schwarz yang tertentu. Maklumat keselamatan berbilang bahasa disertakan bersama produk. Ikut arahan pemasangan yang diberikan.

Opsi atau aksesori ini dirancang untuk produk Rohde & Schwarz tertentu. Informasi keamanan dalam beberapa bahasa juga disertakan bersama produk. Ikuti petunjuk pemasangan yang disediakan.

Esta opción o este accesorio están diseñados para un producto Rohde & Schwarz en concreto. El producto va acompañado de información de seguridad en varios idiomas. Siga las instrucciones de instalación proporcionadas con el producto.

Esta opção ou acessório foi desenvolvido para um produto Rohde & Schwarz específico. Informações de segurança em vários idiomas acompanham o produto. Siga as instruções de instalação disponibilizadas.

אפשרות זו או האביזר מיועדים למוצר ספציפי של Rohde & Schwarz. מידע רב-לשוני בנושא בטיחות מצורף למוצר. יש לפעול בהתאם להנחיות ההתקנה המצורפות.

تم تصميم هذا الخيار أو الملحق لمنتج معين من منتجات Rohde & Schwarz. يتم تزويد معلومات السلامة متعددة اللغات مع المنتج. اتبع تعليمات التركيب الموضحة.

این قابلیت یا وسیله جانبی منحصراً برای محصول به خصوص Rohde & Schwarz طراحی شده است. اطلاعات ایمنی چندزبانه همراه این دستگاه ارائه شده است. دستورالعمل‌های نصب ارائه شده را دنبال کنید.

اس اختیار یا حصے کو مخصوص Rohde & Schwarz پروڈکٹ کے لئے تیار کیا گیا ہے۔ پروڈکٹ کے ساتھ کثیر السانی زبانوں میں تحفظ کی معلومات فراہم کی جاتی ہیں۔ فراہم کردہ تنصیب کی ہدایات پر عمل کریں۔

2 Documentation overview

This section provides an overview of the R&S TSVP (test system versatile platform) user documentation.

All documents are delivered with the Generic Test Software Library ("R&S GTSL") installation package. After installing the software, you can open all the documentation from the Windows "Start" menu. Additionally, you can find detailed information about the software interfaces in the "R&S GTSL Help" folder in the Windows "Start" menu.

The user documentation and "R&S GTSL" installation package are also available for download in GLORIS at:

https://gloris.rohde-schwarz.com/

For details, see the R&S TSVP Getting Started manual.

2.1 Getting started manual

Introduces the R&S TSVP (test system versatile platform) and describes how to set up and start working with the product. It includes safety information.

A printed version is delivered with the instrument.

2.2 User manuals

Separate manuals are provided for the base units, the individual plug-in module types, as well as for the control software and the calibration tool:

- Base unit manual
  The base unit user manuals introduce the base units and describes how to set up and operate the product. It includes safety information and information on maintenance and instrument interfaces. It includes the contents of the getting started manual.
- Plug-in module manuals
  Contain the description of the specific modules. Basic information on setting up the R&S TSVP (test system versatile platform) is not included.
- In-System calibration user manuals
  Provide all the information required for installation and operation of the in-system calibration R&S TS-ISC solution.
- Control software
  - R&S GTSL
    Generic Test Software Library
  - R&S EGTSL
    Enhanced Generic Test Software Library
  - R&S IC-Check

Generic Test Software Library

2.3 System manual

Describes the complete R&S TSVP (test system versatile platform) as a whole, including the combined use of PXI based base units and the R&S PowerTSVP, plug-in modules and generic test software. It also includes typical use cases.

Additionally, it describes known installation problems (hardware and software) along with possible solutions.

2.4 Service manual

Describes the self-test to check correct operation, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists.

2.5 Printed safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

2.6 Brochures and specifications

Separate brochures are provided for the base unit, the individual plug-in module types, as well as for the control software. The brochures provide an overview of the base units and each additional module, and also contain the technical specifications. They also list the hardware options and their order numbers, and optional accessories.

2.7 Release notes and open source acknowledgment

The release notes list new features, improvements and known issues of the current software version. In addition, the available firmware versions and the firmware update procedure for plug-in modules are described.

The open-source acknowledgment document provides verbatim license texts of the used open source software.

3 Welcome to the R&S TS-ISC

3.1 General

This user manual provides all the information required for installation, programming and operation of the TSVP In-System Calibration R&S TS-ISC. It also contains detailed information about the special features of the R&S TS-ISC. All processes described in the manual assume the reader is familiar with personal computers, the Windows XP / Windows 7 operating system and the basic principles of electrical measuring systems in modular form (CompactPCI or PXI modules).

3.2 Description of product

The TSVP In-System CalibrationR&S TS-ISC enables the modules of the R&S CompactTSVP and R&S PowerTSVP production testing platforms to be calibrated in the system and readjusted if required. This means that it is no longer necessary to remove the modules.

3.3 Associated documentation

The following documentation is to be followed when using the TSVP In-System Calibration R&S TS-ISC:

- R&S Test Management Software G5, Getting Started
- R&S Test Management Software G5, User Manual
- Software Description for Rohde & Schwarz Generic Test Software Library R&S GTSL

3.4 Scope of delivery

The scope of delivery for the TSVP In-System Calibration R&S TS-ISC includes the following components:

- R&S TS-PCAL2 calibration module
- Adapter and cable

Open the package carefully and check to make certain the hardware inside has been delivered in perfect condition. If the modules included in the delivery show any signs of damage that would interfere with their intended purpose, please contact ROHDE & SCHWARZ Customer Support.

Figure 3-1: R&S TS-PCAL2 calibration module with adapter and cable

3.4.1   R&S TS-PCAL2 calibration module

The R&S TS-PCAL2 card provides the signals necessary for calibration. The module includes the following components:

- Floating 5V reference source
- Three reference resistors
- Ground referenced current source (adjustable up to 1 A)
- Floating signal generator

DC:	±0 … 40 V
AC sinusoid:	0 … 80 Vpp in frequency range 20 Hz … 50 kHz
	0 … 2 Vpp in frequency range 20 Hz … 1 MHz

- Floating measuring system for voltage, current and resistance measurements.
- Relay matrix for connecting the components to the analog bus lines on an R&S TS-PMB module installed in the front of the R&S TSVP

3.4.2   Adapter and cable

The external multimeter is connected to the different device under tests (DUT) using the cable and adapters. The following adapter components are used:

- Calibration adapter TS-PCALA

- Calibration adapter TS-PCALB
- Calibration adapter TS-PCALC
- Cable for connecting the adapters to the external multimeter

3.4.3 TS-LISC software license

ⓘ Starting with GTSL 3.30, no GTSL license is required.

Calibration is carried out using special testing software. The R&S TS-LISC GTSL license is required to operate this software.

ⓘ License management and the "R&S GTSL License Viewer" are described in section 4 of *Software Description Generic Test Software Library R&S GTSL*.

3.5 System requirements

To allow calibration of the TSVP modules in the system, the following requirements need to be met:

- R&S TS-PMB module (firmware version 03.04 or higher) installed
- Agilent multimeter 3458 A installed
- "High stability option 002" installed in Agilent multimeter 3458 A, if TS-PIO2 modules are to be adjusted
- GPIB USB-HS or GPIB-PXI module from National Instruments installed
- Windows 10 or Windows 11 installed
- A printer must be installed
- GTSL 3.42 or higher installed

💡 To calibrate the high power switching modules R&S TS-PSM3, R&S TS-PSM4 and R&S TS-PSM5, additional equipment is required. This includes an appropriate power supply, calibration resistors and special cable sets. These components are not included in the R&S TS-ISC kit.

A suitable cable set is available under order number 5046.4869.00.

4 Installing components

Calibration requires a few hardware and software components.

Installing the R&S TS-PCAL2 module

Requirement: Installation of an R&S TS-PMB Matrix Module B.

The selected Matrix Module B R&S TS-PMB must have a firmware version of at least 03.04. The firmware can be updated using the "`FirmwareUpdate.exe`" tool if required.

1. Install the R&S TS-PCAL2 module in the matching rear I/O slot as described in the user manuals for the base unit.

2. **WARNING!** Risk of electric shock. The test environment, e.g the UUT or additional power supplies, can supply high voltages to the instruments. In this case, the voltage can also apply to the signal output connectors of the R&S TSVP, in particular the analog bus connector X2.
   Therefore, do not connect or disconnect devices from the X2 connectors while connected to an external power supply or UUT.

   Always connect both ends of the cable connecting the instruments. Thus, you avoid the risk of touching the X2 connector with a possibly hazardous voltage applied.

   Take the system into operation as described in the user manuals for the base unit.

Installing the calibration software

Installation of the calibration software is described in section 2 of the *Software Description for Rohde & Schwarz Generic Test Software Library R&S GTSL*. In the "Setup - Select Program Components" dialog box, you can select installation of the calibration software.

Configuring the test system environment

The "Tweak TM G5" configuration program is provided for adapting the test program to the infrastructure (unique test system name, drive paths for saving measured results etc.). The settings are subject to various security levels and can only be changed by users who know the associated passwords.

User name	Password
User	-
Test system administrator	_TSAdmin

The other levels are only accessible to program developers.

1. Start the "Tweak TM G5" software from the Windows Start menu ("Start > All Programs > GTSL > Tools > Tweak TM G5").

2. Define the name of the test system ("Test System > Name").

5 Performing the calibration

Extensive explanations of how to operate the testing software and interpret the measured results can be found in the following documents:

- R&S Test Management Software G5, Getting Started
- R&S Test Management Software G5, User Manual

The user manuals can be started from the Windows Start menu:

"Start > All Programs > GTSL > Documentation > User Manuals > In-System Calibration"

To calibrate R&S TSVP modules, the steps described in this section must be carried out.

5.1 Starting the test program

The program for performing the calibration is started from the Windows Start menu:

"Start > All Programs > GTSL > In-System Calibration"

5.2 Configuring the test system

The **"Extras" > "System Configuration"** option in the menu opens up a dialog box for displaying the system configuration and changing certain system settings.
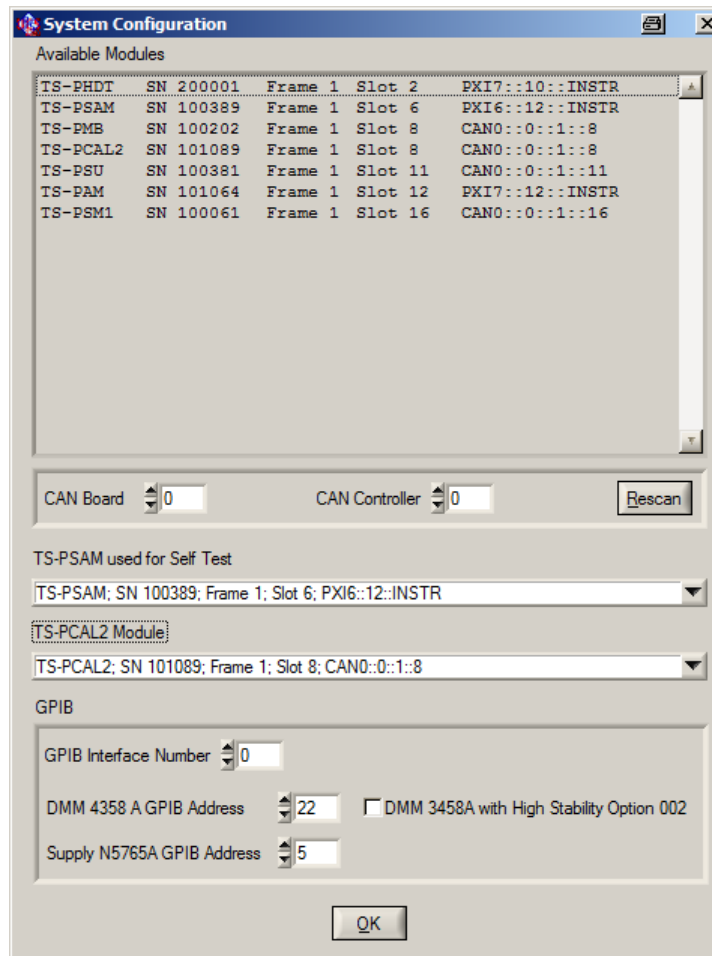
Figure 5-1: System Configuration dialog box

The upper section lists the modules found in the system and supported by the calibration software.

The **"CAN Board"** and **"CAN Controller"** settings relate to the configuration of the CAN bus for the TSVP modules. The default value for these settings is 0. For special system configurations, a different CAN controller can be selected in these fields. The **"Rescan"** button triggers a new search for modules in the system.

ⓘ A Rescan must always be carried out if the module configuration is changed while the program is running. For example, this is the case if a connected R&S PowerTSVP frame is turned on or off.

If the system contains several R&S TS-PSAM modules, the **"TS-PSAM used for Self Test"** setting can be used to specify which module will be used for the measurements in the self test. The selected module is also used for calibrating an R&S TS-PICT module.

If the system contains several R&S TS-PCAL2 modules, the **"TS-PCAL2 Module"** setting can be used to specify the one to be used.

The external DMM is controlled via GPIB. The **"GPIB Interface Number"** and **"GPIB Address"** settings are used to configure this interface. In addition, the availability of the "High Stability option 002" is set here.

When you exit the dialog box, the settings are applied and saved on the hard disk when the software is closed.

5.3 Specifying device under test (DUT) and test parameters

The **"Edit"** > **"Configuration Database"** > **"Open Editor..."** command in the menu opens up a dialog box for selecting the device under test (DUT) and various test parameters.
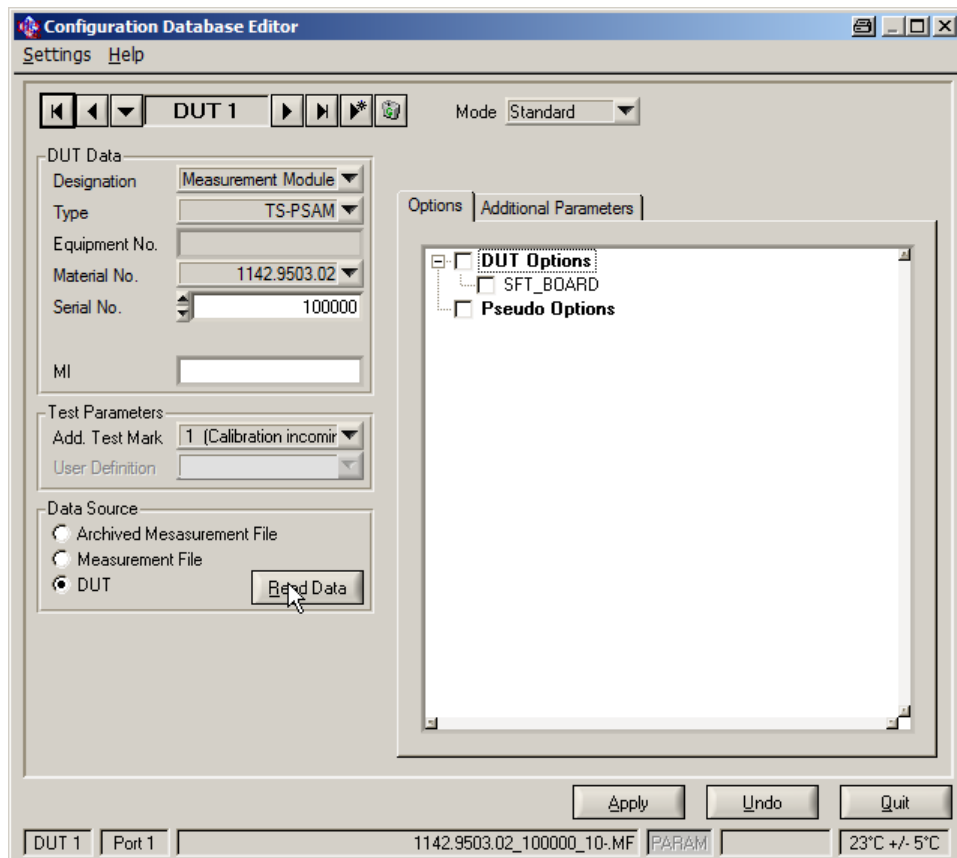
Figure 5-2: Test and Test Report Configuration Data dialog box

The easiest way to select the device under test to the tested is with the **"Read Data"** button in the **"Data Source"** section.

- Selecting **"DUT"** allows the device under test to be selected from the list of modules found in the system.

- Selecting **"Measurement File"** allows the device under test to be selected from a list of available measurement results files. The device under test-specific data in the **"Device Data"** section is then entered automatically.

For very simple device under tests (e.g. R&S TS-PRIO) that do not have an EEPROM, the data in the **"Device Data"** section must be entered manually or by selecting a measurement results file. If the system contains several of these modules the position in the frame can be selected when transferring the device under test data.
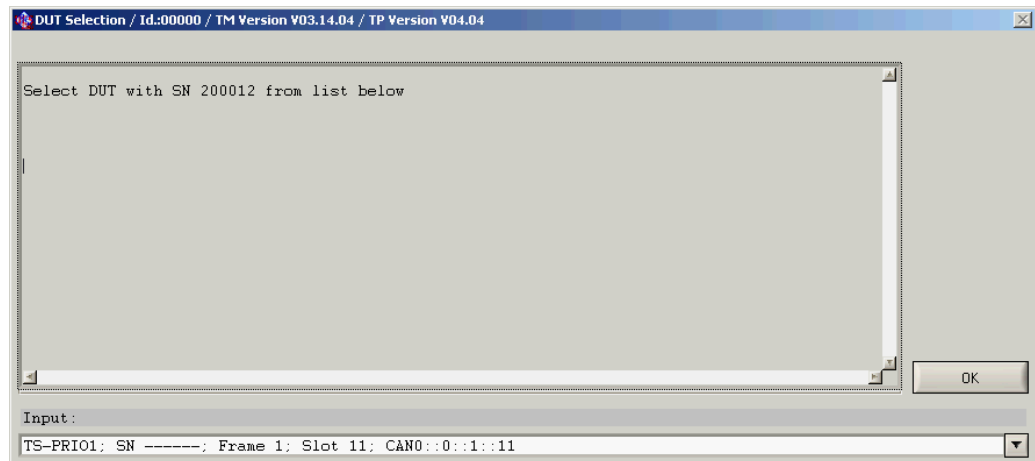
Figure 5-3: Dialog box for assigning the serial number

The **"Test Parameters"** section is used to specify the test conditions. Testing a device under test normally involves an incoming test (Add. Test Mark: "1 (Calibration Incoming Test)") and an outgoing test (Add. Test Mark: "2 (Calibration Outgoing Test)"). The "1" and "2" characters are used to create different names for the measurement results files:

e.g.

1142.9503.02_200000_101.MF Results of incoming test

1142.9503.02_200000_102.MF Results of outgoing test

Depending on the test condition selected, different test sequences are available. For the outgoing test, an adjustment sequence is normally available in addition to the calibration sequence. Only the results of the calibration sequence are entered in the test report.

If results in the incoming test are outside the tolerance range, adjustment of the device under test can be attempted. If the device under test is not defective, this eliminates the deviation.

If all results in the incoming test are within the tolerance range, an outgoing report can be created directly by selecting the **"Calibration Outgoing Test"** test condition and transferring the measurement results from the incoming test.
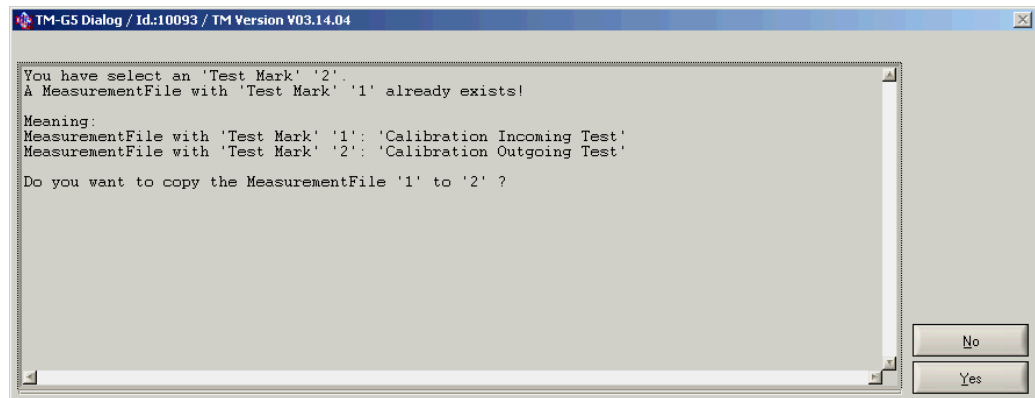
Figure 5-4: Transferring the results of the incoming test

If the device under test has been adjusted, a master test sequence (calibration sequence) must be performed in the outgoing test to verify that the adjustment has been successful and document it.

If a self test connector is available for a device under test, you can select **"SFT_BOARD"** under **"Options"**. In this case, the test cases for which a self test connector is necessary are carried out when running the self test.

The **"Apply"** button applies the changes. Clicking on **"Quit"** closes the **"Test and Test Report Configuration Data"** dialog box.

5.4 Performing the measurements

5.4.1 Information on external multimeter 3458a

The external multimeter is operated by the control computer via IEC bus (GPIB) and must be connected accordingly.

The **"Terminals"** switch must be set to match the inputs used. The **"Guard"** switch must be set to the **"Open"** position.

The measuring inaccuracies displayed assume that auto correction (ACAL) has been performed on the external multimeter. Auto correction should be performed at least every 24 hours or after a change of 1 °C in the temperature. The internal temperature of the multimeter is monitored.

The multimeter should be operated in an environment with a stable temperature. In addition, a warming up time of 2 hours should be incorporated.

For determining the uncertainties of measurement with the external multimeter 3458A, we assume that the last external calibration was at the most one year ago and that the calibration standards used featured a traceability identical to that of a manufacturer calibration.

When starting a test or a test sequence, the system checks whether auto correction is necessary.

(i) The software always recommends auto correction after 24 hours. As the multimeter does not have access to time monitoring, the calibration software saves the time of the last prompt to perform auto correction.

For some measurements, "High Stability Option 002" is necessary for the external multimeter 3458A (e.g. adjustment of the R&S TS-PIO2 module). If it is not available, the test case is aborted with an error message.

The test sequence started is not carried out if the software recommends auto correction. Auto correction must be performed manually on the multimeter.
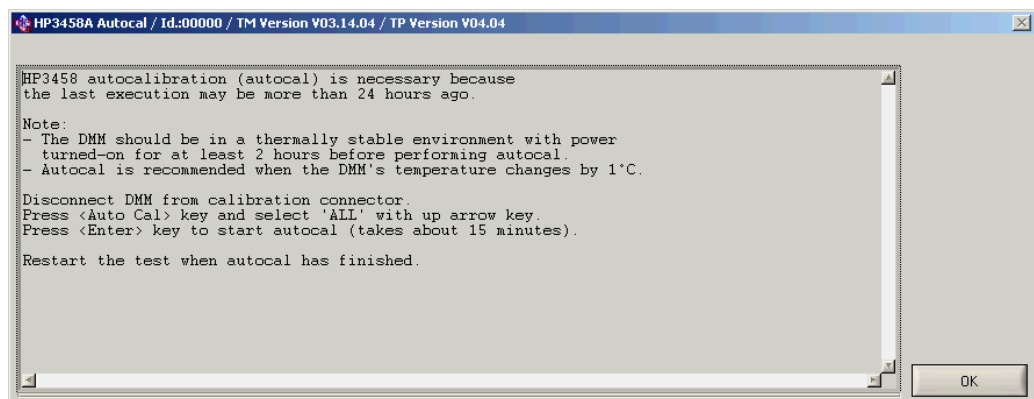
Figure 5-5: Auto correction recommendation

The following steps are necessary for autocorrection:

1. The multimeter must be disconnected from the calibration adapter (TS-PCALA, TS-PCALB or TS-PCALC).

2. Press the "Auto Cal" button and use the up arrow key to select "ALL".

3. Press the "Enter" key to start the process.

4. When auto correction is complete, restart the test sequence.

5.4.2 Starting the test sequences

In the TSVP calibration program incoming and outgoing test, the **Master Test Sequence** contains test cases that are necessary to ensure the function and the data sheet specifications of the device under test. User interactions are normally necessary while performing the tests. The additional **Adjustment Sequence** is available for adjusting a device under test. Details of the various modules are described in the following sections.

> ⓘ When calibrating R&S TSVP modules, the test cases are not divided into the **Master Test Sequence** and **Master Test Sequence Appendix**, as described in the R&S Test Management Software documentation.

1. Open the context menu with the right mouse button.

2. Select "Execute" to start a test sequence.
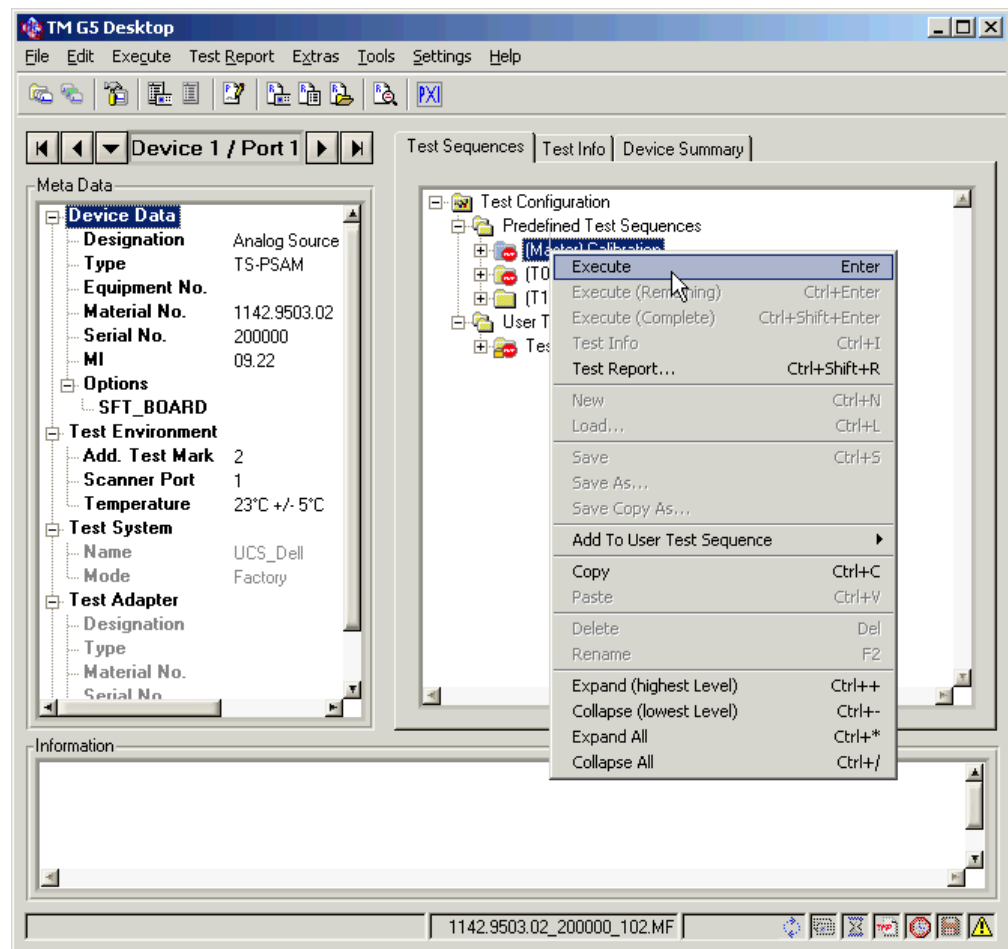
Figure 5-6: Starting a test sequence

Other options for editing and running the test sequences are described in the R&S Test Management Software documentation.

3. **NOTICE!** Damaged device under test and measuring system. Connecting test adapters when not prompted can lead to incorrect measurements and may cause damage to the device under test or the measuring system.
   Connect the test adapter only if a change is required.

   Connect the TS-PCALA, TS-PCALB and TS-PCALC test adapters to a particular module.
   The number of the frame and the corresponding slot is specified.

4. Connect the DMM to the corresponding test adapter.
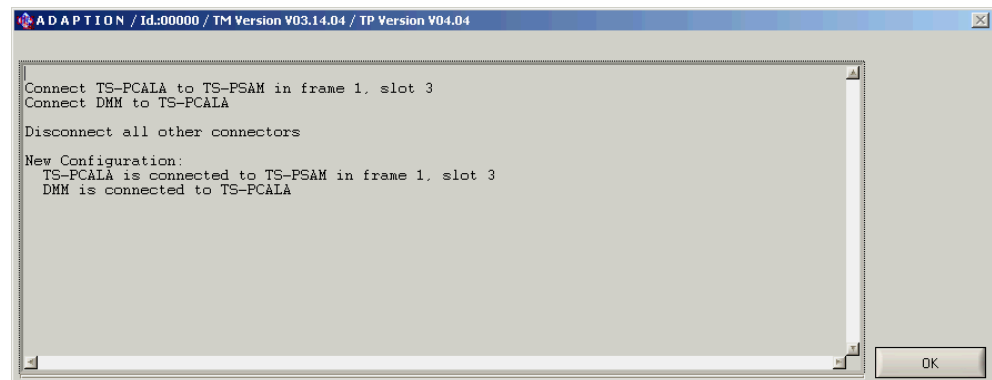
Figure 5-7: Change adapter dialog box

The current adapter is saved by the software. The dialog box is only displayed if a change is required.

5. Select "OK" to confirm the configuration.

5.4.3 Aborting and interrupting test sequences

The **"Interrupt Panel"** in the R&S Test Management Software can be used to abort or interrupt a test sequence in progress. The details are described in the associated manual.

Figure 5-8: Interrupt Panel

5.4.4 Measurement results and test report

The test results are saved in a measurement results file. The report is generated from this file. As soon as measurement results are available, the current report can be displayed and printed by selecting **"Test Report" > "Customer Report" > "Current Device"** in the menu.

For the "Self Test" test case, the TSVP self test for the current device under test is performed and a detailed report is generated, which is added to the measurement results file. The self test report can be exported using the paperclip button in the measurement results screen.
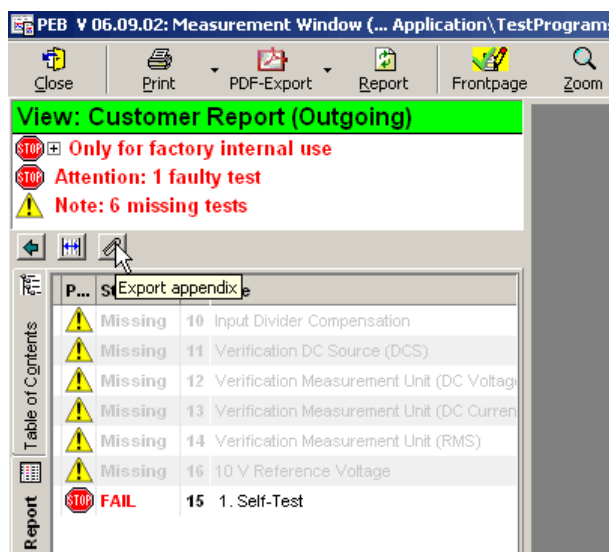
Figure 5-9: Exporting the self test report

Further details of handling the measurement results file (file name, saving, displaying) can be found in the R&S Test Management Software documentation.

6 Calibrating R&S TS-xxx modules

6.1 R&S TS-PCAL2 with R&S TS-PMB

ⓘ Before calibrating the R&S TS-PCAL2 module, allow a warming up time of at least one hour.

On the R&S TS-PCAL2 module there are sources and references that are required to calibrate other R&S modules in the R&S CompactTSVP / R&S PowerTSVP. Therefore, it should always be calibrated first to ensure that this module functions correctly.

The associated R&S TS-PMB module connected on the front is used to transmit the signals via the local analog bus to the backplane and via the front connector to the external multimeter. The function of the R&S TS-PMB module must therefore also be ensured.

6.1.1 Incoming test

The master test sequence includes the calibration sequences and thus all test cases ensuring the values specified in the datasheet of the measurement module.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

6.1.2 Outgoing test

The master test sequence includes the calibration sequences and thus all test cases ensuring the values specified in the datasheet of the measurement module.

A sequence for adjusting the device under test is also available.

6.2 R&S TS-PSAM

ⓘ Before calibrating the R&S TS-PSAM module, allow a warming up time of at least 15 minutes.

During the test sequence, the adapters for the external multimeter must be changed several times. For measurements on the attenuator, the polarity of the DMM_HI und DMM_LO lines needs to be exchanged once directly on the multimeter.

6.2.1 Incoming test

The master test sequence includes the calibration sequence and thus all test cases that ensure the values specified in the datasheet of the R&S TS-PSAM analog stimulus and measurement module.

It is recommended that the entire test sequence is always started, as some tests depend on the completion of previous tests.

If results are outside the tolerance range, adjustment of the R&S TS-PSAM module can be performed in the outgoing test. The measurement results from the incoming test are used to calculate the new correction values.

6.2.2 Outgoing test

Like the incoming test, the master sequence includes the calibration sequence.

A sequence for adjustment of the R&S TS-PSAM analog stimulus and measurement module is also available. During the adjustment process (test step **"Write Correction Data"**) the results from the calibration sequence and the current correction values are used to calculate new correction values and transfer them to the module. To carry out the adjustment, the entire calibration sequence must therefore have been completed. This can also have been done as part of the incoming test.

For modules from change index 06.00 the "Input Divider Adjustment" test is available. Perform this test to adjust the attenuator trimmer capacitors. To adjust them, valid correction values must be available in the EEPROM of the module.

The adjustment is only required if the "Input Divider Compensation" test returns an error. To adjust the trimmer capacitors, use only the tools recommended by the producer. Choose a slot in which the trimmer capacitors can be reached easily.

After adjustment, all results from the calibration sequence are set to invalid. The incoming test report is not changed. However, calibration must be repeated to document the success of the adjustment in the outgoing test report.

The outgoing test provides two other test steps in the **"Additional Tests"** sequence.

- **"Write Neutral Correction Data"**
- **"Compensation Adjustment"** (for modules 1142.9832.02 from version 03.00 and version smaller 06.00)

The **"Write Neutral Correction Data"** test resets all correction values in the module EEPROM. As a result, it then needs to be completely readjusted. To do this, the following steps are required in the specified order:

1. Performing the **"Compensation Adjustment"** test (only for modules 1142.9832.02 from version 03.00 and version smaller 06.00)

2. Performing the **"Calibration"** test sequence

3. Performing the **"Write Correction Data"** test

4. Performing the **"Calibration Sequence"** again to document the success of the adjustment.

ⓘ With neutral correction values in the EEPROM, some test cases will fail in the self test.

The **"Compensation Adjustment"** test determines a new setting for the attenuator compensation (only for modules 1142.9832.02 from version 03.00). A new standard adjustment must also be performed after this test.

1. Performing the **"Calibration"** test sequence

2. Performing the **"Write Correction Data"** test

3. Performing the **"Calibration"** again to document the success of the adjustment.

6.3 R&S TS-PFG

ⓘ Before calibrating the R&S TS-PFG module, allow a warming up time of at least 15 minutes.

6.3.1 Incoming test

The master test sequence includes all test cases ensuring the values specified in the datasheet of the R&S TS-PFG function generator.

If results are outside the tolerance range, adjustment of the R&S TS-PFG module can be performed in the outgoing test.

6.3.2 Outgoing test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PFG function generator. After completion, an outgoing report is generated.

A sequence for adjusting the device under test is also available. During adjustment, all results from the calibration sequence are set to invalid. Therefore, calibration must be repeated to document the success of the adjustment.

6.4 R&S TS-PICT

ⓘ Before calibrating the R&S TS-PICT module, allow a warming up time of at least 15 minutes.

In conjunction with the R&S TS-PSAM measurement module and the R&S EGTSL software, the module is used to realize in-circuit measurements.

In order for the ICT R&S TS-PICT expansion module to be calibrated, a functional R&S TS-PSAM module must therefore be installed in the system. If several R&S TS-PSAM cards are available, the module set in the system configuration is used for the self test.

ⓘ Calibrating the corresponding R&S TS-PSAM module first is therefore recommended.

6.4.1 Incoming test

The master test sequence includes all test cases ensuring the values specified in the datasheet of the R&S TS-PICT ICT expansion module.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

6.4.2 Outgoing test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PICT ICT expansion module. After completion, an outgoing report is generated.

A sequence for adjusting the device under test is also available. If one of the **"Adjustment CMU"** or **"Adjustment AOS"** tests is performed, the existing correction values in the module EEPROM are overwritten with neutral data before the measurements are started. New correction values are available again when the two adjustment tests have been performed successfully. The **"Write Correction Data"** test transfers the new correction values to the device under test.

Performing the entire "Adjustment" sequence is therefore recommended if adjustment of the device under test is required.

During adjustment, all results from the calibration sequence are set to invalid. Therefore, calibration must be repeated to document the success of the adjustment.

6.5 R&S TS-PMB

A function test is performed for the R&S TS-PMB matrix module.

6.6 R&S TS-PSM1

A function test is performed for the R&S TS-PSM1 power switching module.

6.7 R&S TS-PSU, R&S TS-PSU12

ⓘ Before calibrating the R&S TS-PSU and R&S TS-PSU12 modules, allow a warming up time of at least 15 minutes.

6.7.1 Incoming test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PSU power supply/load module and the R&S TS-PSU12 12V power supply/load module.

ⓘ It is recommended that the entire test sequence is always started, as some tests depend on the completion of previous tests.

If results are outside the tolerance range, adjustment of the modules can be attempted in the outgoing test. The measurement results from the incoming test are used to calculate the new correction values.

6.7.2 Outgoing test

Like the incoming test, the master test sequence includes the calibration sequence.

The **"Adjustment Sequence"** for adjusting the module is also available. The entire calibration sequence must have been completed to perform adjustment (this can also be done in the incoming test). After adjustment, all results from the calibration sequence are set to invalid. The incoming test report is not changed. Therefore, calibration must be repeated to document the success of the adjustment in the outgoing test report.

The **"Write Neutral Correction Data"** test step is available in the **"Additional Tests"** sequence in the outgoing test. This test resets all correction values in the module EEPROM. As a result, the module then needs to be completely readjusted. To do this, the following steps are required in the specified order:

1. Performing the **"Calibration Sequence"** test sequence

2. Performing the **"Adjustment Sequence"** test sequence

3. Performing the **"Calibration"** test sequence again to document the success of the adjustment.

6.8 R&S TS-PAM

Before calibrating the R&S TS-PAM module, allow a warming up time of at least 30 minutes.

The **"DC Accuracy"** sub-sequence in turn consists of two sequences. These sequences for path A and path B in the R&S TS-PAM analyzer module contain two test cases, which must always be performed in the specified order.

6.8.1 Incoming test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PAM analyzer module.

It is recommended that the entire test sequence is always started, as some tests depend on the completion of previous tests.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test. The measurement results from the incoming test are used to calculate the new correction values.

6.8.2 Outgoing test

Like the incoming test, the master test sequence includes the calibration sequence.

The **"Adjustment Sequence"** for adjusting the R&S TS-PAM analyzer module is also available. The entire calibration sequence must have been completed to perform adjustment (this can also be done in the incoming test). During adjustment, the measuring channels are first reset. The DAC's must then be measured again and subsequently adjusted. When measuring the DAC's in the **"DAC Calibration"** test, errors can occur. The success of the DAC adjustment is verified in the calibration sequence in the **"DC Accuracy"** test.

After adjustment, all results from the calibration sequence are set to invalid. The incoming test report is not changed. Therefore, calibration must be repeated to document the success of the adjustment in the outgoing test report.

The **"Write Neutral Correction Data"** test step is available in the **"Additional Tests"** sequence in the outgoing test. This test resets all correction values in the module EEPROM. As a result, it then needs to be completely readjusted. To do this, the following steps are required in the specified order:

1. Performing the **"Calibration Sequence"** test sequence

2. Performing the **"Adjustment Sequence"** test sequence

3. Performing the **"Calibration"** test sequence again to document the success of the adjustment.

ⓘ   With neutral correction values in the EEPROM, some test cases are excluded from the self test.

6.9   R&S TS-PSM2

A function test is performed for the R&S TS-PSM2 multiplex/switching module 2.

6.10   R&S TS-PIO2

ⓘ   Before calibrating the R&S TS-PIO2 module, allow a warming up time of at least one hour.

For adjustment of the R&S TS-PIO2 analog/digital IO module 2, the "High Stability Option 002" is necessary for the external multimeter 3458A. If the option is not available, calibration can still be performed. However, the measuring inaccuracy will be increased accordingly. This is indicated once by a dialog box.
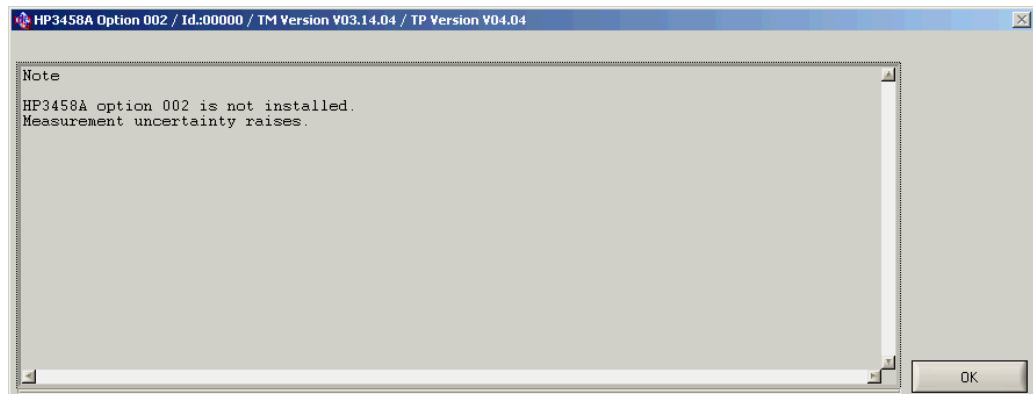
Figure 6-1: Warning Option 002 not installed

6.10.1   Incoming test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PIO2 analog/digital IO module 2.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

6.10.2 Outgoing test

Like the incoming test, the master test sequence includes the calibration sequence.

The **"Adjustment Sequence"** is also available for adjustment of the R&S TS-PIO2 analog/digital IO module 2. After adjustment, all results from the calibration sequence are set to invalid. Therefore, calibration must be repeated to document the success of the adjustment in the outgoing test report.

6.11 R&S TS-PRIO

A function test is performed for the R&S TS-PRIO module. However, the relays can only be tested using a self test connector.

As this module does not have an EEPROM, the serial number and the change index must be entered manually. The serial number is logged in the test report. The software does not currently evaluate the change index for this module.

Therefore, this module does not appear in the selection dialog box for the available device under tests if you are attempting to import the device under test data using the **"Read Data"** button.

If the system contains several R&S TS-PRIO modules the position in the frame can be selected when transferring the device under test data.

6.12 R&S TS-PDFT

A function test is performed for the R&S TS-PDFT digital function test module.

6.13 R&S TS-PHDT

A function test is performed for the R&S TS-PHDT high speed digital test module.

6.14 R&S TS-PKISC

Selecting this device under test type allows the TS-PCALA, TS-PCALB and TS-PCALC test adapters to be tested. A test case is also available for the cable between DMM and the test adapter. The sequence for the incoming and outgoing tests has the same structure for these device under tests. Adjustment is not necessary.

6.15 R&S TS-PSM3

There are two methods to calibrate the R&S TS-PSM3, a standard calibration and a custom calibration.

6.15.1 Standard calibration

To determine the correction values for this module the following measuring instruments are needed:

- Power supply with at least 30 A output current, GPIB interface, SCPI instruction set (e.g. Agilent 5765A)
- Calibration resistor 10 mOhm, 0.03 %, 2 A (e.g. burster 1240-0,01)
- High load calibration resistor 1 mOhm , 0.02 %, 30 A (e.g. burster 1282-0,001)

A suitable cable set is available under order number 5046.4869.00.

ⓘ When calibrating a R&S TS-PSM3 module no signals must be connected to the rear plugs.

1. Start the test program and follow the instructions.

2. Check that the power supply is inactive.
   Normally, the software deactivates the power supply automatically. In rare cases, however, automatic deactivation does not work and you have to deactivate the power supply manually.

3. **CAUTION!** Risk of skin burns. During the measurement, currents up to 30 A occur. If the contacts are in a poors state, such current can generate heat that can cause skin burns. Change the cables only after you have checked that the power supply is inactive.

   Connect the devices in the setup as shown in Figure 6-2.

4. Resume the test program.
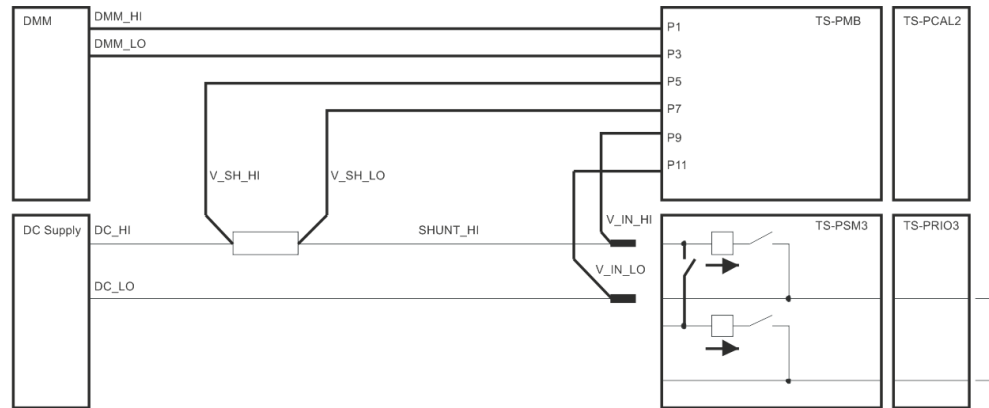
Figure 6-2: Test setup for R&S TS-PSM3

The lines V_IN_HI and V_IN_LO must be contacted directly at the plug contacts of the R&S TS-PSM3.

Since all channels are tested on the module, the manual effort required to contact the external power supply with the test leads is very high.

At R&S TS-PSM3 modules of Variant 02 calibration may be very complicated, since the connection of the power supply by default can not be done via plug contacts. This must be done under certain circumstances with adapter cables.

To check the signal paths via a R&S TS-PRIO3 module following jumpers are necessary on this module:

X12 (2A)

CH1 - CH2

CH3 - CH4

CH5 - CH6

CH7 - CH8

X14 (30A)

CH9 - CH10

CH11 - CH12

CH13 - CH14

CH15 - CH16

6.15.1.1   Incoming test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PSM3.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

6.15.1.2 Outgoing test

The master test sequence includes the calibration sequence as the incoming test. Additionally the sequence **"Adjustment Sequence"** to adjust the R&S TS-PSM3 module is available. Here correction values are calculated and stored on the module. The correction values are used by a device driver function, which converts the voltages measured at the shunt resistors in current values. After the alignment all the results of the calibration sequence are set to invalid. The calibration has to be repeated in order to document the success of the adjustment in the end test report. The new correction values are calculated with the previously measured voltages and the results are stored in the report.

6.15.2 Custom calibration

A custom partial calibration is possible for system configurations with fix wiring.

For more information, see Chapter B, "Custom calibration", on page 54.

6.16 R&S TS-PSM4

There are two methods to calibrate the R&S TS-PSM4, a standard calibration and a custom calibration.

6.16.1 Standard calibration

To determine the correction values for this module the following measuring instruments are needed:

- Power supply with at least 16 A output current, GPIB interface, SCPI instruction set (e.g. Agilent 5765A)
- Calibration resistor 10 mOhm, 0.03 %, 2 A (e.g. burster 1240-0,01)
- High load calibration resistor 1 mOhm , 0.02 %, 16 A (e.g. burster 1282-0,001)

A suitable cable set is available under order number 5046.4869.00.

ⓘ When calibrating a R&S TS-PSM3 module no signals must be connected to the rear plugs.

1. Start the test program and follow the instructions.

2. Check that the power supply is inactive.

Normally, the software deactivates the power supply automatically. In rare cases, however, automatic deactivation does not work and you have to deactivate the power supply manually.

3. **CAUTION!** Risk of skin burns. During the measurement, currents up to 16 A occur. If the contacts are in a poors state, such current can generate heat that can cause skin burns. Change the cables only after you have checked that the power supply is inactive.

   Connect the devices in the setup as shown in Figure 6-3.

4. Resume the test program.
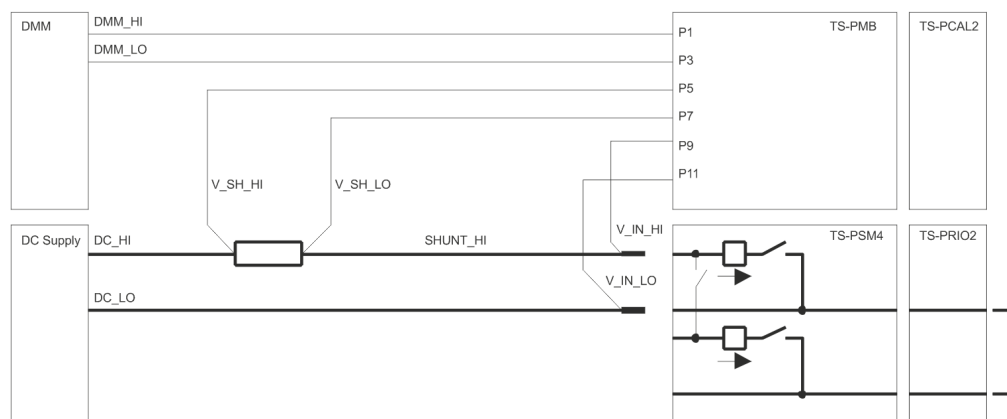
Figure 6-3: Test setup for R&S TS-PSM4

The lines V_IN_HI and V_IN_LO must be contacted directly at the plug contacts of the R&S TS-PSM4.

Since all channels are tested on the module, the manual effort required to contact the external power supply with the test leads is very high.

At R&S TS- PSM4 modules of variant 02 calibration may be very complicated, since the connection of the power supply by default can not be done via plug contacts. This must be done under certain circumstances with adapter cables.

To check the signal paths via a R&S TS-PRIO2 module following jumpers are necessary on this module:

X1, X2 (2A)

CH1 - CH2

CH3 - CH4

CH5 - CH6

CH7 - CH8

X3, X4, X5 (16A)

CH9 - CH10

CH11 - CH12

CH13 - CH14

CH15 - CH16

CH17 - CH18

CH19 - CH20

6.16.1.1 Incoming test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PSM4.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

6.16.1.2 Outgoing test

The master test sequence includes the calibration sequence as the incoming test. Additionally the sequence **"Adjustment Sequence"** to adjust the R&S TS-PSM3 module is available. Here correction values are calculated and stored on the module. The correction values are used by a device driver function, which converts the voltages measured at the shunt resistors in current values. After the alignment all the results of the calibration sequence are set to invalid. The calibration has to be repeated in order to document the success of the adjustment in the end test report. The new correction values are calculated with the previously measured voltages and the results are stored in the report.

6.16.2 Custom calibration

A custom partial calibration is possible for system configurations with fix wiring.

For more information, see Chapter B, "Custom calibration", on page 54.

6.17 R&S TS-PSM5

There are two methods to calibrate the R&S TS-PSM5, a standard calibration and a custom calibration.

6.17.1 Standard calibration

To determine the correction values for this module the following measuring instruments are needed:

● Power supply with at least 50 A output current, GPIB interface, SCPI instruction set (e.g. Agilent 5765A)

- Calibration resistor 10 mOhm, 0.03 %, 2 A (e.g. burster 1240-0,01)
- High load calibration resistor 1 mOhm , 0.02 %, 50 A (z.B. burster 1282-0,001)

A suitable cable set is available under order number 5046.4869.00.

> ⓘ When calibrating a R&S TS-PSM3 module no signals must be connected to the rear plugs.

1. Start the test program and follow the instructions.

2. Check that the power supply is inactive.
   Normally, the software deactivates the power supply automatically. In rare cases, however, automatic deactivation does not work and you have to deactivate the power supply manually.

3. **CAUTION!** Risk of skin burns. During the measurement, currents up to 50 A occur. If the contacts are in a poors state, such current can generate heat that can cause skin burns. Change the cables only after you have checked that the power supply is inactive.

   Connect the devices in the setup as shown in Figure 6-4.

4. Resume the test program.
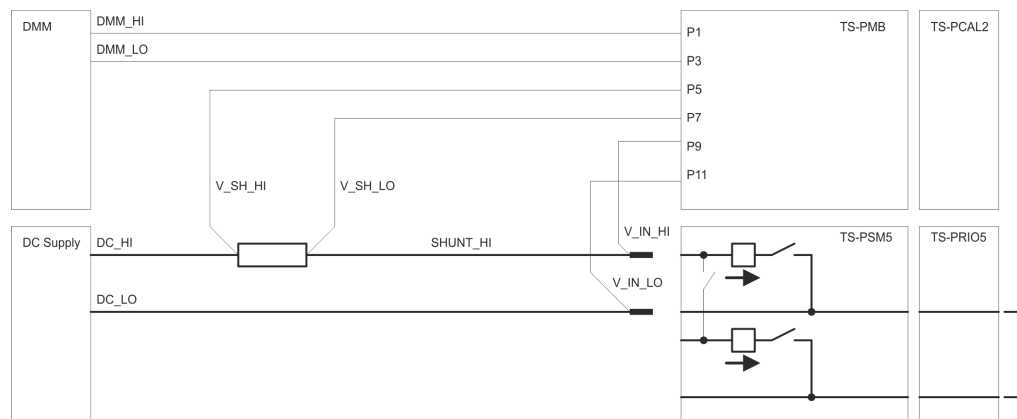
Figure 6-4: Test setup for R&S TS-PSM5

The lines V_IN_HI and V_IN_LO must be contacted directly at the plug contacts of the R&S TS-PSM5.

Since all channels are tested on the module, the manual effort required to contact the external power supply with the test leads is very high.

At R&S TS- PSM5B modules of variant 02 calibration may be very complicated, since the connection of the power supply by default can not be done via plug contacts. This must be done under certain circumstances with adapter cables.

To check the signal paths via a R&S TS-PRIO5 module following jumpers are necessary on this module:

2 A Terminals

CH1 - CH2

CH3 - CH4

50 A Terminals

CH5 - CH6

CH7 - CH8

6.17.1.1 Incoming test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PSM5.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

6.17.1.2 Outgoing test

The master test sequence includes the calibration sequence as the incoming test. Additionally the sequence **"Adjustment Sequence"** to adjust the R&S TS-PSM5 module is available. Here correction values are calculated and stored on the module. The correction values are used by a device driver function, which converts the voltages measured in current values. After the alignment all the results of the calibration sequence are set to invalid. The calibration has to be repeated in order to document the success of the adjustment in the end test report. The new correction values are calculated with the previously measured voltages and the results are stored in the report.

6.17.2 Custom calibration

A custom partial calibration is possible for system configurations with fix wiring.

For more information, see Chapter B, "Custom calibration", on page 54.

6.18 R&S TS-PIO4

A function test is performed for the R&S TS-PIO4 digital function test module.

6.19 R&S TS-PIO5

A function test is performed for the R&S TS-PIO5 digital functiion test module.

7 Specifications

The technical data of the TSVP In-System Calibration R&S TS-ISC are shown in the corresponding data sheets. In the event of any discrepancies between date in this user manual and technical data in the data sheet, the data sheet takes precedence.

Annex

A Calibration / adjustment procedures

A.1 General

Generally, first a **calibration** of the device under test is performed within the scope of an incoming test. For some modules, the measurement results of this test are used for an optional **adjustment**. If measured values are beyond the tolerance range, the device under test can be adjusted in the outgoing test. Following an **adjustment**, the **calibration** must be repeated as part of the outgoing test to document the success.

For TSVP modules, for which adjustment is not intended, the self-test is primarily performed of the calibration sequence. The execution times are documented in this case.

Several user interactions are generally required after the sequences have been started. In the "LED Test", for example, the function of the LEDs on the front of the modules must be confirmed. For this reason, it is best to check the LEDs when the system is switched on.

Before starting the test sequences, take into consideration the heating period of the modules and the external multimeter.

A.2 R&S TS-PCAL2

A.2.1 Calibration

Time min:s	Note
00:00	Start of the sequence
00:05	Adaption: R&S TS-PCALA on R&S TS-PMB
15:15	End of the sequence

A.2.2 Adjustment

Time min:s	Note
00:00	Start of the sequence Adaption: R&S TS-PCALA on R&S TS-PMB
08:00	End of the sequence

A.3 R&S TS-PSAM

A.3.1 Calibration

Time min:s	Note
00:00	Start of the sequence
00:25	Adaption: Plug SFT board (if available)
00:30	Adaption: Remove SFT board, R&S TS-PCALA on DUT
01:00	Adaption: Change HI / LO polarity on the DMM
01:30	Adaption: Change HI / LO polarity on the DMM
04:00	Adaption: R&S TS-PCALA on R&S TS-PMB
06:30	Adaption: Disconnect R&S TS-PCALA from R&S TS-PMB, R&S TS-PCALC on DUT
10:30	Adaption: R&S TS-PCALA on DUT
12:30	End of the sequence

A.3.2 Adjustment

For this module, in the adjustment process, the topical correction values and the results from the measurements during calibration are used to calculate new correction values and transfer them to the flash memory of the module. For this reason, the calibration sequence must be performed before starting the adjustment.

The trimmer capacitors adjustment for modules from change index 06.00 is only required in exceptional cases.

Time min:s	Note
00:00	Start of the sequence
00:05	End of the sequence

A.4　R&S TS-PFG

A.4.1　Calibration

Time min:s	Note
00:00	Start of the sequence
00:15	Adaption: Plug SFT board (if available)
00:20	Adaption: Remove SFT board, R&S TS-PCALA on DUT
06:00	Adaption: Change R&S TS-PCALA from DUT to R&S TS-PMB
06:15	End of the sequence

A.4.2　Adjustment

Time min:s	Note
00:00	Start of the sequence Adaption: R&S TS-PCALA on R&S TS-DUT
09:00	End of the sequence

A.5　R&S TS-PICT

A.5.1　Calibration

Time min:s	Note
00:00	Start of the sequence
00:10	Adaption: R&S TS-PCALA on R&S TS-PMB
02:30	End of the sequence

A.5.2   Adjustment

Time min:s	Note
00:00	Start of the sequence Adaption: R&S TS-PCALA on R&S TS-PMB
01:30	End of the sequence

A.6   R&S TS-PSU, R&S TS-PSU12

A.6.1   Calibration

Time min:s	Note
00:00	Start of the sequence
00:25	Adaption: Plug SFT board (if available)
00:35	Adaption: Remove SFT board, R&S TS-PCALA on DUT
04:00	End of the sequence

A.6.2   Adjustment

Time min:s	Note
00:00	Start of the sequence
00:05	Adaption: R&S TS-PCALA on DUT
01:00	End of the sequence

A.7   R&S TS-PAM

A.7.1   Calibration

Time min:s	Note
00:00	Start of the sequence
00:25	Adaption: Plug SFT board (if available)
00:30	Adaption: Remove SFT board

Time min:s	Note
00:45	Adaption: R&S TS-PCALC on DUT
25:00	End of the sequence

A.7.2　Adjustment

In the adjustment process, the topical correction values and the results from the measurements during calibration are used to calculate new correction values and transfer them to the flash memory of the module. Subsequently, the DAC's will be calibrated and the determined correction values transferred to the module. For this reason, the calibration sequence must be performed before starting the adjustment.

Time min:s	Note
00:00	Start of the sequence
00:15	End of the sequence

A.8　R&S TS-PIO2

A.8.1　Calibration

Time min:s	Note
00:00	Start of the sequence
01:50	Adaption: Plug SFT board (if available)
01:55	Adaption: Remove SFT board
02:00	Independent automatic correction (if required)
03:10	Adaption: R&S TS-PCALB on DUT
17:00	End of the sequence

A.8.2　Adjustment

Prior to the measurement, the calibration software checks the temperature stability. Subsequently, the adjustment will be performed. The times stated are based on a properly heated module.

Time min:s	Note
00:00	Start of the sequence
00:05	Adaption: R&S TS-PCALC on DUT
03:45	End of the sequence

A.9   R&S TS-PMB

A.9.1   Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:30	Adaption: Plug SFT board (if available)
00:35	Adaption: Remove SFT board
00:45	End of the sequence

A.10   R&S TS-PSM1

A.10.1   Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:30	Adaption: Plug SFT board (if available)
00:35	Adaption: Remove SFT board
00:45	End of the sequence

A.11 R&S TS-PSM2

A.11.1 Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:30	Adaption: Plug SFT board (if available)
00:45	Adaption: Remove SFT board
00:55	End of the sequence

A.12 R&S TS-PRIO

A.12.1 Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:10	Adaption: Plug SFT board (if available)
00:15	Adaption: Remove SFT board
00:30	End of the sequence

A.13 R&S TS-PDFT

A.13.1 Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:05	Adaption: Plug SFT board 1 (if available)
00:10	Adaption: Remove SFT board 1, plug SFT board 2 (if available)
00:20	End of the sequence

A.14 R&S TS-PHDT

A.14.1 Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:25	Adaption: Plug SFT board (if available)
00:30	Adaption: Remove SFT board
00:40	End of the sequence

A.15 R&S TS-PKISC

A.15.1 Calibration

Time min:s	Note
00:00	Start of the sequence
00:05	Adaption: Short-circuiting of the banana plugs of the measurement cable Plug cable on R&S TS-PMB
00:45	Adaption: Plug R&S TS-PCALA on R&S TS-PMB, short-circuited cable on R&S TS-PCALA
01:00	Adaption: Remove short-circuits, connect cable to DMM
01:30	Adaption: Remove R&S TS-PCALA, plug R&S TS-PCALB on R&S TS-PMB, connect to DMM
02:15	Adaption: Remove R&S TS-PCALB, plug R&S TS-PCALC on R&S TS-PMB, connect to DMM
03:15	End of the sequence

A.16 R&S TS-PSM3

A.16.1 Calibration

The time for calibration is approx. 30 minutes.

A.16.2   Adjustment

The time for adjustment is approx. 5 seconds.

A.17   R&S TS-PSM4

A.17.1   Calibration

The time for calibration is approx. 30 minutes.

A.17.2   Adjustment

The time for adjustment is approx. 5 seconds.

A.18   R&S TS-PSM5

A.18.1   Calibration

The time for calibration is approx. 15 minutes.

A.18.2   Adjustment

The time for adjustment is approx. 5 seconds.

A.19   R&S TS-PIO4

A.19.1   Calibration (Self-Test)

Time min:sec	Note
00:00	Start of sequence
02:30	Adaption: Plug SFT - board 1 (if available)

Time min:sec	Note
03:00	Adaption: Remove SFT - board 1, plug SFT board 2 (if available)
03:30	End of Sequence

A.20 R&S TS-PIO5

A.20.1 Calibration (Self-Test)

Time min:sec	Note
00:00	Start of sequence
00:05	Adaption: Plug SMB - Cable CLK <-> TRIG (if available)
00:10	Adaption: Plug LVDS - Cable DIGA <-> DIGB (if available)
00:20	Adaption: Remove LVDS - Cable DIGA <-> DIGB
00:25	Adaption: Remove SMB - Cable CLK <-> TRIG
00:30	End of Sequence

B Custom calibration

A custom (partial) calibration of the R&S TS-PSM3 / -PSM4 and -PSM5 modules is possible for system configuration with a fix wiring. You can calibrate those modules manually or with the R&S GTSL software.

Required equipment

Custom calibration requires the following equipment:
- Measurement cable
- Power supply
- Digital multimeter (for example R&S TS-PSAM or an external multimeter, depending on your requirements)
- Calibration resistor 10 mOhm (e.g. Burster 1240-0,01)
- High load calibration resistor 1 mOhm (e.g. Burster 1282-0,001)

A suitable cable set is available under order number 5046.4869.00.

B.1 Manual calibration

You can manually calibrate the module using one of the following methods.
- Manual calibration in which you read out each result of the voltage measurement manually using the "Current Calculator" of the R&S TSVP instrument soft panel.
- Automated calibration using the functions available in the GTSL library.

Calibration of the module consists of a series of measurements that determine the current. The current in turn is determined by a voltage measurement that uses the shunt resistor or current-voltage converter built into the module. The measurement takes into account the correction values stored on the module. Generating new correction values is not necessary.

Calibrating high power channels

To check the voltage drop at the relay contacts of high power channels (16 A, 30 A or 50 A), you have to clear the forming film from the contacts before calibrating the module. Clearing the contacts requires switching of the high power channels multiple times under load.

1. Set the voltage of the power supply to 12 V.

2. Limit the current:
    - 5 A for R&S TS-PSM4.
    - 10 A for R&S TS-PSM3 and -PSM5.

3. Turn on the power supply.
    The current overshoot of the power supply during its settling time is irrelevant, because the contacts of the modules can handle high currents.

Calibrating low power channels

1. **NOTICE!** Risk of module damage. Typical power supplies have a settling time of a few milliseconds. During the settling time a current overshoot occurs, which can damage the contacts of the module. To avoid damage to the module, do not apply a load to the relays of the 2 A channels.

   Close the relay contact.

2. Limit the current to 2 A.

3. Turn on the power supply.

4. Open the relay contacts when the current output of the power supply has settled.

Characteristics of shunt resistors

Because shunt resistors are linear components, calibration is performed at a single current value only.

- 2 A for 22 mOhm resistors.
- 16 A for 5 mOhm resistors.

Shunt resistor voltage measurements occur on channels "a1" and "b1" of the analog bus.

Characteristics of the current-voltage converter

Applicable to R&S TS-PSM3 and -PSM5 only.

For a full calibration, measuring the linearity of the current-voltage converter requires measurements for both current flow directions, positive and negative. The measurements occur at different currents.

- R&S TS-PSM3: ± 30 A, ± 15 A und ± 5 A
- R&S TS-PSM5: ± 50 A, ± 25 A und ± 5 A

Some setups use current that flows only in one direction. For these setup, you only have to calibrate the module in one direction (partial calibration).

In addition, if the setup uses current that does not vary or varies only a little, it is sufficient to calibrate at that value only, and not the other two.

Measurement of the output voltage of the current-voltage converter occurs on channels "b1" and "d1" or "d2 (GND)" with an ungrounded voltmeter (for example R&S TS-PSAM or an external digital multimeter).

Typical setups for partial calibration

- Calibrate negative current only
  The following calibration setup calibrates the channel which is connected to the "DC_HI" signal of the power supply. In this setup, the current-voltage converter can only measure negative current.
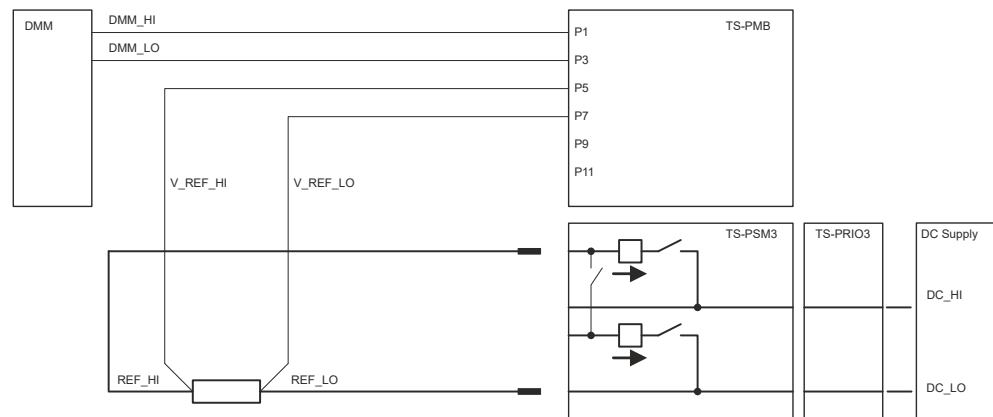
Figure B-1: Setup to calibrate negative current

- Calibrate positive current only
  The following calibration setup calibrates the channel which is connected to the
  "DC_LO" signal of the power supply. In this setup, the current-voltage converter
  can only measure positive current.
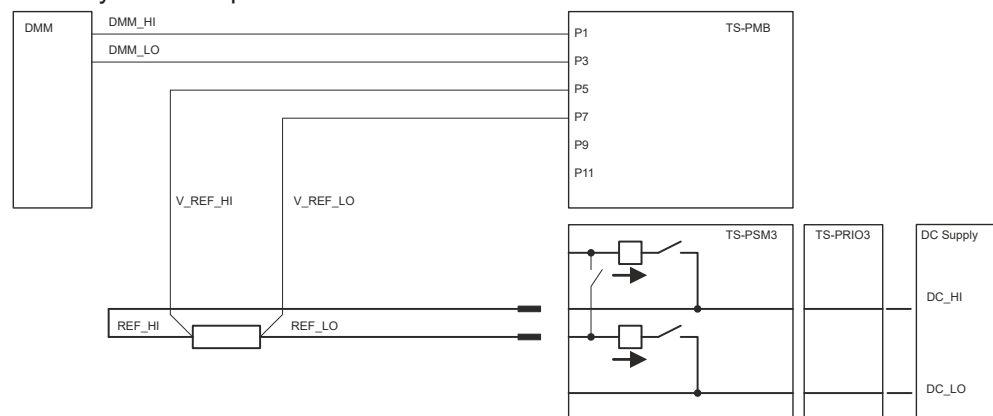
Figure B-2: Setup to calibrate positive current

- Calibrate channels with no direct connection to the power supply
  The following calibration setup calibrates channels with no direct connection to the
  power supply. Such channels can be on a second switch module. The "DC_HI" and
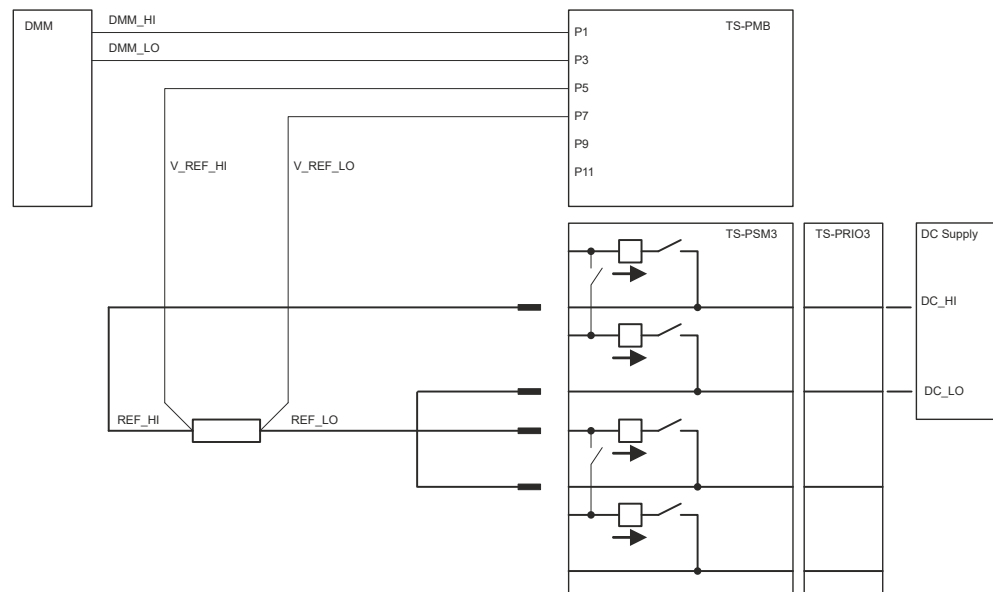 "DC_LO" signals are routed through thefirst module.

Figure B-3: Setup to calibrate channels with no direct power supply connection

Measurement uncertainties

Measurement uncertainties depend on the accuracy of the voltage measurement and the impressed current. The accuracy of the voltage measurement in turn depends on the accuracy of the voltmeter of the shunt resistor or current-voltage converter.

The impressed current is measured during factory calibration based on a voltage measurement with an external calibration resistor ("V_REF_HI", "V_REF_LO"). Therefore, the impressed current of the power supply is not relevant.

You can use different equipment for the voltage measurement, depending on the accuracy you need, for example:

● The R&S TS-PSAM module.
● An external multimeter controlled by the R&S TS-PMB module connected to the analog bus.

Make sure that the test setup is accurate, because especially the shunt resistor measurements occur on low voltages. We recommend to average the results over multiple measurements to get an accurate result.

Result evaluation

You can read out the results with different methods.

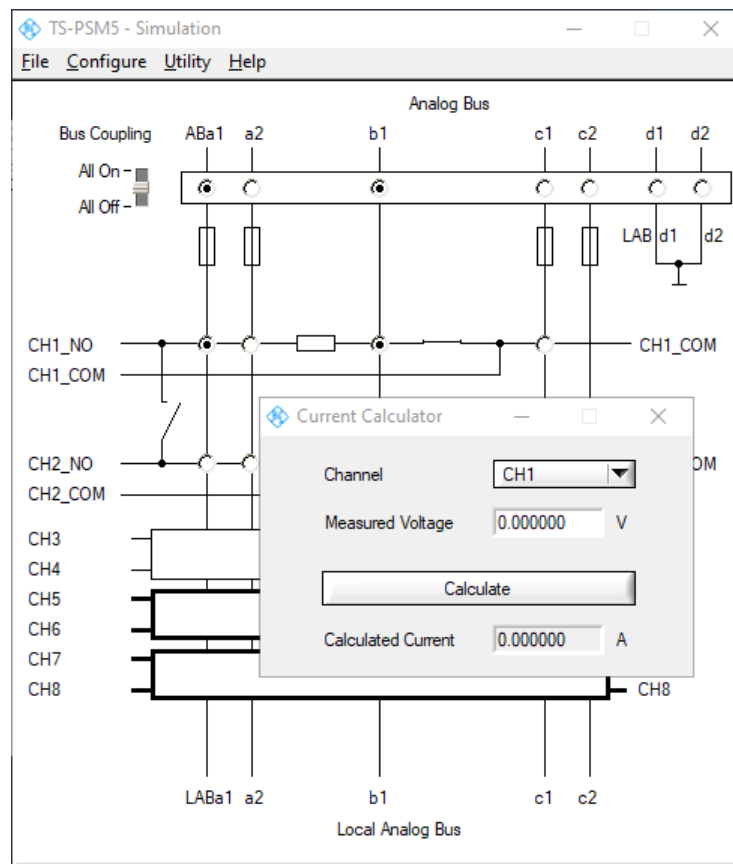● Use the "Current Calculator" available in the soft panel of the R&S TSVP.

Figure B-4: Overview of the current calculator

- Read out the results with the driver function
  `<prefix>*_GetCalculatedCurrent`.
  `*<prefix>` = `rspsm3`, `rspsm4` or `rspsm5`, depending on the module.

Both methods determine the current flow based on the correction values stored on the module.

See the moldule datasheet for the exact tolerances of the shunt resistors and current-voltage converter.

B.2 Software-controlled custom calibration

In addition to manual calibration, you can perform a custom calibration using the tools available with the R&S GTSL software.

Required equipment:

- Measurement cable
- Power supply
- Digital multimeter HP3458a (mandatory)
- Calibration resistor 10 mOhm (e.g. Burster 1240-0,01)

- High load calibration resistor 1 mOhm (e.g. Burster 1282-0,001)

You can remote control the power supply unit if the remote interface of the device uses the SCPI standard.

Preparing the calibration

Software-controlled calibration requires a file `010075_PsmxConfiguration.ini` with a certain content. The file is in the following directory:

`C:\Program Files (x86)\Rohde-Schwarz\RSDMB\TestPrograms\ 1142.9503xxx`

Change the contents of the `010075_PsmxConfiguration.ini` file according to the rules described below.

Define as many R&S TS-PSM3, -PSM4 or -PSM5 modules to be calibrated in one or more R&S TSVP base units.

Performing calibration

When you custom calibrate one of the modules R&S TS-PSM3 / -PSM4 or -PSM5, make sure to select "CustomizePSMx_Calibration" in the "Configuration Database Editor".
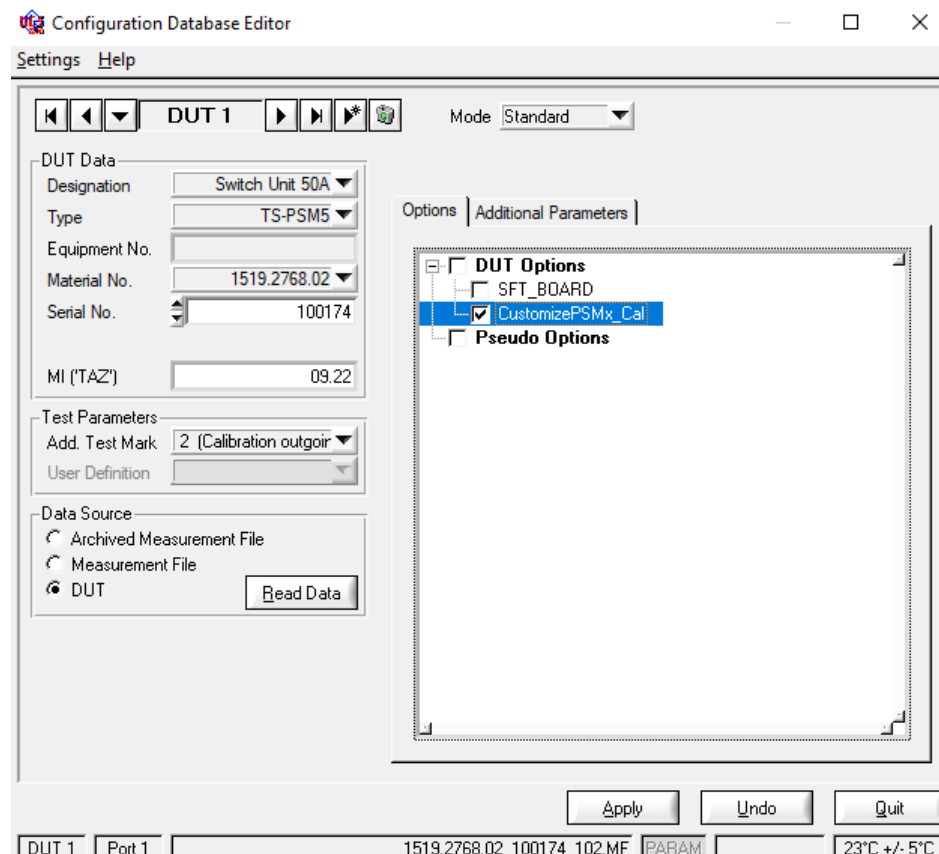

Figure B-5: Configuration in the software for calibration of R&S TS-PSM3 / -PSM4 or -PSM5

B.2.1 Structure of the .ini file

The initialization file (.ini) has a certain structure that you have to keep in order for it work.

Overview of the file sections

The .ini file contains several section as shown below.

```
//Configuration of the external power supply
device->Supply_0

//Configuration of the modules
//All module configurations must exist, even if you do no use them
//<i> depends on the number of installed modules of the same type
PSM3_<i>->Configuration
PSM4_<i>->Configuration
PSM5_<i>->Configuration

//Definition of the tests for each module
//All module configurations must exist, even if you do no use them
//<i> depends on the number of installed modules of the same type
PSM3_<i>->Tests
PSM4_<i>->Tests
PSM5_<i>->Tests


//Configuration for each test
//All paths must exist, even if they are not tested
//For PSM3 <n>=16
//For PSM4 <n>=20
//For PSM5 <n>=8
//<i> depends on the number of installed modules of the same type
PSM3_<i>->Path<n>
PSM4_<i>->Path<n>
PSM5_<i>->Path<n>
```

Each section contains several elements as shown below. For a detailed description of all elements, see Chapter B.2.2, "Elements of the .ini file", on page 63.

Overview of the elements in the "supply" section

```
[device->Supply_0]
Description = "TDK GEN+80-65 PowerSupply #1"
ResourceDesc = GPIB0::5::INSTR
MaxCurrent   = 60.0
CMD_RESET         = *RST
CMD_CONF_CURR        = SOURCE:CURRENT
CMD_CONF_VOLTAGE     = SOURCE:VOLTAGE
CMD_CONF_OUTP_ON    = OUTPUT:STATE ON
CMD_CONF_OUTP_OFF    = OUTPUT:STATE OFF
SETTLING_DELAY       = 0.1
```

Overview of the elements in the "configuration" section

The following overview shows the configuration for an R&S TS-PSM3 module. The elements for the R&S TS-PSM4 and -PSM5 are the same.

```
[PSM3_1->Configuration]
RearPath     = RIO-Module ;Options: TS-PK04,Skip
Supply        = Supply_0
Test          = PSM3_1->Tests
SetupTxt      = 1. Connect Power Supply Output 'DC_Hi' to cable "DC_SH_HI".\n2.
Connect Power Supply Output 'DC_Lo' to cable 'V_IN_LO'.\n3.
Connect cable 'DC_SH_HI' to the shunt resistor according upcomming instruction.
```

Overview of the elements in the "tests" section

The following overview shows the configuration for an R&S TS-PSM3 module. The only difference for the R&S TS-PSM4 and -PSM5 are the number of paths (20 and 8 respectively).

```
[PSM3_1->Tests]
Test1 = PSM3_1->Path1
Test2 = PSM3_1->Path2
Test3 = PSM3_1->Path3
Test4 = PSM3_1->Path4
Test5 = PSM3_1->Path5
Test6 = PSM3_1->Path6
Test7 = PSM3_1->Path7
Test8 = PSM3_1->Path8
Test9 = PSM3_1->Path9
Test10 = PSM3_1->Path10
Test11 = PSM3_1->Path11
Test12 = PSM3_1->Path12
Test13 = PSM3_1->Path13
Test14 = PSM3_1->Path14
Test15 = PSM3_1->Path15
Test16 = PSM3_1->Path16
```

Overview of the elements in the "paths" section

The following overview shows the configuration for a path of the R&S TS-PSM3 module. The elements for the R&S TS-PSM4 and -PSM5 are the same.

```
[PSM3_1->Path1]
Channel       = 1
Type           = LC_PATH_SHORT_RIO
SetupTitle      = PSM3 CH1 Low Current Path
SetupBmp       = PATH.png
SetupTxtPath     = Connect V_IN_HI > PSM3 X10.  B6    (CH1_NO).\nConnect V_IN_LO > PSM3 X10.
MeasVin       = 1
MeasVrel      = 1
ResFrontPathNom  = 0.100
ResRearPathNom   = 0.389
ResShortRelay1Nom = 0.068
```

```
VoltPathNom    = 0.200
VoltPathDLp   = 0.020
VoltPathDLn   = -0.050
VoltRelNom    = 0.020
VoltRelDLp    = 0.010
VoltRelDLn    =-0.015
VoltRearNom    = 0.730
VoltRearDLp    = 0.050
VoltRearDLn   =-0.100
VoltShort1Nom   = 0.130
VoltShort1DLp   = 0.020
VoltShort1DLn   =-0.040
VoltRes1Nom    = 0.044
VoltRes1DLp    = 0.002
VoltRes1DLn   =-0.002
VoltRes2Nom    = 0.020
VoltRes2DLp    = 0.0005
VoltRes2DLn   =-0.0005
```

Determining the module index <i>

1. Double click in the G5 panel to open the "Configuration Database Editor".
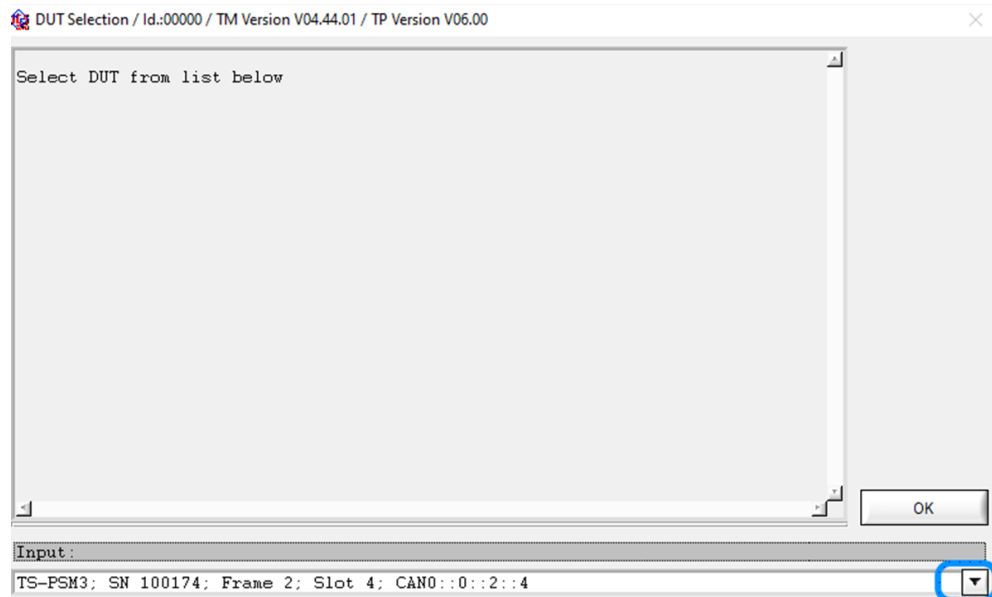
2. Select the "Input" list selector to get a list of all modules where a calibration can be performed.
   A list of all modules appears. The first column shows the index number of the module. In the image below, the R&S TS-PSM3 module has index = 14.

B.2.2   Elements of the .ini file

The `.ini` file contains several sections, each of which contains different syntax elements.

B.2.2.1   Elements of the "device" section

The `[device->Supply_0]` section describes the properties of the external power supply used to provide the high current for the calibration. The section occurs once in the `.ini` file. The entries in this section are mandatory.

Description
Mandatory entry

Data type: string

Defines a description of the power supply, for example its name.

Example: `Description = "TDK GEN+80-65 PowerSupply #1"`

ResourceDesc
Mandatory entry

Data type: string

Defines the remote interface and its address.

Example: `ResourceDesc = GPIB0::5::INSTR`

MaxCurrent

Mandatory entry

Data type: double

Defines the maximum current that can be provided by the power supply.

Example: `MaxCurrent = 60.0`

Power supply control

Mandatory entry

Data type: SCPI commands

Defines a set of SCPI commands to control the power supply unit.

Example:

```
SCPI command to perform a reset :
CMD_RESET = *RST
SCPI command to set the current value:
CMD_CONF_CURR    = SOURCE:CURRENT
SCPI command to set the source voltage:
CMD_CONF_VOLTAGE    = SOURCE:VOLTAGE
SCPI command to enable the output:
CMD_CONF_OUTP_ON    = OUTPUT:STATE ON
SCPI command to disable the output:
CMD_CONF_OUTP_OFF    = OUTPUT:STATE OFF
SCPI command to insure a settling time after using the output:
SETTLING_DELAY    = 0.1
```

B.2.2.2 Elements of the "configuration" sections

The `[PSM<x>_<i>->Configuration]` section describes the properties of the corresponding module. The section occurs once in the `.ini` file for each module model and for each installed module. The entries in this section are mandatory.

Example structure for a system that contains:
- 2 x R&S TS-PSM3
- 1 x R&S TS-PSM4
- 1 x R&S TS-PSM3

```
PSM3_1->Configuration
PSM3_2->Configuration
PSM4_1->Configuration
PSM5_1->Configuration
```

RearPath

Mandatory entry

Data type: string

Defines the rear path configuration during the calibration.

Example: `RearPath = RIO-Module ;Options: TS-PK04,Skip`

Supply

Mandatory entry

Data type: string

Defines the external power supply used during the calibration.

Example: `Supply = Supply_0`

Note that a corresponding section in the `.ini` file must exist.

Test

Mandatory entry

Data type: string

Selects the test set for the module.

Example: `Test = PSM3_1->Tests`

Note that a corresponding section in the `.ini` file must exist.

SetupTxt

Mandatory entry

Data type: string

Defines test instructions for the calibration.

Example: `SetupTxt = 1. Connect Power Supply Output 'DC_Hi' to cable "DC_SH_HI".\n`

`2. Connect Power Supply Output 'DC_Lo' to cable 'V_IN_LO'.\n`

`3. Connect cable 'DC_SH_HI' to the shunt resistor according upcomming instruction.`

B.2.2.3 Elements of the "test" sections

The `[PSM<x>_<i>->Tests]` section maps the channels to each test performed. The section occurs once in the `.ini` file for each module model and for each installed module. The entries in this section are mandatory.

Test<n>

Mandatory entry

Data type: string

Maps the tests to a path. The number `Test` elements (`<n>`) depends on the module model.

- R&S TS-PSM3: 16 channels
- R&S TS-PSM4: 20 channels

- R&S TS-PSM5: 8 channels

Example: `Test4 = PSM3_1->Path4`

B.2.2.4 Elements of the "path" section

The `[PSM<x>_<i>->Path<n>]` section defines the test configuration for one chan-
nel. The section occurs multiple times in the `.ini` file: once for each channel in every
module model and for each installed module.

- The R&S TS-PSM3 has 16 channels, thus the section occurs 16 times for each
  installed module.
- The R&S TS-PSM4 has 20 channels, thus the section occurs 20 times for each
  installed module.
- The R&S TS-PSM5 has 8 channels, thus the section occurs 8 times for each instal-
  led module.

Channel

Mandatory entry

Data type: integer

Selects the channel index.

The value range depends on the module type:
- 1...8 (R&S TS-PSM5)
- 1...16 (R&S TS-PSM3)
- 1...20 (R&S TS-PSM4)

Example: `Channel = 1`

Type

Mandatory entry

Data type: string

Defines the test type.

Example: `Type = LC_PATH_SHORT_RIO`

LC_PATH

> Low current signal path. The channel relay and the shunt resistor of the path will be tested.

LC_PATH_SHORT

> Low current signal path. The channel relay, the shunt resistor and the short relay of the path will be tested.

LC_PATH_SHORT_RIO

> Low current signal path. The channel relay, the shunt resistor, the short relay and the rear I/O (shorted) line of the path will be tested.

HC_PATH

> High current signal path. The channel relay, the shunt resistor or the I/V converter of the path will be tested.

HC_PATH_SHORT

> High current signal path. The channel relay, the shunt resistor or the I/V converter and the short relay of the path will be tested.

HC_PATH_SHORT_RIO

> High current signal path. The channel relay, the shunt resistor or the I/V converter, the short relay and the rear I/O (shorted) line of the path will be tested.

SetupTitle

Mandatory entry

Data type: string

Defines the title shown in user instruction display.

Example: `SetupTitle = PSM3 CH1 Low Current Path`

SetupBmp

Mandatory entry

Data type: string

Selects the picture shown in user instruction display for path tests.

Example: `SetupBmp = PATH.png`

SetupBmpShort

Mandatory entry

Data type: string

Selects the picture shown in user instruction display for short relay tests.

Example: `SetupBmpShort = path_short.png`

SetupTxtPath

Mandatory entry

Data type: string

Defines the text shown in user instruction display to instruct path tests.

Example: `SetupTxtPath = Connect V_IN_HI > PSM3 X10. B6 (CH1_NO).\n`

```
Connect V_IN_LO > PSM3 X10. B2 (CH1_COM).
```

SetupTxtPath2
Mandatory entry

Data type: string

Defines the text shown in user instruction display to instruct reverse path tests.

Example: `SetupTxtPath2 = Connect V_IN_LO > PSM3 X10. B2 (CH1_NO).`

SetupTxtShort
Mandatory entry

Data type: string

Defines the text shown in user instruction display to instruct short relay tests.

Example: `SetupTxtShort = Connect V_IN_HI > PSM3 X10. A5 (CH11_NO).\n`

```
Connect cable V_IN_LO > PSM3 X10. A6 (CH12_NO).
```

MeasVin
Mandatory entry

Selects the direction of the path measurement.

Default value: 2

0	Any path measurements disabled
1	Path measurements for positive direction only enabled.
2	Path measurements for positive and negative direction only enabled.

MeasVrel
Mandatory entry

Selects the direction of the relay contact measurement.

Default value: 2

0	Any path measurements disabled
1	Relay contact measurements for positive direction only enabled.
2	Relay contact measurements for positive and negative direction only enabled.

ResFrontPathNom
Mandatory entry

Defines the mean resistor value between V_IN_HI and V_IN_LO path.

Default value: Value from factory calibration

ResRearPathNom
Mandatory entry

Defines the mean resistor value between V_IN_HI and V_IN_LO rear path.

Default value: Value from factory calibration

ResShortRelay1Nom

Mandatory entry

Defines the mean resistor value between V_IN_HI and V_IN_LO short path.

Default value: Value from factory calibration

ResShortRelay2Nom

Mandatory entry for R&S TS-PSM3 modules modification index > 1.1 only

Defines the mean resistor value between V_IN_HI and V_IN_LO short path.

Default value: Value from factory calibration

VoltPathNom

Mandatory entry

Defines the nominal value of the voltage drop for path measurements.

Default value: Value from factory calibration

VoltPathDLp

Mandatory entry

Defines the upper limit of the voltage drop for path measurements.

Default value: Value from factory calibration

VoltPathDLn

Mandatory entry

Defines the lower limit of the voltage drop for path measurements.

Default value: Value from factory calibration

VoltRelNom

Mandatory entry

Defines the nominal value of the voltage drop over relay contact.

Default value: Value from factory calibration

VoltRelDLp

Mandatory entry

Defines the upper limit of the voltage drop over relay contact.

Default value: Value from factory calibration

VoltRelDLn

Mandatory entry

Defines the lower limit of the voltage drop over relay contact.

Default value: Value from factory calibration

VoltRearNom

Mandatory entry

Defines the nominal value of the voltage drop over rear I/O path.

Default value: Value from factory calibration

VoltRearDLp

Mandatory entry

Defines the upper limit of the voltage drop over rear I/O path.

Default value: Value from factory calibration

VoltRearDLn

Mandatory entry

Defines the lower limit of the voltage drop over rear I/O path.

Default value: Value from factory calibration

VoltShort1Nom

Mandatory entry

Defines the nominal value of the voltage drop over short relay path.

Default value: Value from factory calibration

VoltShort1DLp

Mandatory entry

Defines the upper limit of the voltage drop over short relay path.

Default value: Value from factory calibration

VoltShort1DLn

Mandatory entry

Defines the lower limit of the voltage drop over short relay path.

Default value: Value from factory calibration

VoltShort2Nom

Mandatory entry for R&S TS-PSM3 modules with MI > 1.1

Defines the nominal value of the voltage drop over short relay path.

Default value: Value from factory calibration

VoltShort2DLp

Mandatory entry for R&S TS-PSM3 modules with MI > 1.1

Defines the upper limit of the voltage drop over short relay path.

Default value: Value from factory calibration

VoltShort2DLn

Mandatory entry for R&S TS-PSM3 modules with MI > 1.1

Defines the lower limit of the voltage drop over short relay path.

Default value: Value from factory calibration

VoltRes1Nom

Mandatory entry

Defines the nominal value of the voltage drop over external reference resistor for 5 A.

Default value: Value from factory calibration

VoltRes1DLp

Mandatory entry

Defines the upper limit of the voltage drop over external reference resistor for 5 A.

Default value: Value from factory calibration

VoltRes1DLn

Mandatory entry

Defines the lower limit of the voltage drop over external reference resistor for 5 A.

Default value: Value from factory calibration

VoltRes2Nom

Mandatory entry

Defines the nominal value of the voltage drop over external reference resistor for 10 A.

Default value: Value from factory calibration

VoltRes2DLp

Mandatory entry

Defines the upper limit of the voltage drop over external reference resistor for 10 A.

Default value: Value from factory calibration

VoltRes2DLn

Mandatory entry

Defines the lower limit of the voltage drop over external reference resistor for 10 A.

Default value: Value from factory calibration

VoltRes3Nom

Mandatory entry

Defines the nominal value of the voltage drop over external reference resistor for 15 A.

Default value: Value from factory calibration

VoltRes3DLp

Mandatory entry

Defines the upper limit of the voltage drop over external reference resistor for 15 A.

Default value: Value from factory calibration

VoltRes3DLn

Mandatory entry

Defines the lower limit of the voltage drop over external reference resistor for 15 A.

Default value: Value from factory calibration

VoltRes4Nom

Mandatory entry

Defines the nominal value of the voltage drop over external reference resistor for 30 A (R&S TS-PSM5: 50 A).

Default value: Value from factory calibration

VoltRes4DLp
Mandatory entry

Defines the upper limit of the voltage drop over external reference resistor for 30 A (R&S TS-PSM5: 50 A).

Default value: Value from factory calibration

VoltRes4DLn
Mandatory entry

Defines the lower limit of the voltage drop over external reference resistor for 30 A (R&S TS-PSM5: 50 A).

Default value: Value from factory calibration

VoltIvOffNom
Mandatory entry

Defines the nominal value of the voltage from current-voltage converter for 0 A.

Default value: Value from factory calibration

VoltIvOffDLp
Mandatory entry

Defines the upper limit of the voltage from current-voltage converter for 0 A.

Default value: Value from factory calibration

VoltIvOffDLn
Mandatory entry

Defines the lower limit of the voltage from current-voltage converter for 0 A.

Default value: Value from factory calibration

VoltIvPos1Nom
Mandatory entry

Defines the nominal value for positive direction measurements of the voltage from current-voltage converter for 5 A.

Default value: Value from factory calibration

VoltIvPos1DLp
Mandatory entry

Defines the upper limit for positive direction measurements of the voltage from current-voltage converter for 5 A.

Default value: Value from factory calibration

VoltIvPos1DLn
Mandatory entry

Defines the lower limit for positive direction measurements of the voltage from current-voltage converter for 5 A.

Default value: Value from factory calibration

VoltIvNeg1Nom
Mandatory entry

Defines the nominal value for negative direction measurements of the voltage from current-voltage converter for 5 A.

Default value: Value from factory calibration

VoltIvNeg1DLp
Mandatory entry

Defines the upper limit for negative direction measurements of the voltage from current-voltage converter for 5 A.

Default value: Value from factory calibration

VoltIvNeg1DLn
Mandatory entry

Defines the lower limit for negative direction measurements of the voltage from current-voltage converter for 5 A.

Default value: Value from factory calibration

VoltIvPos2Nom
Mandatory entry

Defines the nominal value for positive direction measurements of the voltage from current-voltage converter for 10 A.

Default value: Value from factory calibration

VoltIvPos2DLp
Mandatory entry

Defines the upper limit for positive direction measurements of the voltage from current-voltage converter for 10 A.

Default value: Value from factory calibration

VoltIvPos2DLn
Mandatory entry

Defines the lower limit for positive direction measurements of the voltage from current-voltage converter for 10 A.

Default value: Value from factory calibration

VoltIvNeg2Nom
Mandatory entry

Defines the nominal value for negative direction measurements of the voltage from current-voltage converter for 10 A.

Default value: Value from factory calibration

VoltIvNeg2DLp
Mandatory entry

Defines the upper limit for negative direction measurements of the voltage from current-voltage converter for 10 A.

Default value: Value from factory calibration

VoltIvNeg2DLn
Mandatory entry

Defines the lower limit for negative direction measurements of the voltage from current-voltage converter for 10 A.

Default value: Value from factory calibration

VoltIvPos3Nom
Mandatory entry

Defines the nominal value for positive direction measurements of the voltage from current-voltage converter for 30 A (R&S TS-PSM5: 50 A).

Default value: Value from factory calibration

VoltIvPos3DLp
Mandatory entry

Defines the upper limit for positive direction measurements of the voltage from current-voltage converter for 30 A (R&S TS-PSM5: 50 A).

Default value: Value from factory calibration

VoltIvPos3DLn
Mandatory entry

Defines the lower limit for positive direction measurements of the voltage from current-voltage converter for 30 A (R&S TS-PSM5: 50 A).

Default value: Value from factory calibration

VoltIvNeg3Nom
Mandatory entry

Defines the nominal value for negative direction measurements of the voltage from current-voltage converter for 30 A (R&S TS-PSM5: 50 A).

Default value: Value from factory calibration

VoltIvNeg3DLp
Mandatory entry

Defines the upper limit for negative direction measurements of the voltage from current-voltage converter for 30 A (R&S TS-PSM5: 50 A).

Default value: Value from factory calibration

VoltIvNeg3DLn
Mandatory entry

Defines the lower limit for negative direction measurements of the voltage from current-voltage converter for 30 A (R&S TS-PSM5: 50 A).

Default value: Value from factory calibration