R&S®TS-PAM
Analyzer Module
User Manual

1152380812
Version 12

ROHDE&SCHWARZ
Make ideas real

This manual describes the following R&S®TSVP module:

- R&S®TS-PAM

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1152.3808.12 | Version 12 | R&S®TS-PAM

The following abbreviations are used throughout this manual: R&S®TS-PAM is abbreviated as R&S TS-PAM.

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.

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۔

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.

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 R&S CompactTSVP and 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-PAM

This manual describes the function and operation of the Analyzer Module R&S TS-PAM for use in PXI based R&S TSVP base units. The hardware is designed as a PXI module which occupies one slot on the front panel of the R&S TSVP. The accompanying rear I/O module R&S TS-PDC (DC/DC converter module) is plugged into the same slot on the rear side.

The following analyses are possible using the Analyzer Module R&S TS-PAM and the Signal Analysis Library:

- Voltage and voltage changes with different qualifications
- Time measurements
- Events
- Wave-form comparison

The wave form analyzer is able to record electrical signals on two measuring paths (channels) at a high sampling rate of 20 MHz or on up to eight measuring paths (channels) in the „Scan“operation (quasi simultaneous) at a the low sampling rate of 5 MHz. The signals can be evaluated after acquisition with respect to parameters such as voltage, time, frequency, events. The measurement options can, in many cases, replace a digital voltmeter (DVM), a timer/counter or a digital oscilloscope. The Analyzer Module R&S TS-PAM covers the application range above a fast sampling voltmeter (e.g. R&S TS-PSAM or data acquisition module with scanner).

A wide range of trigger options for acquisition of the correct measuring interval and automatic analysis options in the actual production environment, where no optical evaluation of the signals can take place, ensure the reproducibility of the measurements.

Features of the R&S TS-PAM

- Two fully independent, floating acquisition units with working voltage up to 120 VDC
- Acquisition modes with up to 8 single-ended or 4 differential channels
- High sampling rate 20 MSamples/s for two channels
- Multi channel signal recording for up to 8 channels at 5 MSamples/s
- Synchronous acquisition of 8 programable comparator signals and PXI-trigger additionally
- Wide dynamic range with 14 bit resolution
- Input ranges ±0.2 VDC up to ±100 VDC
- 3:1 relay multiplexer per channel
- 2 x 1 MSamples memory depth
- Analog and digital trigger signals
- Analog measurement bus access to 8 bus lines
- Selftest capabilities
- Soft front panel support for direct operation
- LabWindows/CVI driver support
- R&S GTSL test software library in DLL format

Features of the R&S TS-PDC module

The Rear I/O Module R&S TS-PDC is used as a floating DC voltage source for the Analyzer Module R&S TS-PAM . It contains two identical DC/DC converters. The following floating voltages are obtained from an input voltage of 5 VDC:

- +15 VDC ±5 %, 0,5 A (2x)
- -15 VDC ±5 %, 0,5 A (2x)
- +5 VDC ±5 %, 0,5 A (2x)
- +3,3 VDC ±5 %, 0,25 A (2x)

4 Module tour

4.1 R&S TS-PAM

The analyzer module R&S TS-PAM is designed as a long plug-in module for mounting in the front of PXI based base units.

Figure 4-1: Overview of connectors and LEDs on the module R&S TS-PAM

LEDs = Chapter 4.1.1, "Status LEDs", on page 13
X1 = Chapter 4.1.2, "Connectors X1 and X20", on page 13
X10 = Chapter 4.1.3, "Connector X10", on page 14
X20 = Chapter 4.1.2, "Connectors X1 and X20", on page 13
X30 = Chapter 4.1.4, "Connector X30", on page 14

4.1.1 Status LEDs

The LEDs on the front indicate the current status of the module.

- "PWR" (green LED)
  Indicates that all necessary supply voltages are present.
- "COM" (yellow LED)
  Indicates data exchange via the interface.
- "ERR" (red LED)
  Indicates an error condition if illuminated.

4.1.2 Connectors X1 and X20

Type: PXI bus

Interface to connect the module to the backplane of PXI based base units.

See Chapter C.1.1, "Connector X1", on page 41 and Chapter C.1.2, "Connector X20", on page 42 for a detailed description of the connectors.

4.1.3 Connector X10

Interface to connect test objects and UUTs to the module.

See Chapter C.1.3, "Connector X10", on page 42 for a detailed description of the connector.

4.1.4 Connector X30

Type: Analog bus

Interface to connect the module to the analog bus backplane.

See Chapter C.1.4, "Connector X30", on page 44 for a detailed description of the connector.

4.2 R&S TS-PDC

The R&S TS-PDC is a rear panel I/O module that you must connect with the R&S TS-PAM in a PXI based base unit.

The module R&S TS-PDC exists in 3 different models:

- Grouted in a black housing - version up to 1.8 (1157.9804.02 obsolete)
- Encapsulated in metal housing with cooling fins - version 1.9 (1157.9804.02 obsolete)
- Without case - version from 2.0 (1157.9804.12 current version)

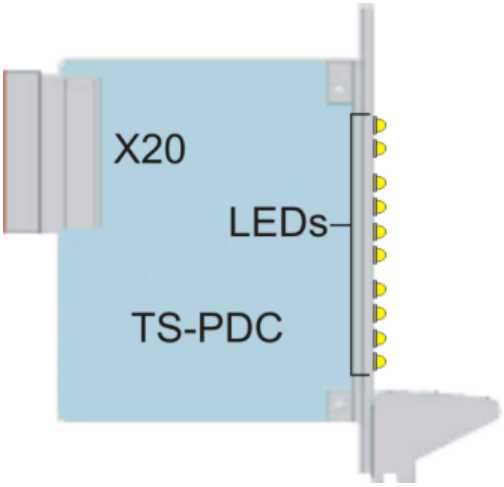

Figure 4-2: Overview of the connector and LEDs on the R&S TS-PDC module

LEDs = Chapter 4.2.1, "Status LEDs", on page 15
X20 = Chapter 4.2.2, "Connector X20", on page 16

4.2.1 Status LEDs

The meaning of the status LEDs depend on the module version.

Module version < 2.0 (1157.9804.02)

Eight green LEDs indicate the status of the module. Each LED indicates the presence of an output voltage.

In fault free operation all 8 LEDs must light up simultaneously.

Module version ≥ 2.0 (1157.9804.12)

Ten LEDs indicate the status of the module. The LEDs have the following meaning.

- "PWR" (green color)
  Indicates that the module is on and running.
- "ERR" (orange color)
  Indicates that the module has shut down because of an overload or a temperature that is too high.
- "<xx> V" (eight LEDs in green color)
  Indicate the presence of an output voltage.
  In fault free operation all 8 voltage LEDs must light up simultaneously.

Figure 4-3: LEDs on the R&S TS-PDC module from Version 2.0

4.2.2 Connector X20

Interface to connect the R&S TS-PDC to the backplane in the PXI based base unit.

See Chapter C.2, "R&S TS-PDC", on page 45 for a detailed description of the connector.

5 Installing the module

The R&S TS-PAM is a module installed on the front panel of PXI based base units. It requires an R&S TS-PDC rear I/O supply module.

1. Install the R&S TS-PAM front module as described in the user manuals for the base units.
2. Install the R&S TS-PDC supply module in the matching rear I/O slot as described in the user manuals for the base unit.
3. **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 R&S CompactTSVP and R&S PowerTSVP. 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.

6 Functions

6.1 R&S TS-PAM

The analyzer module R&S TS-PAM is a signal analyzer similar to a multi-channel digital storage oscilloscope (DSO). It has two acquisition units, which can be operated separately or synchronized. Thus, the R&S TS-PAM functions as two separate digital oscilloscopes or as a digital oscilloscope with twice the number of channels. The two acquisition units are separated according to control/software as well as potential. Because each path is floating, each path can be connected to a different potential and measured there with high accuracy of measurement. Naturally the paths can also be grounded, as with digital oscilloscopes.

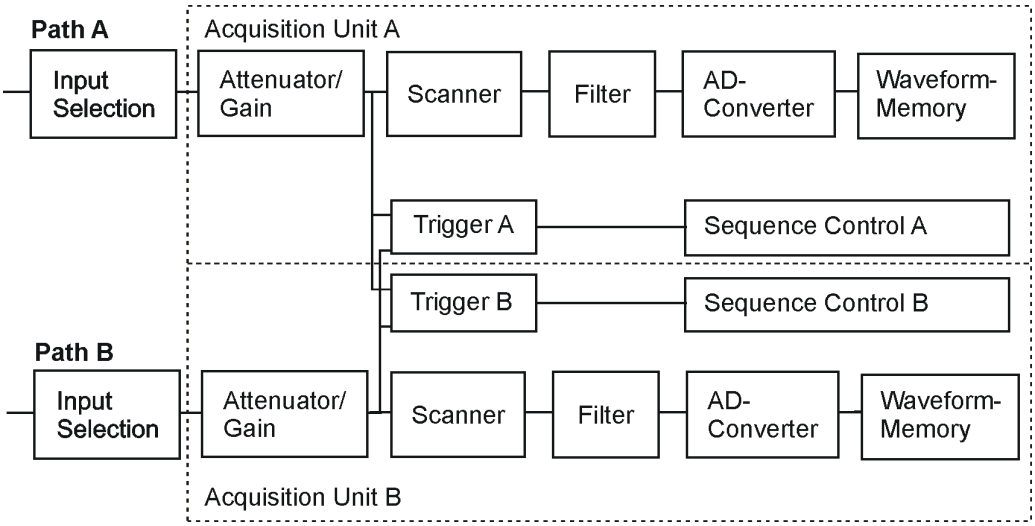

Figure 6-1: Functional blocks of R&S TS-PAM

6.1.1 Acquisition unit

Each acquisition unit has four channels with individually adjustable gain.

In single-channel mode, two channels or one channel and the floating reference potential can be statically selected. The A/D converter measures the difference signal with maximum sample rate. With two acquisition units, two signals with conversion rates up to 20 MHz can be recorded, which corresponds to a sampling period of 50 ns.

In multi-channel mode, two to four signals of a path can be quasi-simultaneously acquired. The channels are scanned and recorded with time offset. At the maximum sampling frequency of 20 MHz, the effective sampling frequency for four aquisition channels is 5 MHz, the interval delta time (offset) is 50 ns. You can select whether the difference between individual channels or the difference of the channels against the floating reference potential is to be measured. With two acquisition units, a total of eight channels can be simultaneously recorded.

Because in most cases, the floating potentials can serve as a reference or even be measured single-ended against GND, all eight channels can be used and there is seldom need to take the difference between two channels. The reference potential of a path is connected to GND or different reference potential of the unit under test. With particularly sensitive units under test, it is possible that the test signal may be distorted if the reference potential of a path is connected directly to the unit under test (cause: The reference potential has a higher capacitance and higher leakage current to GND compared to an input). This can be avoided by using two channels of a unit and measuring fully differential with two high-impedance inputs.

In the standby state after software initialization, each acquisition unit is connected to GND through a relay and a resistor, for reasons of signal technology. During floating operation, this relay is automatically opened when a connection is made to a front connector pin or to the analog bus. During grounded operation, when the GND relay remains closed, care must be taken that the relay and resistor are not overloaded.

Depending on the version of the R&S TS-PAM module, different protective resistors are installed:

- R&S TS-PAM 1143.0100.02 | 50 Ohm | (obsolete Version)
- R&S TS-PAM 1157.9410.02 | 400 Ohm

6.1.2 Inputs and measurement ranges

Each measuring channel can be switched with relays to three input channels, to four lines of the local analog bus LABxy, to the reference potential CHA_LO or CHB_LO or to the analog output for the trigger threshold of the comparator. If the local analog bus line is used as an additional input, 4 x 8 = 32 pins on the connector X10 can be measured without having to use a relay in the adapter or an additional plug-in card.

If the local analog bus LAB is connected with the global analog bus AB, up to eight channels can be simultaneously measured and there is access to an almost unlimited number of measuring points (90 channels per plug-in module R&S TS-PMB). Here too, single-ended and differential measurements are possible.

Each measuring channel has a programmable input divider and measurement amplifier. With nine measurement ranges from 0.2 V to 100 V, small to high voltages can be optimally acquired with 14 bit resolution. In the small measurement ranges, instead of the normal input impedance of 1 MΩ, higher impedances can be measured. Because the floating measuring technique is used, the measuring accuracy of the small ranges is also possible for small signals on high potential.

The maximum permitted rated voltage between arbitrary pins is 120 V.

Table 6-1: Measurement ranges

Measurement range	Resolution	Input impedance
± 100 V	15 mV	1 MΩ
± 50 V	7.5 mV	1 MΩ
± 20 V	3 mV	1 MΩ
± 10 V	1.5 mV	1 MΩ

Measurement range	Resolution	Input impedance
± 5 V	0.75 mV	1 MΩ or >10 MΩ selectable
± 2 V	0.3 mV	1 MΩ or >10 MΩ selectable
± 1 V	0.15 mV	1 MΩ or >10 MΩ selectable
± 0.5 V	75 µV	1 MΩ or >10 MΩ selectable
± 0.2 V	30 µV	1 MΩ or >10 MΩ selectable

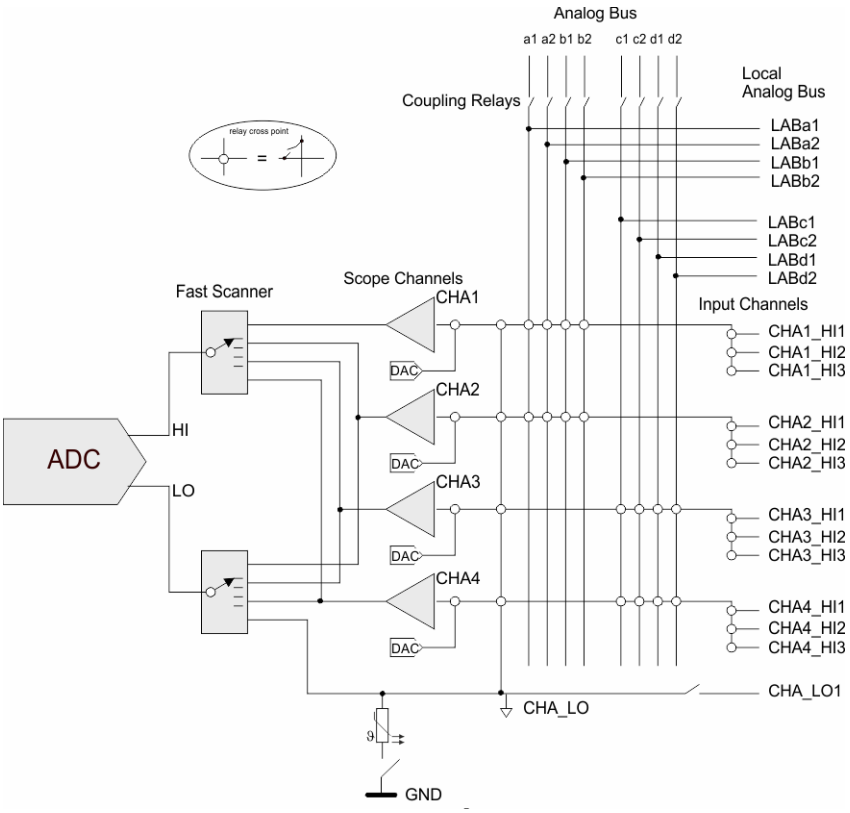

Figure 6-2: Signal inputs and scanner of an acquisition unit (path A)

Signals can be recorded within the input bandwidth. Similarly to digital oscilloscopes, no anti-aliasing filter is provided. For signal conditioning, hardware low pass filters can be connected in series.

The inputs are DC coupled. An AC coupling can be done by connecting an external capacitor in series. The time constant is optimized by the appropriate selection of R and C on the measuring frequency and the desired transient time.

Four programmable analog sources (DAC) per acquisition unit set the trigger threshold of the comparators of each channel and can be connected as a control voltage source for the self-test to the analog bus. The programming is according to the value of the trigger threshold and the set measurement range.

Figure 6-3 shows a number of typical permissible voltage configurations between the analog buses and ground.

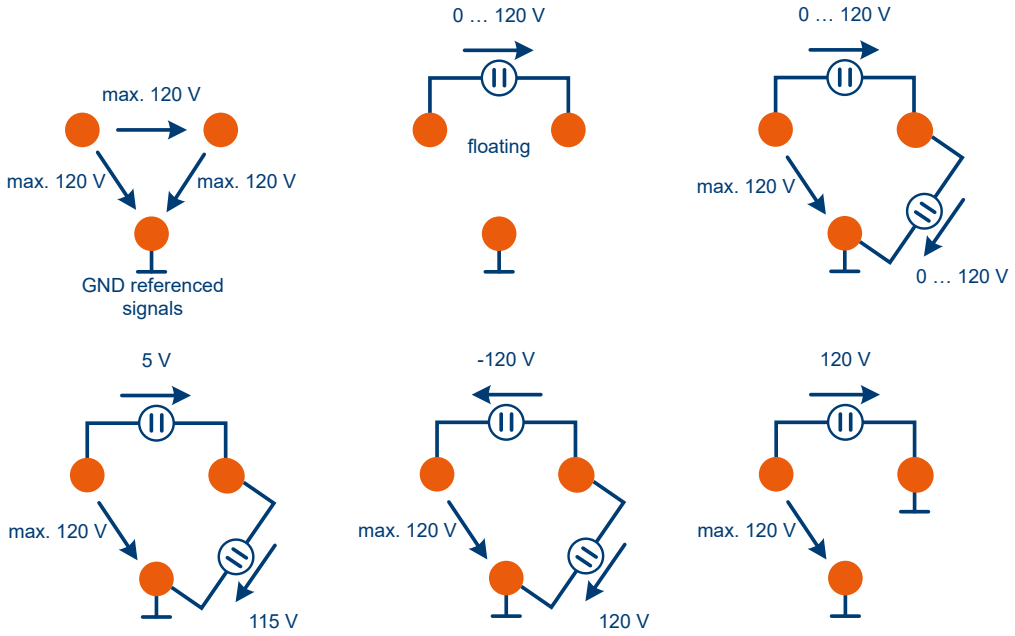

Figure 6-3: Permissible voltages on analog bus lines

6.1.3 Timing control, scanner

The sampling rate can be varied so that slow or fast signals are optimally acquired and stored in the wave form memory. Because the timing of each acquisition unit can be independently set, slow and fast signals can be simultaneously optimally acquired, which results in a considerably better use of the wave form memory and effectively increases its depth.

Depending on whether the single-channel or multi-channel operating mode is used, the sampling rate can be max. 20 MHz or 5 MHz.

The precise time reference is derived from the 10 MHz PXI clock of the Test System Versatile Platform R&S CompactTSVP.

6.1.4 Synchronization, trigger

Each acquisition unit can be started through the software, through the test signals, external trigger inputs or PXI trigger inputs (from other modules). For triggering through the test signals, analog comparators with programmable threshold and selectable flanks are used.

Trigger output signals can trigger other modules on the front connector X10 or on the PXI trigger bus. Through the pins XTO1 and XTO2, the trigger time points of both acquisition units or the eight analog trigger signals can be fed out. These signals can also be fed to the eight PXI trigger lines.

The acquisition units can begin the recording synchronously, independently or initiated by the other acquisition unit. The storage in the wave form memory can be done pre- or post-trigger.

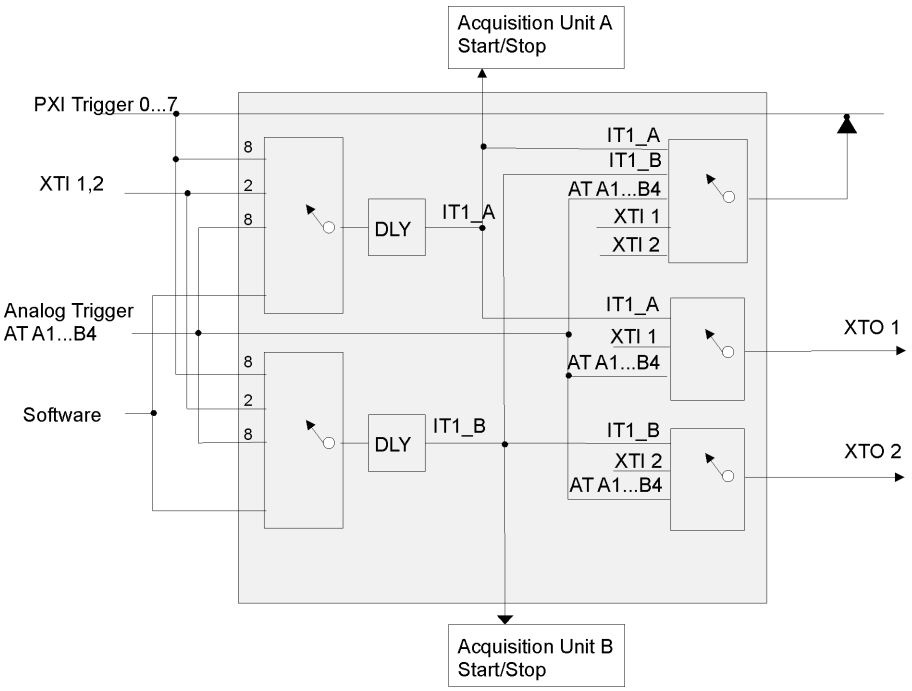

Figure 6-4: Trigger unit

6.1.5 Memory

The wave form memory contains 1 MSamples (of 32 Bit width) per acquisition unit. This means that in the single-channel mode, two channels (each acquisition unit) can record a maximum of 1 MSamples each. In the multi-channel mode, eight channels up to a depth of 256 ksamples each can be measured. In addition to the analog values, the trigger information from the PXI-Bus and the analog comparators is also recorded.

6.1.6 Signal processing, filter

The measuring channels are broadband and have, like digital oscilloscopes, no specific anti-aliasing filters. For noise suppression, a 100 kHz or 400 Hz filter can be connected in the path. It has to be observed that the filters are arranged behind the measuring scanner. The filters only function correctly if the filter cut-off frequency is distinctly higher than the scan frequency. Otherwise, a distortion of the measurement value can occur up to an identical test signal of all channels.

An additional filtering can be obtained with the digital filter (low pass filter with cut-off frequency 0.2 x sampling frequency).

Additional special filter features can be implemented with software by processing of the waveform arrays with commercially available programs.

6.1.7 Analog bus access

Each input channel has direct access to four local analog bus lines and through coupling relays to the global analog bus. Thus, a total of eight channels can be simultaneously connected to the analog bus. Instead of an input channel, the floating reference potential CHA_LO or CHB_LO can be switched to the analog bus. In this way, the measuring channels can measure signals from other switch modules, and signals to the connector X10 can also be connected to other measuring modules.

When there is signal feed through the analog bus and other cards, it must be noted that the best signal quality is obtained only for short signal paths. Signals to the connector X10 can therefore be best measured.

6.1.8 Measuring functions

The acquisition units can record analog signals and at the same time digital trigger signals within a given time. An analysis of the wave forms can be done with the Signal Analysis Library (see Chapter 7.3, "Signal analysis library", on page 29).

6.1.9 Particulars of floating measurements

To make optimum use of the possibilities of floating measurement of R&S TS-PAM, it is important to look at the grounding. The unit under test or the measuring instrument must be grounded in order to obtain reproducible, stable measuring results. Only with very slow measuring techniques (battery operated hand multimeters) the hum can be equalized by decelerating averaging. For fast and accurate measurements, one must give some thought to the grounding. It is important here to only provide a single grounding point. See examples Figure 6-5 to Figure 6-9.

- **Simple single-ended grounding**

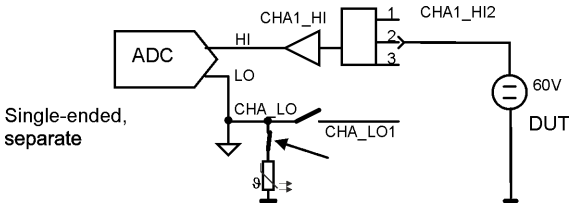

Figure 6-5: Grounding procedure “simple single-ended grounding”

In the simplest case (Figure 6-5) with low accuracy requirements, grounding is done “somewhere”, i.e. the unit under test is grounded in the fixture, the measuring unit is internally connected to GND.
Advantage: Only the test signals are considered; the grounding is connected in some way. The connection becomes very simple. If the signals are fed through the analog bus, you save one bus line for the GND.
Disadvantage: Low accuracy, particularly for signals in the magnitude of 100 mV and lower.
When there is a small difference in the grounding potentials, transient currents flow which distort the measurement. The LO input of the measurement unit does not

feature a low resistance at random but is connected to ground via a PTC resistor and a relay contact; disturbance may be caused by leakage currents. In addition, this type of wiring bears the risk of inadvertently applying a voltage with ground reference to CHA_LO. In this case, a high current may flow that destroys the relay contacts. Despite the installed PTC resistor you should ensure that neither the max. current of the relay of 500 mA nor the switching capacity of 15 W is exceeded.
This measurement method is used for digital oscilloscopes and non-differential A/D converter cards. There is no option to separate the acquisition unit from GND for these devices.

- **Single-ended, grounding on the unit under test**

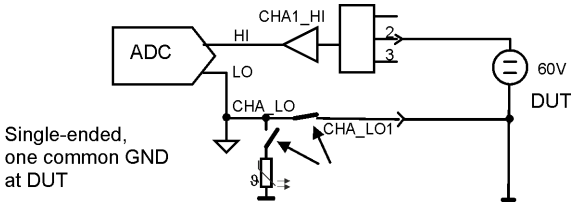

Figure 6-6: Grounding procedure "single-ended, grounding on unit under test"

With this wiring (Figure 6-6), the floating character of the acquisition unit of R&S TS-PAM is used to ground only on the low-resistance ground point of the unit under test (grounding only on one point).
Advantage: Accurate measurements even at low voltages, no ground loops or potential differences, because there is only a single ground point.
Disadvantage: The CHA_LO must be specifically connected with relays and wired in the fixture. When there is signal feed through the analog bus, an additional bus line is necessary.

- **Floating with potential as reference**

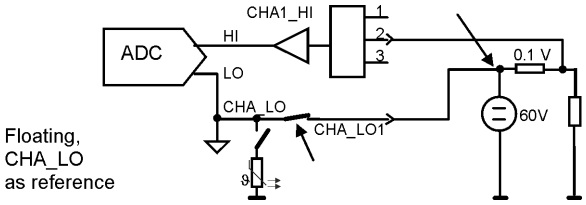

Figure 6-7: Grounding procedure "floating with potential as reference"

With this wiring, (Figure 6-7) the measuring unit can be operated on a deviating, higher potential (instead of being grounded).
Advantage: Despite a voltage of 60 V e.g. , the smallest ranges and not the 100 V range can be used to measure the current. The common mode suppression is nearly ideal using the floating measuring technique.
Disadvantage: The „cold" connection CHA_LO is not exactly equal to the „hot" signal connection (CHA1_HI2). The LO connection has a greater capacity (to the order of 1 nF) to ground and exhibits greater leak currents between LO and GND. In most cases this capacity can change the signal on the unit under test. Therefore LO must be applied to a low resistant point of the unit under test. In the example of the current measurement by the voltage drop at a resistor, this is the side facing the source.

Digital oscilloscopes and non-differential A/D converter cards must use two channels for this. Otherwise, they can only measure in the inaccurate large measurement ranges (60 V). Even differential A/D converter cards must use the large measurement ranges and lose accuracy.

- **Differential measurement with two channels**

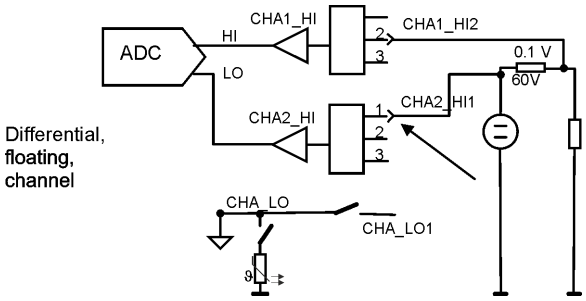

Figure 6-8: Grounding procedure "differential measurement with two channels"

Similarly to Figure 6-7, with this wiring (Figure 6-8), measurement can be done on a different potential. However, a high-resistance separate channel with low capacitance is used as reference.
For reproducible measurements the input ranges with 1 MΩ input resistance must be used. This reistance must be selected specifically in the small measuring ranges.
Reason: Since the acquisition unit is operated here without direct reference potential, leak currents of the operational amplifier cannot otherwise flow to the reference potential CHA_LO.
Advantage: The high-resistance input from CHA2_HI1 distorts the signal on the unit under test very little. Measurement can be done in the more accurate small measurement ranges.
Disadvantage: An additional channel is necessary.

- **Differential measurement at high reference potential**

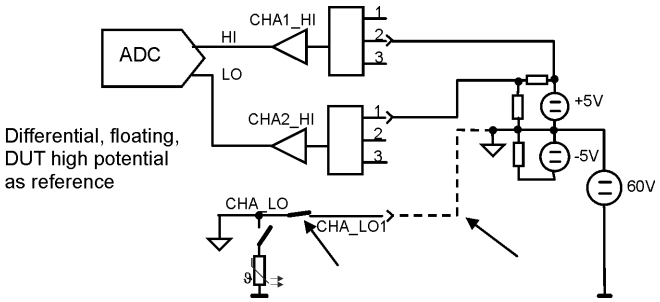

Figure 6-9: Grounding procedure "differential measurement at high reference potential"

The wiring as in Figure 6-9 is optimally suited when a unit under test has a larger portion of the circuit at a higher reference potential than the other grounded circuit. The reference potential of the acquisition unit is connected to the reference potential of unit under test (60 V in the example, broken line).
Advantage: All measurements can be carried out in the small, more accurate measurement ranges. Single-ended measurements against the reference potential or differential measurements between various signals of the high potential can be carried out. Fewer analog bus lines are necessary.

Disadvantage: It must be noted which signals belong to the high reference potential and a line for this provided. There is danger of a short circuit between GND and high reference potential.
It must be ensured that one does not inadvertantly close the GND relay and thus cause a short circuit.

6.1.10 Power supply

The digital portion of the Analyzer Module R&S TS-PAM is supplied with power of +5 V and +3.3 V of the CompactPCI Bus. The two floating measuring portions are each supplied with a set of floating voltages, +5 V, +3.3 V, +15 V, -15 V from the rear I/O module R&S TS-PDC (DC/DC converter). The associated capacity is taken from the 5 V CompactPCI supply.

6.2 R&S TS-PDC

The Rear I/O Module R&S TS-PDC is configured as a primary switched DC/DC converter. The input voltage (5 VDC) is transfered to two secondary potentials and rectified to the nominal voltage by line controllers. The status of the output voltage is displayed in each case by an LED.

The following DC voltages are generated:

- +15 VDC, 0,5 A (2x)
- -15 VDC, 0,5 A (2x)
- +5 VDC, 0,5 A (2x)
- +3,3 VDC, 0,25 A (2x)

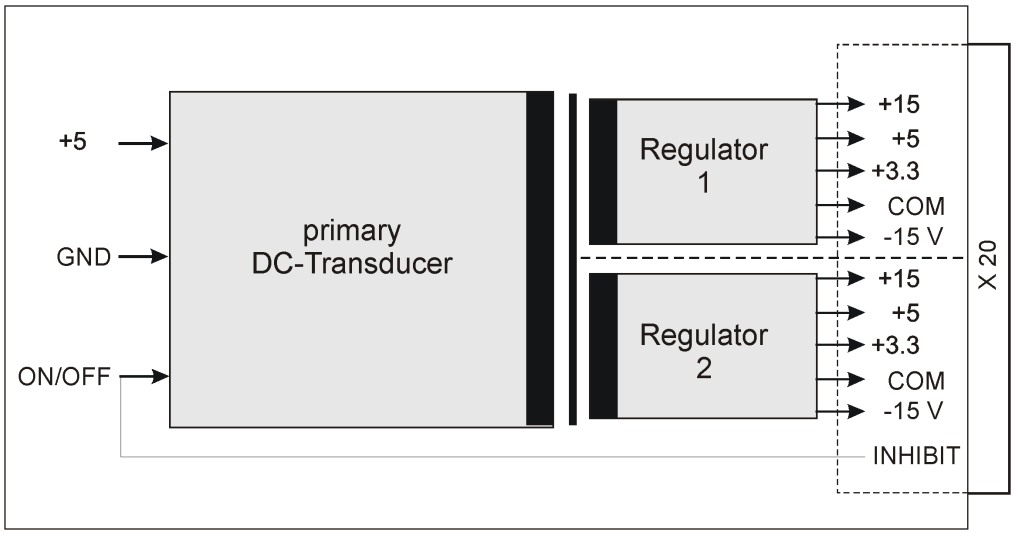

Figure 6-10: Block schematic diagram of Rear I/O Module R&S TS-PDC

7 Software

7.1 Driver software

For signal recording with the Analyzer Module R&S TS-PAM , a LabWindows IVI SCOPE driver is available. All other functions of the hardware are served by specific extensions of the driver. The driver is a component of the ROHDE & SCHWARZ GTSL software. All functions of the driver are fully documented in the online help and in the LabWindows/CVI Function Panels.

During driver installation, the following software modules are installed:

Table 7-1: Driver installation R&S TS-PAM

Module	Path	Comment
rspam.dll	<GTSL directory>\Bin	Driver
rspam.chm	<GTSL directory>\Bin	Help files
rspam.fp	<GTSL directory>\Bin	LabWindows CVI Function Panel file, function panels for CVI development interface
rspam.sub	<GTSL directory>\Bin	LabWindows CVI attribute file. This file is required by some „function panels“.
rspam.lib	<GTSL directory>\Bin	Import Library
rspam.h	<GTSL directory>\ Include	Header file for the driver

To use the driver, the IVI and VISA libraries from National Instruments are necessary.

7.2 Soft panel

For the Analyzer Module R&S TS-PAM, there is a Soft Panel available (Figure 7-1). The Soft Panel is based on the LabWindows CVI driver. The Software Panel enables interactive operation of the module. The measured values are displayed graphically.

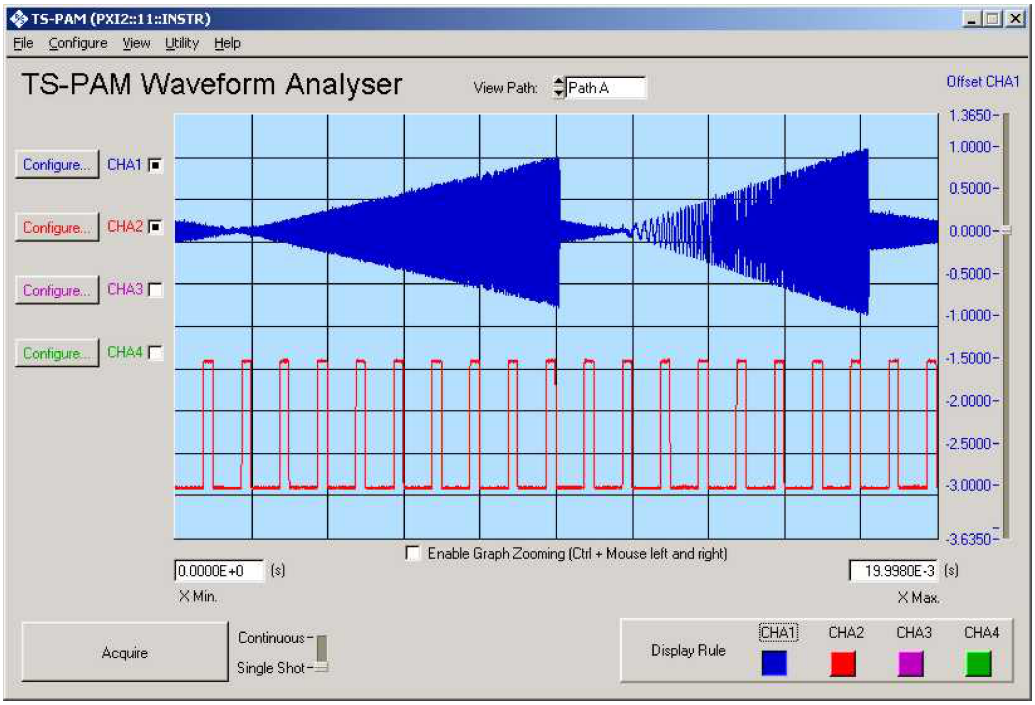

Figure 7-1: Soft Panel R&S TS-PAM

The switching of the signal path of R&S TS-PAM can be done through the Soft Panel (Figure 7-2).

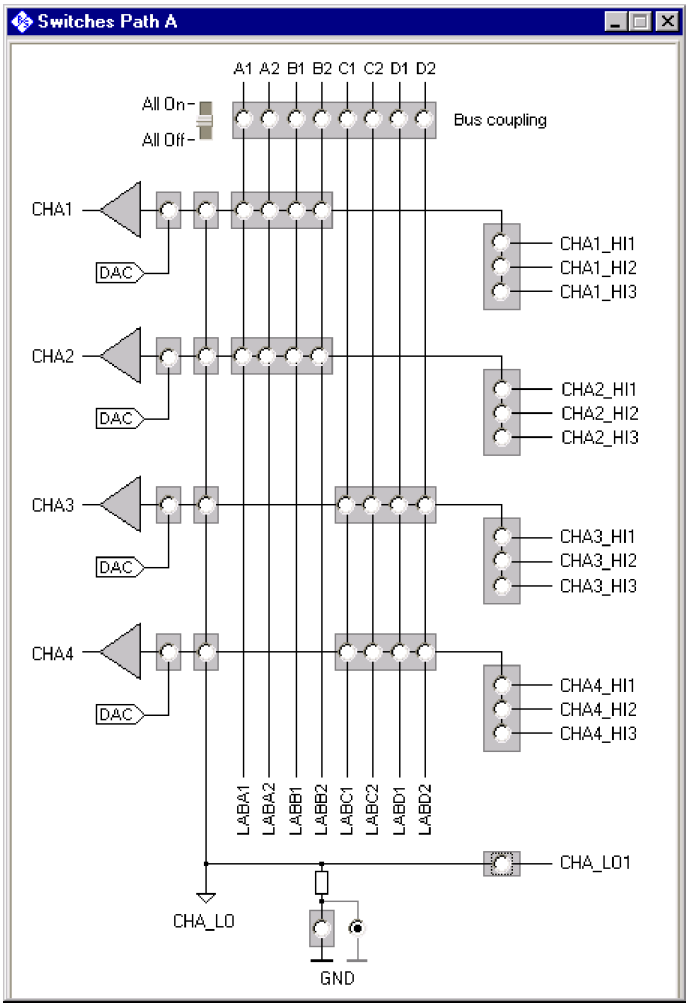

Figure 7-2: Soft Panel R&S TS-PAM switching

7.3 Signal analysis library

The Signal Analysis Library offers functions for the analysis of the signals recorded by the Analyzer Module R&S TS-PAM . The following signal parameters can be determined:

- Frequency, period
- Average value, RMS
- Rise and fall times
- Pulse width
- Maximum and minimum values (absolute and relative maxima/minima
- Event counting (slopes, minima, maxima)
- Time measurement between two events

In addition, the Signal Analysis Library offers the following functions:

- Wave form comparison
- Calculation of reference wave forms
- LLoading and saving of the wave forms as files
- Display of signal waves with reference curves and markers

Table 7-2: Installation of the signal analysis library

Module	Pfad	Comment
siganl.dll	<GTSL directory>\Bin	Driver
siganl.hlp / siganl.chm	<GTSL directory>\Bin	Help files
siganl.fp	<GTSL directory>\Bin	LabWindows CVI Function Panel file, function panels for CVI development interface
siganl.lib	<GTSL directory>\Bin	Import Library
rspam.h	<GTSL directory>\Include	Header file for the driver

The analysis of audio signals is possible with the Audio Analysis Library R&S TS-LAA. This library offers the following functions:

- RMS calculation
- Single/Multitone frequency response
- Distortion factor
- Filter (low-pass, high-pass, band-pass, band-stop, CCIR weighted/unweighted)
- Windowing of the signal

7.4 Programming example

The following sample program shows the recording of a signal which contacts the connections CHA1_HI1 and CHA_LO1 on the front side connector.

```
/*
  This sample shows the acquisition of analog waveforms
  using the TS-PAM module.
  Error handling is not considered in this sample in order to
  keep it easy to read. The return status should be checked for
  VI_SUCCESS after each driver call.
*/

#include <ansi_c.h>
#include <userint.h>

#include "rspam.h"

int main (int argc, char *argv[])
```

```
{
  ViSession vi;
  ViStatus status;

  ViReal64 * pWaveform = VI_NULL; /* pointer to waveform array */
  ViInt32  actualPoints;          /* number of samples returned from */
  ViReal64 initialX;              /* time of the first sample, relative
                                     to the trigger event */
  ViReal64 xIncrement;            /* time between two samples */

/*
  Open a session to the device driver. The resource descriptor
  depends on the slot number of the TS-PAM module and must be
  adapted to the target system.
*/
status = rspam_InitWithOptions ( "PXI1::13::0::INSTR",
                                 VI_TRUE,
                                 VI_TRUE,
                                 "Simulate=0,RangeCheck=1",
                                 &vi);

/*
  Configure the acquisition time base for path A:
  Take a minimum of 20000 samples in 1 ms
  - Sample frequency is 20 MHz
  - Trigger delay = 0, i.e. no pre- or post-triggering
*/
status = rspam_ConfigureAcquisitionRecordPath (vi, RSPAM_VAL_PATH_A,
                                               1.0e-3, 20000, 0.0);

/*
  Configure channel CHA1 for a signal between -5 V and + 5 V.
  The vertical range is 10 V (peak-to-peak), the offset is 0 V.
*/
status = rspam_ConfigureChannel (vi, "CHA1", 10.0, 0.0,
                                 RSPAM_VAL_DC, 1.0, VI_TRUE);

/*
  Configure channel CHA1 for 1 MOhm impedance, no lowpass filter
*/
status = rspam_ConfigureChanCharacteristics (vi, "CHA1", 1.0e6, 20.0e6);

/*
  Configure the trigger:
  - Edge trigger
  - Trigger level 2.5 V, positive slope
*/
status = rspam_ConfigureTriggerPath (vi ,RSPAM_VAL_PATH_A,
                                     RSPAM_VAL_EDGE_TRIGGER );
```

```
status = rspam_ConfigureTriggerSourcePath (vi, RSPAM_VAL_PATH_A,
                                           "CHA1", 2.5,
                                           RSPAM_VAL_POSITIVE);

/*
  Configure the path for floating acquisition
*/
status = rspam_ConfigureGroundPath (vi, RSPAM_VAL_PATH_A, VI_FALSE);

/*
  Connect the instrument to the front connector
  and wait until all relays have been closed
*/
status = rspam_Connect (vi, "CHA1_HI", "CHA1_HI1");
status = rspam_Connect (vi, "CHA_LO", "CHA_LO1");
status = rspam_WaitForDebounce ( vi, 1000 );

/*
  Get the actual number of points for the acquisition and allocate
  memory for it. Note that this value may be greater than the minimum
  number of samples requested above.
*/
status = rspam_ActualRecordLengthPath (vi, RSPAM_VAL_PATH_A,
                                       &actualPoints);
pWaveform = calloc (actualPoints, sizeof(ViReal64));

/*
  Start the acquisition
  - Timeout is 1000 ms
*/
status = rspam_ReadWaveform (vi, "CHA1", actualPoints, 1000,
                             pWaveform, &actualPoints, &initialX,
                             &xIncrement);

/*
  Display the waveform
*/
status = WaveformGraphPopup ("Waveform", pWaveform, actualPoints,
                             VAL_DOUBLE, 1.0, 0.0, initialX,
                             xIncrement);

/*
  Close the driver session
*/
status = rspam_close ( vi );

/*
  free memory
*/
free ( pWaveform );
```

```
return 0;
}
```

8 Maintenance, storage and disposal

8.1 Storage

Protect the product against dust. Ensure that the environmental conditions, e.g. temperature range and climatic load, meet the values specified in the data sheet.

8.2 Disposal

Rohde & Schwarz is committed to making careful, ecologically sound use of natural resources and minimizing the environmental footprint of our products. Help us by disposing of waste in a way that causes minimum environmental impact.

Disposing electrical and electronic equipment

A product that is labeled as follows cannot be disposed of in normal household waste after it has come to the end of its service life. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Figure 8-1: Labeling in line with EU directive WEEE

Rohde & Schwarz has developed a disposal concept for the eco-friendly disposal or recycling of waste material. As a manufacturer, Rohde & Schwarz completely fulfills its obligation to take back and dispose of electrical and electronic waste. Contact your local service representative to dispose of the product.

9 Troubleshooting

If the system is not running properly, try to find the problem with the following tests. If the tests do not help to locate the problem, contact your Rohde & Schwarz service representative.

9.1 LED test

The module has three LEDs on its front panel that indicate its status.

After turning on the system, all LEDs light up for a short time to indicate that the power supply is present and that all LEDs are working.

- A single LED does not light up in that time frame:
  Indicates a faulty LED or faulty LED control.
- All LEDs do not light up during that time frame:
  Indicates that the power supply for the module is faulty.
  Check the status LEDs of the main power supply module in slot A3 and A4.

For rear modules, you have to check the LEDs separately, see "Power-on test for modules with a rear I/O supply module" on page 36.

9.2 Power-on test

The power-on test runs at the same time as the LED test. The following statements can be made regarding the different display states of the LEDs.

- "PWR LED" (green LED) = on
  Indicates that all power supply voltages are present.
- "PWR LED" (green LED) = off
  Indicates that at least one power supply voltage is missing.
- "ERR LED" (red LED) = off
  If the green LED is illuminated at the same time, indicates that the system is working without any errors.
- "ERR LED" (red LED) = on (or blinking)
  Indicates a hardware problem.

Power-on test for modules with a rear I/O supply module

If the green LED indicates a problem with the supply voltage, check the LEDs of the corresponding rear I/O supply module separately. If the LEDs on the rear I/O module also indicate a supply voltage failure, replace the rear I/O module.

9.3 R&S TSVP self-test

The R&S TSVP self-test is an extensive test procedure for the whole system or individual components. After the test is done, you receive a test report for all components that have been tested.

The self-test uses the R&S TS-PSAM module as a measurement unit. The functionality of the modules in the system is ensured by measurements via the analog measurement bus.

For more information about running the system self-test and the test procedures, refer to the R&S TSVP service manual.

9.4 Contacting customer support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

Contact information

Contact our customer support center at www.rohde-schwarz.com/support, or follow this QR code:

Figure 9-1: QR code to the Rohde & Schwarz support page

Annex

A Specifications

For an overview of technical specifications of the R&S TS-PAM module, refer to the corresponding product brochure / data sheet.

If discrepancies exist between information in this manual and the values in the data sheet, the values in the data sheet take precedence.

B Block diagram

Figure B-1 shows the simplified functional block diagram of the Analyzer Module R&S TS-PAM and the Rear I/O Module R&S TS-PDC in the R&S CompactTSVP.

Figure B-2 shows the block diagram of the Analyzer Modules R&S TS-PAM.

Figure B-3 shows the block diagram of the Rear I/O Module R&S TS-PDC.

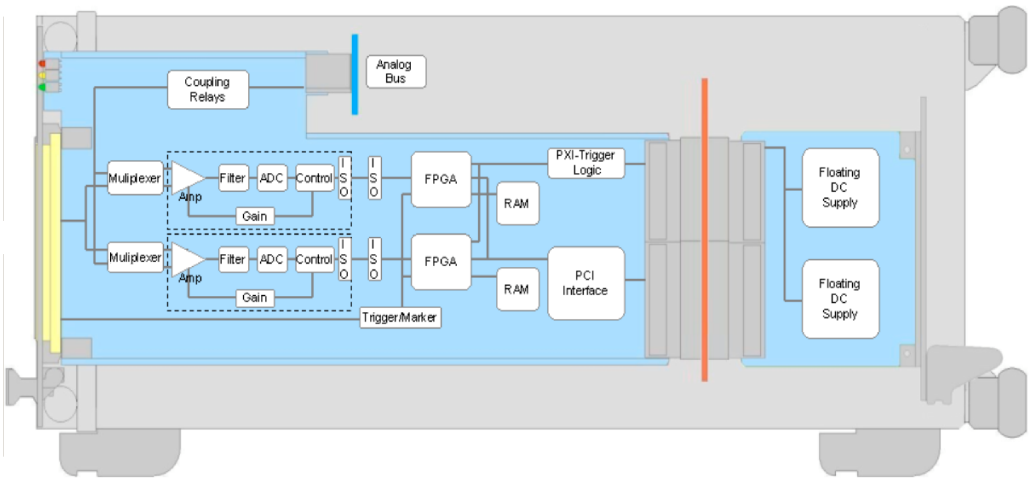

Figure B-1: Functional block diagram of R&S TS-PAM with R&S TS-PDC in the R&S CompactTSVP

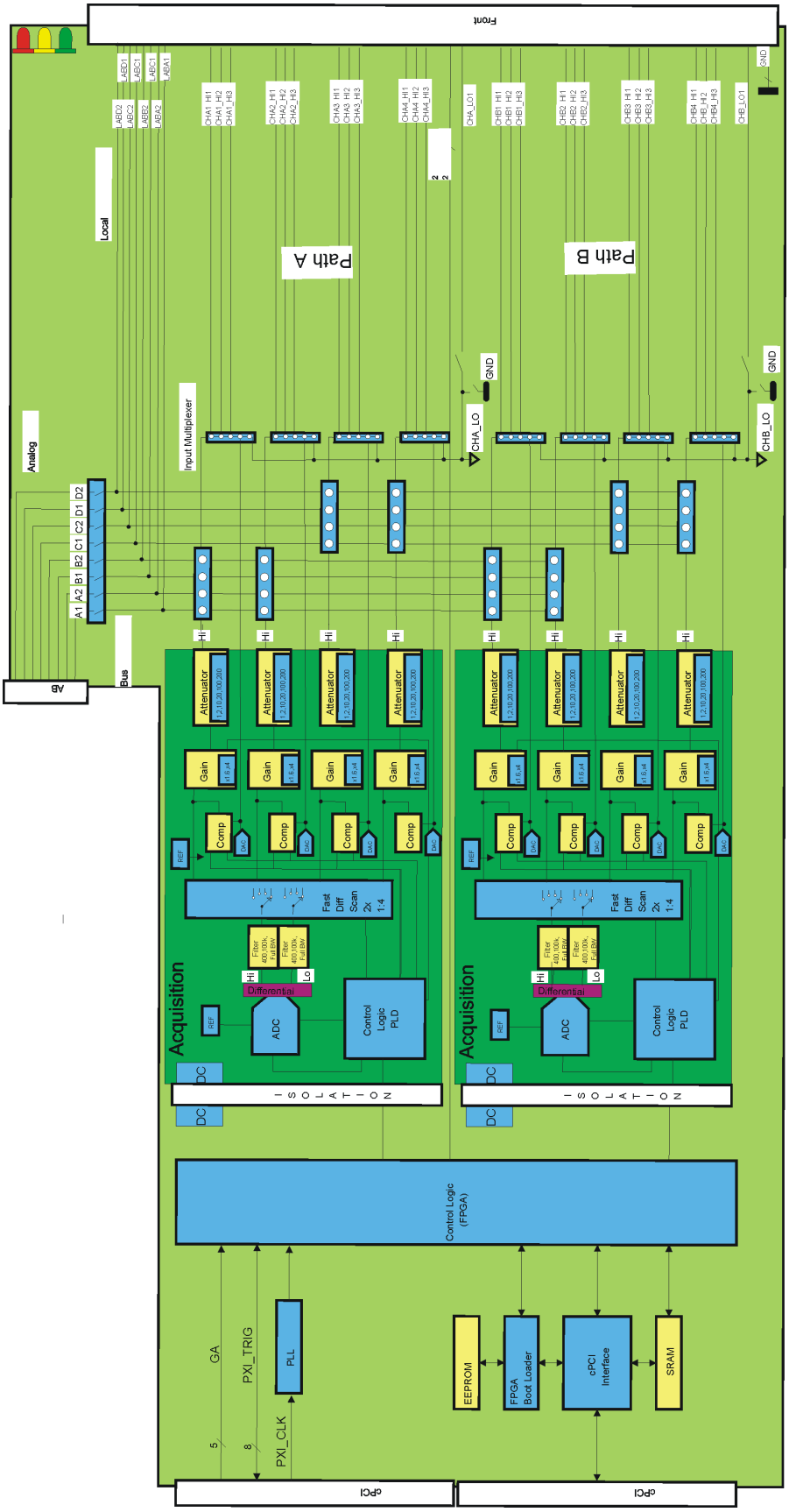

Figure B-2: Block diagram of Analyzer Module R&S TS-PAM

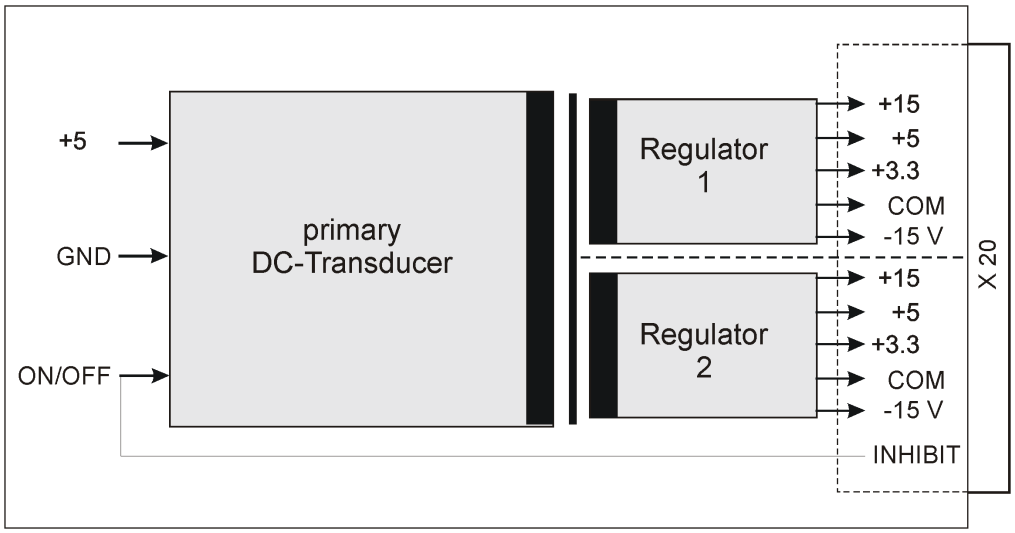

Figure B-3: Block diagram of Rear I/O Module R&S TS-PDC

C Interface description

C.1 R&S TS-PAM

C.1.1 Connector X1

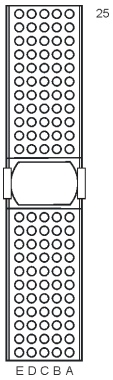

Figure C-1: Connector X1 (view: plug side)

Pin	F	E	D	C	B	A	
25	GND	5V	3.3V	ENUM#	REQ64#	5V	
24	GND	ACK64#	AD[0]	V(I/O)	5V	AD[1]	
23	GND	AD[2]	5V	AD[3]	AD[4]	3.3V	
22	GND	AD[5]	AD[6]	3.3V	GND	AD[7]	
21	GND	C/BE[0]#	M66EN	AD[8]	AD[9]	3.3V	
20	GND	AD[10]	AD[11]	V(I/O)	GND	AD[12]	
19	GND	AD[13]	GND	AD[14]	AD[15]	3.3V	X1
18	GND	C/BE[1]#	PAR	3.3V	GND	SERR#	
17	GND	PERR#	GND	IPMB_SDA	IPMB_SCL	3.3V	C
16	GND	LOCK#	STOP#	V(I/O)	GND	DEVSEL#	O
15	GND	TRDY#	BD_SEL#	IRDY#	FRAME#	3.3V	N
12..14				Key Area			N
11	GND	C/BE[2]#	GND	AD[16]	AD[17]	AD[18]	E
10	GND	AD[19]	AD[20]	3.3V	GND	AD[21]	C
9	GND	AD[22]	GND	AD[23]	IDSEL	C/BE[3]#	T
8	GND	AD[24]	AD[25]	V(I/O)	GND	AD[26]	O
7	GND	AD[27]	GND	AD[28]	AD[29]	AD[30]	R
6	GND	AD[31]	CLK	3.3V	GND	REQ#	
5	GND	GNT#	GND	RST#	BSRSV	BSRSV	
4	GND	INTS	INTP	V(I/O)	HEALTHY#	IPMB_PWR	
3	GND	INTD#	5V	INTC#	INTB#	INTA#	
2	GND	TDI	TDO	TMS	5V	TCK	
1	GND	5V	+12V	TRST#	-12V	5V	

Figure C-2: Pin assignment for connector X1

C.1.2 Connector X20

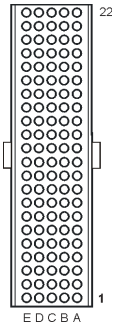

Figure C-3: Connector X20 (view: plug side)

Pin	F	E	D	C	B	A	
22	GND	GA0	GA1	GA2	GA3	GA4	
21	GND				GND		
20	GND		GND				
19	GND				GND		
18	GND	PXI_TRIG6	GND (CAN-En)	PXI_TRIG5	PXI_TRIG4	PXI_TRIG3	X20
17	GND	PXI_CLK10			GND	PXI_TRIG2	
16	GND	PXI_TRIG7	GND		PXI_TRIG0	PXI_TRIG1	
15	GND				GND		
14	NC						CONNECTOR
13	NC						
12	NP	COM_1	+3.3V_1	+5V_1	-15V_1	+15V_1	
11	NP						
10	NC	COM_2	+3.3V_2	+5V_2	-15V_2	+15V_2	
9	NC						
8	NC						
7	NC						
6	NC						
5	NC						
4	GND						
3	GND	RSA0	RRST#		GND	RSDO	
2	GND		RSDI	RSA1		RSCLK	
1	GND				GND	RCS#	

Figure C-4: Pin assignment for connector X20 (NC = not connected, NP = not populated)

C.1.3 Connector X10

Plug type DIN 41612, 96 pin, female

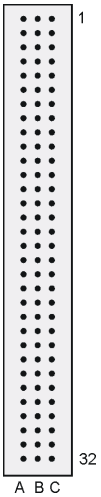

Figure C-5: Connector X10 (view: front panel)

Table C-1: Pin assignment for connector x10 (view front panel)

	A	B	C
1	LABA1	GND	LABA2
2	LABB1	GND	LABB2
3	LABC1	GND	LABC2
4	LABD1	GND	LABD2
5			
6	CHA1_HI1	CHA1_HI2	CHA1_HI3
7	CHA_LO1	CHA_LO1	CHA_LO1
8	CHA2_HI1	CHA2_HI2	CHA2_HI3
9	CHA_LO1	CHA_LO1	CHA_LO1
10			
11	CHA3_HI1	CHA3_HI2	CHA3_HI3
12	CHA_LO1	CHA_LO1	CHA_LO1
13	CHA4_HI1	CHA4_HI2	CHA4_HI3
14	CHA_LO1	CHA_LO1	CHA_LO1
15			
16	CHB1_HI1	CHB1_HI2	CHB1_HI3
17	CHB_LO1	CHB_LO1	CHB_LO1
18	CHB2_HI1	CHB2_HI2	CHB2_HI3
19	CHB_LO1	CHB_LO1	CHB_LO1
20			
21	CHB3_HI1	CHB3_HI2	CHB3_HI3

	A	B	C
22	CHB_LO1	CHB_LO1	CHB_LO1
23	CHB4_HI1	CHB4_HI2	CHB4_HI3
24	CHB_LO1	CHB_LO1	CHB_LO1
25			
26			
27			
28	GND	GND	GND
29	XTO1	GND	XTO2
30	XTI1	GND	XTI2
31	GND	GND	GND
32	GND	GND	CHA_GND

The signal CHA_GND is connected with the front panel of the component and through two 10 nF condensers with GND. The front panel itself has no direct connection to GND. During the connection of a unit under test, the unit under test's GND should be connected to GND. Do not connect GND and CHA_GND to prevent hum loops.

C.1.4 Connector X30

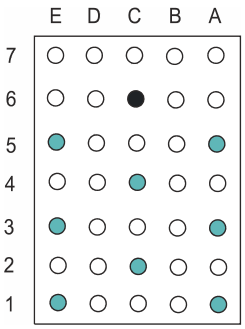

Figure C-6: Connector X30 (mating side)

Table C-2: X30 pinning schedule

Pin	E	D	C	B	A
7					
6			GND		
5	ABC1				ABA1
4			ABB1		
3	ABC2				ABB2

Pin	E	D	C	B	A
2			ABA2		
1	ABD2				ABD1

C.2 R&S TS-PDC

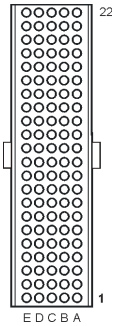

Figure C-7: Connector X20 (R&S TS-PDC mating side)

Pin	Z	A	B	C	D	E	
22	GND						
21	GND		GND or NC *3)				
20	GND			+5V *1)	GND	+5V *1)	
19	GND		GND	+5V *1)			
18	GND				GND or NC *4)		J20
17	GND		GND	+5V *2)	+5V *2)		
16	GND			+5V *2)	GND		
15	GND		GND	+5V *2)	+5V *1)		
14	NC						C
13	NC						O
12	NP	+15V_1	-15V_1	+5V_1	+3.3V_1	COM_1	N
11	NP						N
10	NC	+15V_2	-15V_2	+5V_2	+3.3V_2	COM_2	E
9	NC						C
8	NC	COM_1	COM_1	COM_1	COM_1	COM_1	T
7	NC						O
6	NC	COM_2	COM_2	COM_2	COM_2	COM_2	R
5	NC						
4	NC						
3	GND		GND		RRST#		
2	GND	RSCLK			RSDI		
1	GND	RCS#	GND			+5V *1)	
Pin	Z	A	B	C	D	E	

*1) TS-PDC Version 1.0 is supplied via these pins from +5V, for backplanes up to Version 3.x
*2) TS-PDC Version 1.1 or higher is supplied via these pins or pins from *1)
*3) TS-PDC Version 1.3 or higher: This pin is not connected
*4) TS-PDC Version 1.4 or higher: This pin is not connected

Figure C-8: Pin assignment for connector X20 (R&S TS-PDC)