R&S®TS-PSU12
Power Supply/Load Module 12V
User Manual

1504452412
Version 06

ROHDE&SCHWARZ
Make ideas real

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

- R&S®TS-PSU12

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The following abbreviations are used throughout this manual: R&S®TS-PSU12 is abbreviated as R&S TS-PSU12.

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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-PSU12

These operating instructions provide all the information required for installation, programming, and operation of the power supply / load module R&S TS-PSU12 on the R&S TSVP production test platform. They also include detailed information on the special features of the R&S TS-PSU12, specifications, block diagrams, and pin assignment of the connector.

The R&S TS-PSU12 has a width of one slot and a height of four units. It has two floating channels that are completely independent of each other with a maximum power of 5 W each, a voltage range of +/-12 V and a maximum current of 0,5 A. The currents and voltages can be programmed in both the positive and negative range. Thanks to this 4-quadrant capability of the module, it can also be operated in applications as a load (sink). The measurement units integrated into the module for each channel make it possible to read back the current and voltage of any given channel. Using the multiplexer included in the module, it is also possible with the R&S TS-PSU12 to measure external voltages over time directly on the test object. The functionality of the module also includes extensive options for controlling individual channels via trigger lines and generating trigger signals. As with all modules available from Rohde & Schwarz, the R&S TS-PSU12 also has access to existing analog measurement buses in the R&S TSVP base unit with both channels. This measurement bus makes it possible to switch outputs without any extra wiring to other measurement and switching cards present in the R&S TSVP base units.

The CAN bus (Controller Area Network) present in the R&S TSVP is used to control the R&S TS-PSU12.

The scope of delivery for the Power Supply/Load Module R&S TS-PSU includes the following components:

- PSU power module (for use in a front slot)
- R&S TS-PDC Power supply (use in the appropriate Rear-I/O slot)

Features of the R&S TS-PSU12

- Two fully independent, floating power supply units (up to 12 V / 0 … 12 V / 5 W)
- Source and sink operation with separate sensing (four-quadrant operation)
- Electronic load with up to 6 W continuous dissipated power
- Integrated voltage and current measurement
- Two integrated voltage measurement units for external use
- Recording of voltage or current values as they change over time
- External trigger of source and measurement via PXI trigger signals
- Over voltage, over current, over temperature and short circuit protection
- 4:1 Relay multiplexer (force and sense) per channel for panel test
- Access to analog measurement bus
- Self-test capability
- Softpanel for direct operation
- LabWindows/CVI driver support
- GTSL (generic test software library) in DLL format

4 Module tour

The R&S TS-PSU12 consists of several hardware components.

4.1 Power module

The PSU power module is designed as a long plug-in card for front side insertion in the R&S TSVP production test platform.

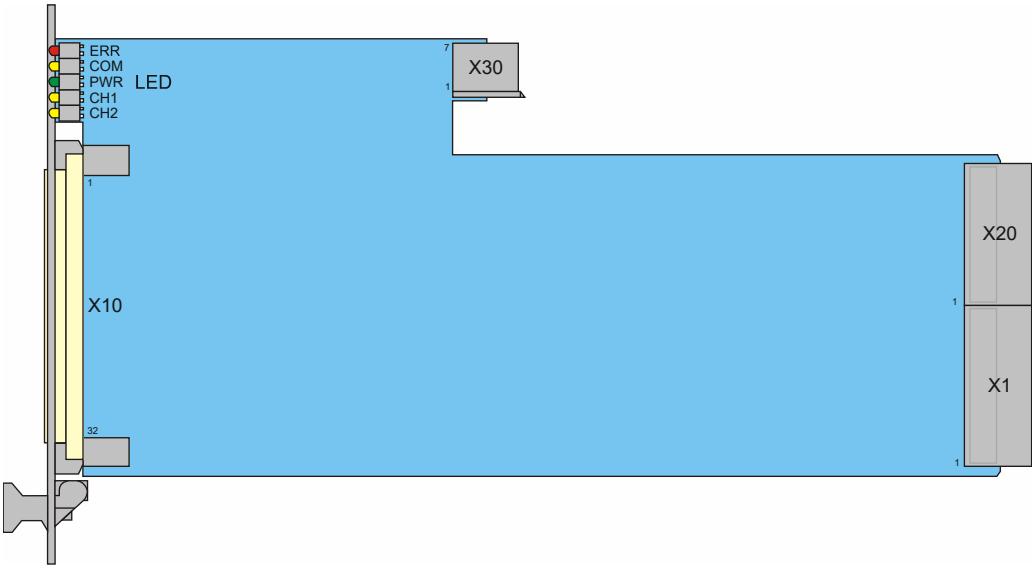

Figure 4-1: Overview of connectors and status LEDs

LED = Chapter 4.1.1, "Status LEDs", on page 14
X1 / X20 = Chapter 4.1.2, "Connector X1 / X20", on page 15
X10 = Chapter 4.1.3, "Connector X10", on page 15
X30 = Chapter 4.1.4, "Connector X30", on page 15

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.
- "CH1" / "CH2" (yellow LEDs)
  Indicates that channels 1 or 2 are working with constant current.
  If the LED blinks, it indicates that the protective mechanism of the corresponding channel has engaged. See Chapter 6.2.8, "Protective mechanisms", on page 24 for details.
- "ERR" (red LED)

Indicates an hardware error if illuminated or blinking.

4.1.2 Connector X1 / X20

Type: PXI

Interface to connect the module to the control backplane of the R&S TSVP base unit.

See Chapter C.1.1, "Connector X1", on page 46 and Chapter C.1.3, "Connector X20", on page 49 for a detailed description of the connectors.

4.1.3 Connector X10

Interface to connect UUTs to the module.

See Chapter C.1.2, "Connector X10", on page 47 for a detailed description of the connector.

4.1.4 Connector X30

Interface for analogue bus access for self-test and current measurement.

See Chapter C.1.4, "Connector X30", on page 50 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-PSU12 in a R&S TSVP 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)

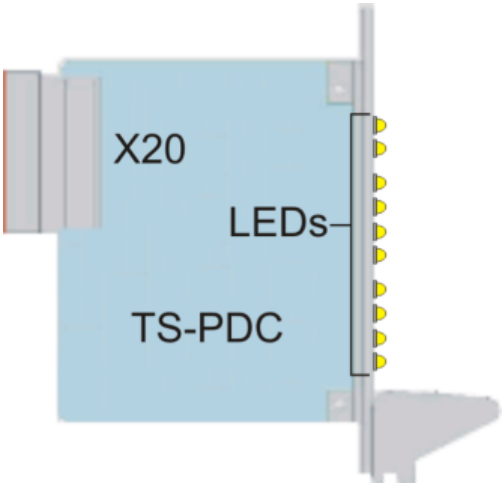

Figure 4-2: Overview of the connector and LEDs on the R&S TS-PDC module

LEDs = Chapter 4.2.1, "Status LEDs", on page 16
X20 = Chapter 4.2.2, "Connector X20", on page 17

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 50 for a detailed description of the connector.

5 Installing the module

The R&S TS-PSU12 is a module installed on the front panel of R&S TSVP base units. It requires an R&S TS-PDC rear I/O supply module.

1. Install the R&S TS-PSU12 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 General

The Power Supply/Load Module 12V R&S TS-PSU12 contains two identically structured, floating analog channels. Unless otherwise noted, the following description applies to both channels. Figure 6-1 shows a block diagram of one channels.

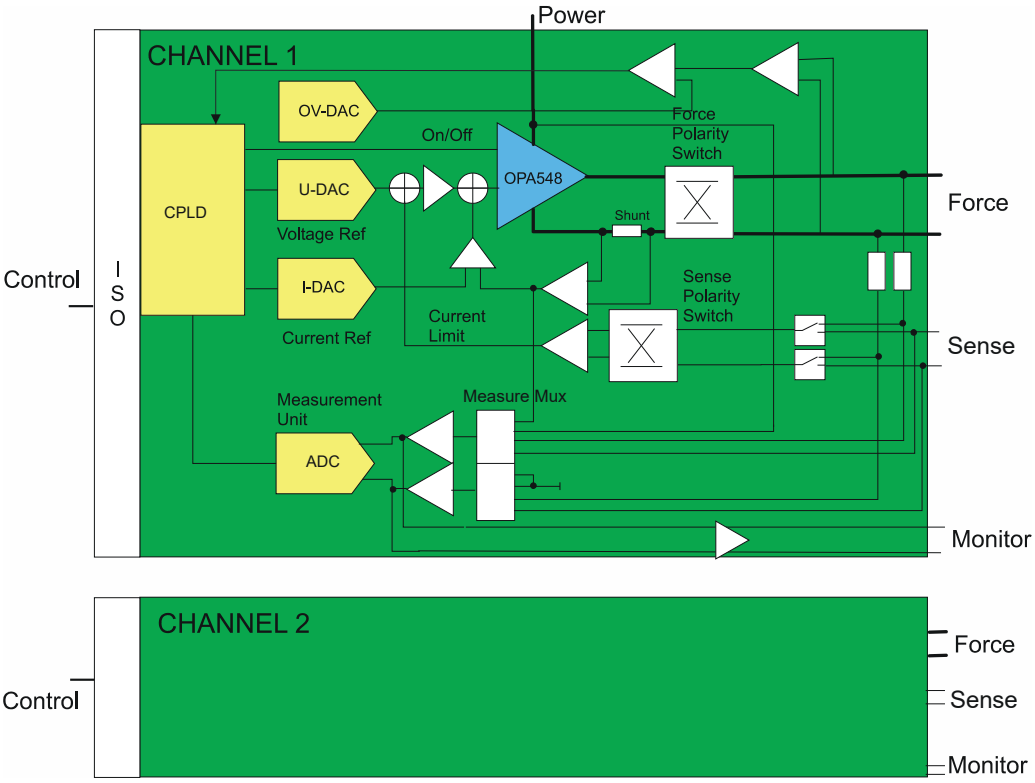

Figure 6-1: Block diagram of channels

6.2 Power supply/load unit

The Power Supply/Load Module 12V R&S TS-PSU12 is designed as a 4- quadrant source consisting of a 2-quadrant output stage followed by a polarity switch. The output stage consists of a linear regulator with current and voltage feedback. The linear regulator receives its power through the R&S TS-PDC supply module.

The settings for output voltage and maximum current are used to configure the output stage.

Users can select between three current ranges.

The following voltage ranges are available:

- 12 V

The following current ranges are available:

- 10mA
- 100mA
- 500mA

For a summary of the possible combinations of voltages and currents, see the characteristic diagram in Chapter 6.2.1, "Characteristic diagram", on page 21.

The setting of current and voltage range determines the resolution of the module. Because of this, the smallest possible range appropriate for any given application should be used. The resolution of voltage setting is 16 bits plus a positive/negative sign. For current, 16 bits represent the quantity only; no positive or negative sign can be selected.

Below the maximum current set, the output stage works as a constant voltage source, otherwise as a constant current source, or switches off (depending on the configuration).

Please also refer to Chapter 6.2.8, "Protective mechanisms", on page 24, step 5

Switching between source mode (Source) and load mode (Sink) is done automatically.

In sink mode, current is also regulated. In addition, the voltage is programmed to less than the externally applied voltage, to force current flow from the test object to the R&S TS-PSU12. This may increase the voltage at the output to rise to the level of the external source, but not beyond the range (12 V).

Over-Voltage-Protection (OVP) should be adjusted appropriately to protect the output stage, especially if the voltage of the external source is higher than the range.

Behaviour when the maximum current is exceeded can be defined by calling function `rspsu_Attr_CurrentLimitBehaviour()`. When „Regulate“ (default state) is selected in parameter behavior, the output current is limited; with “Trip” the output is turned off.

Example of sink operation:

Purpose: Discharging an accumulator with an output voltage of 8 V to 6 V with a maximum discharge current of 0,5 A. The internal resistance of the accumulator is 1Ω.

Setting R&S TS-PSU12: U = 6 V, I = 0,5 A

The charged accumulator with U = 8 V is connected to the R&S TS-PSU12. The R&S TS-PSU12 controls discharging of the accumulator based on the specified setting so that the current flows at a maximum of I = 0,5 A. Thus with an internal resistance of 1Ω and a maximum current of 0,5 A, the voltage difference between the output voltage of the R&S TS-PSU12 and the voltage of the accumulator must not exceed 0,5 V. It follows that at the beginning of discharge on the output of the R&S TS-PSU12, a voltage of 7,5 V is present, which slowly drops to a value of 6 V as the accumulator discharges. Once the voltage of the R&S TS-PSU12 has reached 6 V, that value is main-

tained. As soon as the accumulator voltage has also fallen to 6 V, no more current will flow and discharging is complete.

6.2.1 Characteristic diagram

The maximum voltage or current values are determined by the characteristic data of the R&S TS-PSU12. In addition to the absolute limits 12 V and 0,5 A, a maximum output power (CURRENT_LIMIT * VOLTAGE_LEVEL) of 5 W must not be exceeded in source operation and 6 W in sink mode (continuous operation). This results in the characteristic diagram for Source and Sink mode shown here (Figure 6-2). Special cases must be taken into consideration for low voltages.

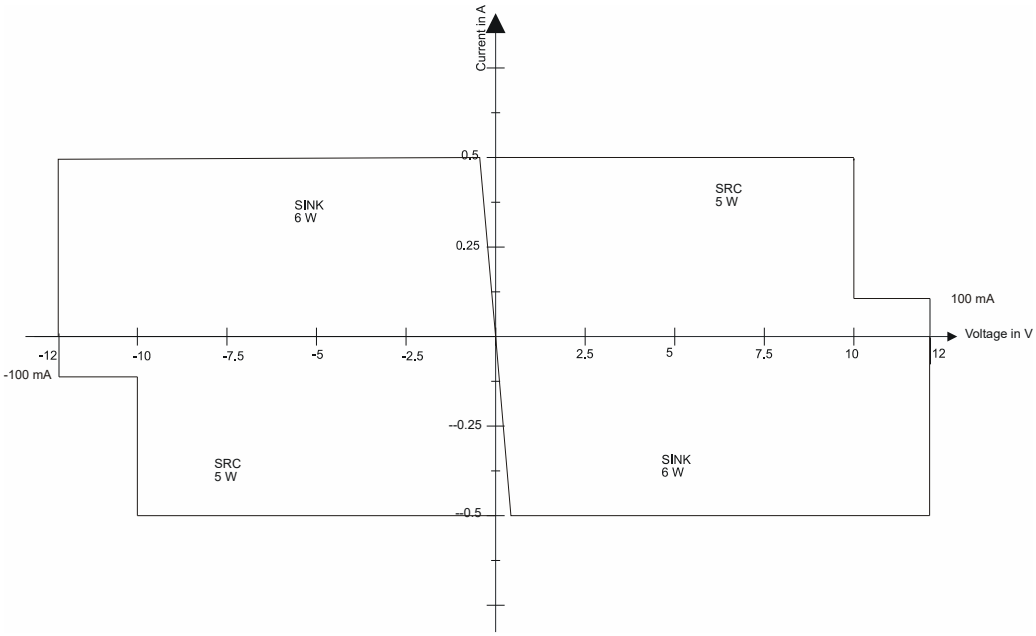

Figure 6-2: Current/voltage characteristic diagram

6.2.2 Reverse polarity in load case

You can connect an external source to the R&S TS-PSU12. The external source can have an opposite polarity to the output voltage defined for the R&S TS-PSU12. In that case, the R&S TS-PSU12 attempts to impose the polarity you have set.

1. Turn off the R&S TS-PSU12.
2. Connect the external source to the R&S TS-PSU12.
3. **NOTICE!** Risk of instrument damage. External sources can have a polarity opposite to the output voltage defined for the R&S TS-PSU12. If the polarity of the R&S TS-PSU12 is set incorrectly, the external source can get damaged if the R&S TS-PSU12 changes the polarity of the external source.

To avoid damage to the external source, make sure to set the polarity of the R&S TS-PSU12 correctly.

Select the correct polarity of the R&S TS-PSU12 based on the polarity of the external source.

The behavior of the R&S TS-PSU12 depends on the ability of the external source to provide current.

- Weak external sources whose current remains below the maximum current
  When you connect a weak external source, the R&S TS-PSU12 forces the polarity set on its pins.
- Strong external sources that can provide a high current
  When you connect a strong external source, the R&S TS-PSU12 remains in the externally applied quadrant, even though according to specification it should be working in a different quadrant. The R&S TS-PSU12 sinks the maximum current set. After discharge (voltage on the pins is approximately < 0,4 V) of the external source, the R&S TS-PSU12 switches to the desired polarity and from then on changes the external source with reverse polarity.

4. Define an appropriate maximum current, especially for external sources that are able to provide high current.
5. Start the R&S TS-PSU12 and the measurements.

6.2.3 Inductive loads

Turning off inductive loads suddenly can generate very high voltage spikes. Flyback diodes should therefore be used to protect the output stage of the R&S TS-PSU12.

If it is not possible to use flyback diodes, proceed as follows when switching off inductive loads:

1. Set the output voltage = 0 V
2. Wait until the current drops to close to 0 A
3. Turn off R&S TS-PSU12 electronically
4. Open the relay(s)

6.2.4 External sensing

To compensate for voltage drops in the line to the external load or source, the R&S TS-PSU12 can be set to external sensing. Then two additional lines directly to the test object are required. The measured voltage difference on these lines is automatically regulated to the target voltage by the R&S TS-PSU12.

If the R&S TS-PSU12 is operated with external sensing, the sense lines must be connected to corresponding input pins on the front connector and switched through the relay matrix to the sense inputs. Otherwise an incorrect voltage will be assumed for regulation of the output voltage, causing an incorrect output voltage to be generated.

For reasons of safety, however, the error voltage of the output stage is limited to a difference of approximately 4 - 5 V. This limit also applies if the sense lines are accidentally shorted or connected with reverse polarity. This determines a maximum correctable error voltage based on maximum line resistances of 4 - 5 V.

Since the pins for external sensing are also used for external voltage measurement, no additional external voltage can be measured in "external sensing" mode.

6.2.5 Wiring channels in series (cascading)

Serial wiring of the module's two output channels is possible using external wiring.

1. Turn off the R&S TSVP.
2. Connect the wires to the channels of the R&S TS-PSU12.
3. **NOTICE!** Risk of instrument damage. Serial wiring can also lead to high currents running through the system. High currents can destroy the module.
   To avoid damage to the module, make sure that the current stays below the values the module can handle.

   Set the current limits of the two channels to approximately the same value (no more than 1 % difference).
   If the current exceeds the value set, one channel will first regulate the voltage to a lower value; the second channel will follow somewhat later. The difference is determined by the amplification and offset error of the current regulator.
4. Set up the system to remain in constant voltage mode.
5. **NOTICE!** Risk of an internal short-circuit. Each separate GND relay must be set specifically. Both GND relays must never be closed together. Doing so would cause a internal short circuit.

   Set each separate GND relay specifically.

Figure 6-3 shows a typical permissible voltage configuration between analog buses and ground.

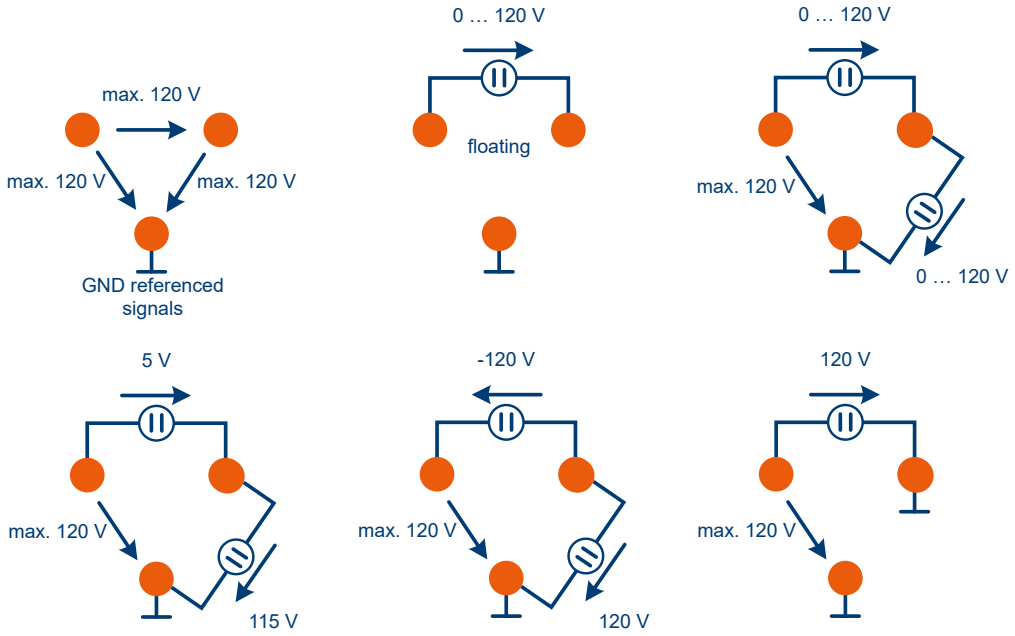

Figure 6-3: Permissible voltages on analog bus lines

6.2.6 Connecting channels in parallel

The R&S TS-PSU12 is **not** designed for parallel wiring of outputs and the possible resulting currents of up to 1 A . Because of this, the outputs must **not** be wired in parallel. Because of the 4-quadrant capability, equalisation currents could flow between the two channels (with one source working in source mode, the other in sink mode).

6.2.7 Electronic on/off and PWM

The R&S TS-PSU12 has an electronic switch for rapid On / Off switching of the output path. For reasons of safety, the module is automatically switched to “Off” after initialisation.

The R&S TS-PSU12 also offers an option for quickly switching back and forth between 0 V and the programmed value with the pulse width modulator (PWM) integrated into the module. This makes it possible, depending on the voltage setting, to generate pulses with a width of at least 50 µs and a maximum frequency of approximately 10 kHz.

6.2.8 Protective mechanisms

A series of protective mechanisms are integrated into the output stage to prevent damage to the R&S TS-PSU12 and externally connected devices. When necessary, these protective mechanisms turn off the linear regulator of the appropriate channel and open the relays of the force lines. The LEDs assigned to the channel (CH1 or CH2) begin to flash. The channel cannot be connected and activated again until the user has

confirmed that the protective mechanism has engaged. Driver function `rspsu_ResetOutputProtection` is used for this purpose. It can also be implicitly called by resetting the module (`rspsu_reset`). The module software can also be used to query whether a channel is in voltage or current mode, and whether a protective mechanism has been triggered.

The module software can also be used to query whether a channel is in voltage or current mode, and whether a protective mechanism has been triggered.

1. **Over-voltage protection**
   If the voltage at the force pins exceeds the programmed threshold value, the protective mechanism will respond. To ensure effective operation, the value must be far enough above normal operation so that minor deviations do not cause triggering.

2. **Current monitoring**
   High currents may flow if regulation fails or in the event of overload. To prevent damage, overcurrent protection engages at approximately 120 % of the current range.
   Example:
   With a the current range of 500 mA, overcurent protection engages at 650 mA.

3. **Excess temperature protection**
   Several temperature sensors are built into the R&S TS-PSU12 to protect the linear regulator. One of these temperature sensors continuously monitors the temperature on the heat sink of the PSU power module. If the limit value of 70°C is exceeded, the protective mechanism for the linear regulator engages. In some applications, however, (for example PWM mode at high frequency and high current), it is possible that only the linear controller will heat up very quickly, without the temperature of the heat sink coming close to the limit temperature of 70°C. A temperature sensor integrated into the linear controller monitors its temperature in addition and switches off the linear controller when necessary to prevent it from being destroyed by excess heat. This condition is also detected by the R&S TS-PSU12 and results in the affected channel being turned off.

4. **Monitoring power supply voltages**
   If one of the power supply voltages is not correctly applied, this will cause the protective mechanism to engage and the yellow LED for that channel will begin to flash.

5. **Current limiting**
   The behaviour of the current limiting function can be configured. With the “regulate” setting, the set current is controlled (default), with the “trip” setting, the system is switched off in the case of a current flow above the set current value.

6.3 Measurement unit

The integrated measurement unit of the Power Supply/Load Module R&S TS-PSU12 consist of 16-bit ADC with a sampling rate of 10 kHz and a front end multiplexer for selecting different sources or measurement points. The measurement unit is closely connected to the output stage of the associated channel and works on the same internal measurement reference point.

6.3.1 Measurement options, resolution

The R&S TS-PSU12 offers the following measurement options:

- Measurement of output voltage on the force pins
- Measurement of voltage on the sense pins
- Measurement of currents via internal shunt

When the output stage is switched to “internal sense” mode, any external voltage can be measured on the sense pins. Without additional wiring only differential measurement is possible, since the R&S TS-PSU12 cannot switch an internal ground connection to CHx_SHI or CHx_SLO. Due to an external wiring from CHx_LO to CHx_SLO and closing of the ground relay, “single ended” measurement is also feasible. The difference in voltage may be up to 12 V. The maximum voltage of each individual signal must not exceed 12 V against CHx_LO.

The voltage measurement range is always 12 V.

The current measurement range is specified by the setting of the R&S TS-PSU12. For example, if the range is set to 10 mA, the range of the measurement unit will also be ±10 mA.

6.3.2 Sampling

The measurement unit implemented on the R&S TS-PSU12 makes it possible to record individual values, average values, or entire waveforms. To record transient processes or current and voltage values over time, the R&S TS-PSU12 is able to record the selected source at a sampling rate of up to 10 kHz and save measurement values. The available memory depth is designed for up to 10000 measurement values. The sampling rate, duration of recording, start delay, and triggering can be freely selected. At the maximum sampling frequency, an interval of one second can still be measured. Correspondingly longer recording is possible at lower sampling frequencies. The measurement can be started via internal or external triggers. It is also possible to start the measurement in the background and retrieve the measurement values later.

6.3.3 Monitor output

The R&S TS-PSU12 has two pins on the X10 front connector that pass the input voltage of the ADC to the output through a buffer. In this way, the selected measurement

source can be recorded using an external oscilloscope or digitizer. The voltages and value range on these monitor outputs (CHx_MHI and CHx_MLO) are as follow:

Table 6-1: Voltages and value range of monitor outputs

Selected source	**Source signal for 2.50V full scale of monitor voltage**	**Conversion factor**
Force voltage	52.7 V	Source signal in V = 21.08 * monitor voltage in V
Sense voltage	52.7 V	Source signal in V = 21.08 * monitor voltage in V
Current 10 mA	12,4 mA	Source current in mA = 4,97 * monitor voltage in V
Current 100 mA	110 mA	Source current in mA = 43,9 * monitor voltage in V
Current 500 mA	932 mA	Source current in A = 0,373 * monitor voltage in V

The monitor output signal must be measured differentially at high impedance. 10 kΩ is built in internally before CHx_MHI and CHx_MLO each as a protective mechanism against short-circuits.

Signals CHx_MHI / CHx_MLO must be measured floating against the force or sense potential. Depending on the quadrant of the source, the potential against CHx_MLO approximates CHx_LO (output voltage positive) or CHx_HI (output voltage negative). This means the common mode voltage on CHx_MLO against CHx_LO is approximately 0 V to approximately -12 V.

6.4 Relay matrix

The relay matrix implemented in the Power Supply/Load Module R&S TS-PSU12 is used for flexible connection and simple wiring of test objects. Its layout is as follows:

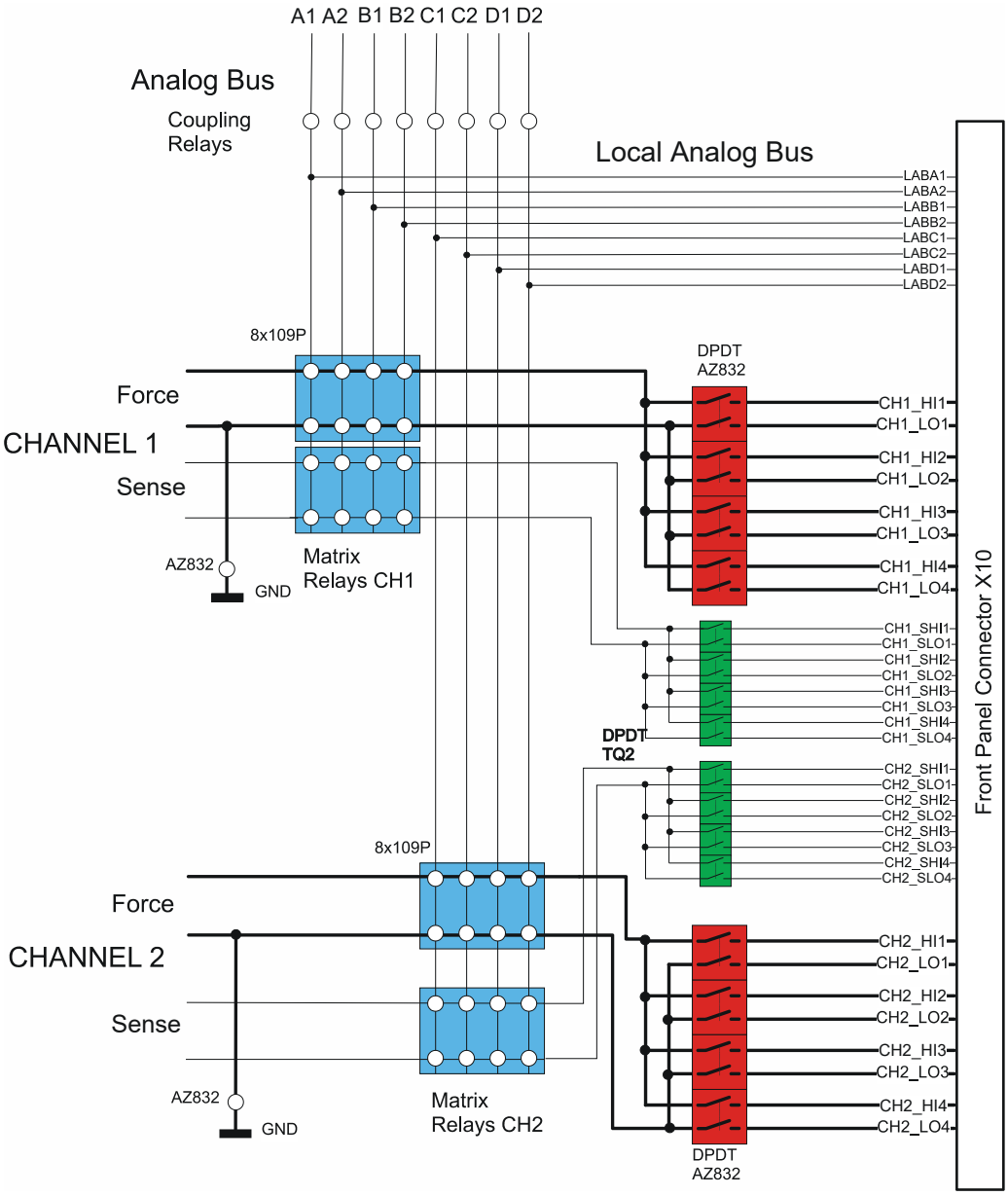

Figure 6-4: Signal connection

6.4.1 Matrix and front relay

The front lines can be switched via the front relays to four outputs on the front connector.

Four sense or measurement inputs (two-pin) can also be directed via the sense lines to the source or measurement unit.

All lines have access to the local analog bus through the matrix relay and via the coupling relays to the analog bus in the R&S CompactTSVP

To prevent the relay contacts from being destroyed, the relays should only be switched if no current is flowing through them. Before a contact is activated, the channel should be turned off electronically.

The following functions are available to operate these relays:

- `rspsu_Connect`
- `rspsu_Disconnect`
- `rspsu_DisconnectAll`

The function `rspsu_DisconnectAll` can be used to break all connections that were set up with `rspsu_Connect`. `rspsu_DisconnectAll` has no effect on the configuration of the coupling relays or ground relay.

6.4.2 Coupling relays

The coupling relays connect the local analog bus on the module with the analog bus in the R&S CompactTSVP. The function `rspsu_ConfigureCoupling` defines the status of the coupling relays. Please consider that the function `rspsu_DisconnectAll` does not open these relays.

6.4.3 Ground relays

Each channel of the R&S TS-PSU12 has its own ground relay that can be used to connect the CHx_LO signal to ground. PSU channels are operated ground free in their basic state. The function `rspsu_ConfigureGround` is used to determine whether a channel is being operated with ground reference or ground free. Also note that `rspsu_DisconnectAll` does not affect the ground relay!

For technical reasons, a non-switched PSU channel (all matrix and front relays of a channel are opened) is automatically grounded with the ground relay. It is automatically opened again before another connection is made if the channel is configured ground-free.

6.5 Trigger unit

6.5.1 Trigger outputs

The Power Supply/Load Module R&S TS-PSU12 can generate trigger signals on lines PXI_TRIGn (X20) and XTOn (X10). The polarity of the trigger signal can be adjusted. The following events may cause a change in the level on trigger lines:

- Call to function `rspsu_InitiateTrigger`. This function generates a “General Purpose” trigger (trigger pulse approximately 1 µs long) if trigger source “GP” has

been configured to one or more trigger outputs by `rspsu_ConfigureTriggerOutput`.

- Switching a channel on or off if trigger source “CH1” or “CH2” has been configured to one or more trigger outputs by `rspsu_ConfigureTriggerOutput`.

6.5.2 Trigger inputs

Trigger signals on trigger inputs PXI_TRIGn (X20) and XTIn (X10) can start a measurement value recording (voltage or current) in the measurement unit or set the output voltage and current limiting of the source to a new value. The two channels can be triggered synchronously.

7 Software

7.1 Driver software

A LabWindows IVI driver is available to control the Power Supply/Load Module 12V R&S TS-PSU12 that supports classes IVI DCPWR and IVI SWTCH. All other functions of the hardware are supported by specific extensions of the driver. The driver is a component of the ROHDE & SCHWARZ GTSL software. All functions of the driver are documented extensively in 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-PSU12

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

A "Soft-Panel" is included with the software package for R&S TS-PSU12 (see Figure 7-1). The Soft-Panel requires the support of the IVI driver. It makes it possible to operate the module interactively.

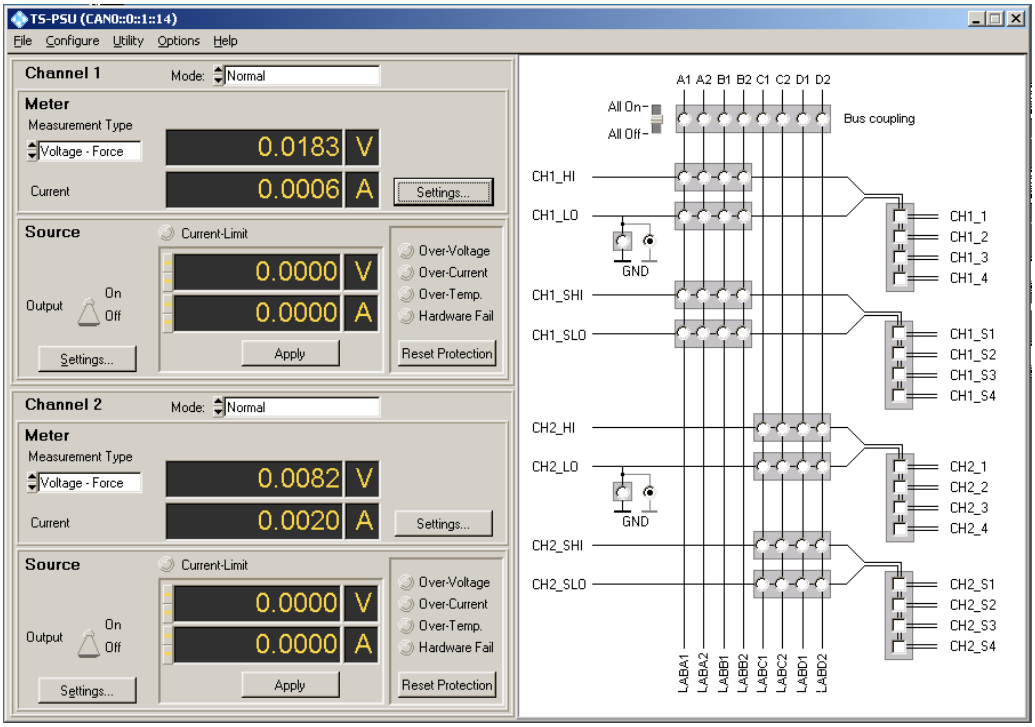

Figure 7-1: Softpanel R&S TS-PSU

The operation of the Softpanel is described in Chapter 13 of the “GTSL Software Description”.

7.2.1 Configuration of sources

Settings...

Activating the "Settings..." button from the "Source" area calls the dialogue for configuring sources.

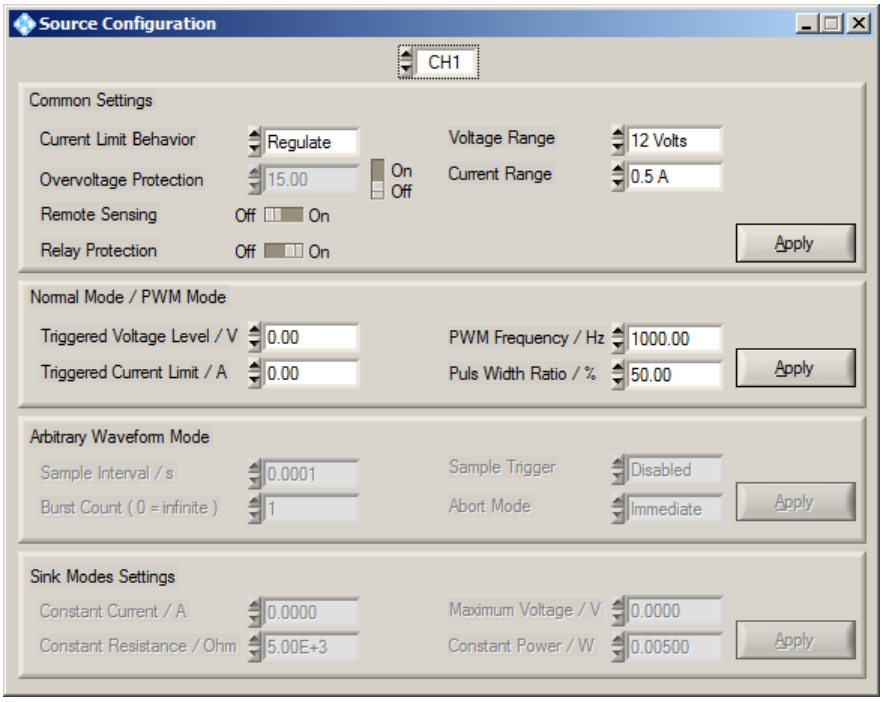

Figure 7-2: Configuration of sources

7.2.2 Configuration of measurement units

Settings...

Activating the "Settings..." button from the "Meter" area calls the dialogue for configuring measurement units.

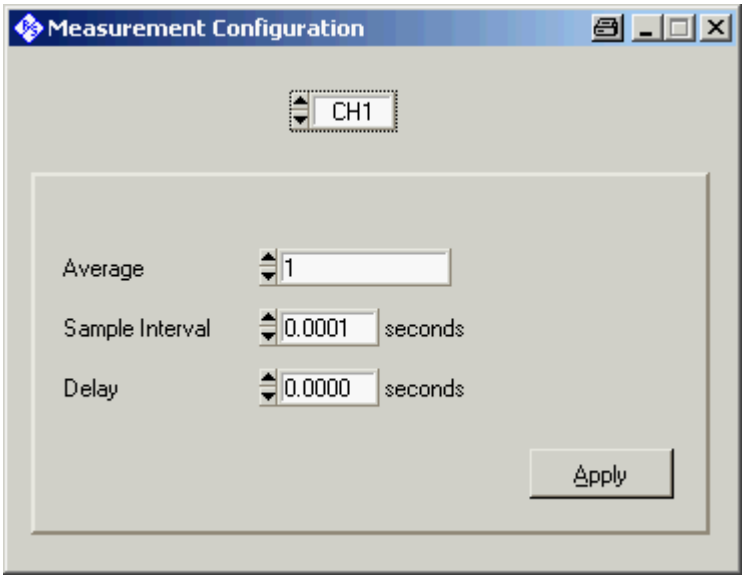

Figure 7-3: Configuration of measurement units

7.3 Sample programmes

7.3.1 Programming with GTSL libraries

```
/*
  This example connects channel 1 to the front connector, configures
  current limit and voltage, switches the source on and measures the
  output current.

  Error handling is not considered in this sample in order to
  keep it easy to read. The return status should be checked for
  "errorOccured" after each library call.

  The following configuration files are used in this example:

physical.ini
------------
[device->psu]
Type         = PSU12
ResourceDesc = CAN0::0::1::12
DriverDll    = rspsu.dll
DriverPrefix = rspsu
DriverOption = "Simulate=0"


PsuApplication.ini
------------------
[bench->dcpwr]

; configure the TS-PSU as power supply
DcPwrSupply1 = device->psu
DcPwrChannelTable = io_channel->dcpwr

; configure the TS-PSU as switch device
SwitchDevice1 = device->psu
AppChannelTable = io_channel->switch

; configure the DC power channels
[io_channel->dcpwr]
CH1 = psu!CH1
CH2 = psu!CH2

; configure the switch channels
[io_channel->switch]
CH1   = psu!CH1
CH1_1 = psu!CH1_1
```

```
*/

#include "resmgr.h"
#include "dcpwr.h"
#include "swmgr.h"

int main (int argc, char *argv[])
{
  long residDcpwr;  /* resource ID for DC power supply library */
  long residSwmgr;  /* resource ID for switch manager library */

  short errorOccurred = 0;
  long errorCode = 0;
  char errorMessage [GTSL_ERROR_BUFFER_SIZE] = "";

  double result = 0.0;

  /* load the physical and application configuration files */
  RESMGR_Setup ( 0, "physical.ini", "PSUApplication.ini",
                 &errorOccurred, &errorCode, errorMessage);

  /* initialize the DC power supply library */
  DCPWR_Setup ( 0, "bench->dcpwr", &residDcpwr,
                &errorOccurred, &errorCode, errorMessage);

  /* initialize the switch manager library */
  SWMGR_Setup ( 0, "bench->dcpwr", &residSwmgr,
                &errorOccurred, &errorCode, errorMessage);

  /* configure channel 1 earth tied */
  DCPWR_Conf_Ground_Relay ( 0, residDcpwr, "CH1", 1,
                            &errorOccurred, &errorCode, errorMessage);

  /* connect channel 1 to front connector */
  SWMGR_Connect ( 0, residSwmgr, "CH1", "CH1_1",
                  &errorOccurred, &errorCode, errorMessage);

  /* set current limit range for channel 1 to 100.0 mA */
  DCPWR_Conf_Output_Range ( 0, residDcpwr, "CH1", DCPWR_VAL_CURRENT, 100.0e-3,
                            &errorOccurred, &errorCode, errorMessage);

  /* set current limit for channel 1 to 10 mA; current limit behavior is regulate */
  DCPWR_Conf_Current_Limit ( 0, residDcpwr, "CH1", DCPWR_VAL_REGULATE, 10.0e-3,
                             &errorOccurred, &errorCode, errorMessage);

  /* select voltage range 12 V*/
  DCPWR_Conf_Output_Range ( 0, residDcpwr, "CH1", DCPWR_VAL_VOLTAGE, 12.0,
                            &errorOccurred, &errorCode, errorMessage);
```

```
  /* set voltage to 10 V */
  DCPWR_Conf_Voltage_Level ( 0, residDcpwr, "CH1", 10.0,
                             &errorOccurred, &errorCode, errorMessage);

  /* wait until relays have settled; timeout 500 ms */
  SWMGR_WaitForDebounce ( 0, residSwmgr, 500,
                          &errorOccurred, &errorCode, errorMessage);

  /* switch on channel 1 */
  DCPWR_Conf_Output_Enabled ( 0, residDcpwr, "CH1", 1,
                              &errorOccurred, &errorCode, errorMessage);

  /* configure the measurement: Sample Count 40, Sample Interval 1 ms, Delay 0.0 */
  DCPWR_Conf_Measurement ( 0, residDcpwr, "CH1", 40, 1.0e-3, 0.0,
                           &errorOccurred, &errorCode, errorMessage);

  /* measure the output current */
  DCPWR_Measure ( 0, residDcpwr, "CH1", DCPWR_VAL_CURRENT, &result,
                  &errorOccurred, &errorCode, errorMessage);

  /* switch off channel 1 */
  DCPWR_Conf_Output_Enabled ( 0, residDcpwr, "CH1", 0,
                              &errorOccurred, &errorCode, errorMessage);

  /* disconnect all */
  SWMGR_DisconnectAll ( 0, residSwmgr,
                        &errorOccurred, &errorCode, errorMessage);

  /* configure channel 1 earth free again */
  DCPWR_Conf_Ground_Relay ( 0, residDcpwr, "CH1", 0,
                            &errorOccurred, &errorCode, errorMessage);

  /* close the libraries */
  SWMGR_Cleanup ( 0, residSwmgr,
                  &errorOccurred, &errorCode, errorMessage);

  DCPWR_Cleanup ( 0, residDcpwr,
                  &errorOccurred, &errorCode, errorMessage);

  RESMGR_Cleanup ( 0, &errorOccurred, &errorCode, errorMessage);

  return 0;
}
```

7.3.2 Programming with device drivers

```
/*
  This example connects channel 1 to the front connector, configures
```

```
  current limit and voltage, switches the source on and measures the
  output current.

  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 "rspsu.h"

int main (int argc, char *argv[])
{
  ViSession vi;
  ViStatus  status;
  ViReal64  result;

  /*
    open a session to the device driver. The resource descriptor
    depends on the slot number of the module and must be adapted
    to the target system.
  */
  status = rspsu_InitWithOptions ("CAN0::0::2::5::INSTR",
                                  VI_TRUE,
                                  VI_TRUE,
                                  "Simulate=0,RangeCheck=1",
                                  &vi);

  /* configure channel 1 earth tied */
  status = rspsu_ConfigureGround (vi, "CH1", VI_TRUE);

  /* connect channel 1 to front connector */
  status = rspsu_Connect (vi, "CH1", "CH1_1");

  /* set current limit range for channel 1 to 100.0 mA */
  status = rspsu_ConfigureOutputRange (vi, "CH1", RSPSU_VAL_RANGE_CURRENT, 100.0E-3);

  /* set current limit for channel 1 to 10 mA; current limit behavior is regulate */
  status = rspsu_ConfigureCurrentLimit (vi, "CH1", RSPSU_VAL_CURRENT_REGULATE, 10.0E-3);

  /* select voltage range 12 V*/
  status = rspsu_ConfigureOutputRange (vi, "CH1", RSPSU_VAL_RANGE_VOLTAGE, 12.0);

  /* set voltage to 10 V */
  status = rspsu_ConfigureVoltageLevel (vi, "CH1", 10.0);

  /* wait until relays have settled; timeout 500 ms */
  status = rspsu_WaitForDebounce (vi, 500);

  /* switch on channel 1 */
  status = rspsu_ConfigureOutputEnabled (vi, "CH1", VI_TRUE);
```

```
  /* configure the measurement: Sample Count 40, Sample Interval 1 ms, Delay 0.0 */
  status = rspsu_ConfigureMeasurement (vi, "CH1", 40, 0.001, 0.0);

  /* measure the output current */
  status = rspsu_Measure (vi, "CH1", RSPSU_VAL_MEASURE_CURRENT, & result);

  /* switch off channel 1 */
  status = rspsu_ConfigureOutputEnabled (vi, "CH1", VI_FALSE);

  /* disconnect all */
  status = rspsu_DisconnectAll(vi);

  /* configure channel 1 earth free again */
  status = rspsu_ConfigureGround (vi, "CH1", VI_FALSE);

  /* close the driver session */
  status = rspsu_close (vi);

  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.

- LED test 40
- Power-on test 40
- R&S TSVP self-test 41
- Contacting customer support 41

9.1 LED test

The module has five 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 41.

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.
- "CH1 LED" / "CH2 LED" (yellow LED) = off
  Indicates that the system is working without any errors.
- "CH1 LED" / "CH2 LED" (yellow LED) = blinking
  Indicates that the channel is inactive due to an error.

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-PSU12 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 a simplified functional block diagram of the Power Supply/Load Module 12V R&S TS-PSU12. This functional block diagram represents the modules of the R&S TS-PSU12.

- PSU power module
- Rear-I/O module R&S TS-PDC

Figure B-2 shows a block diagram of the Power Supply/Load Module 12V R&S TS-PSU12.

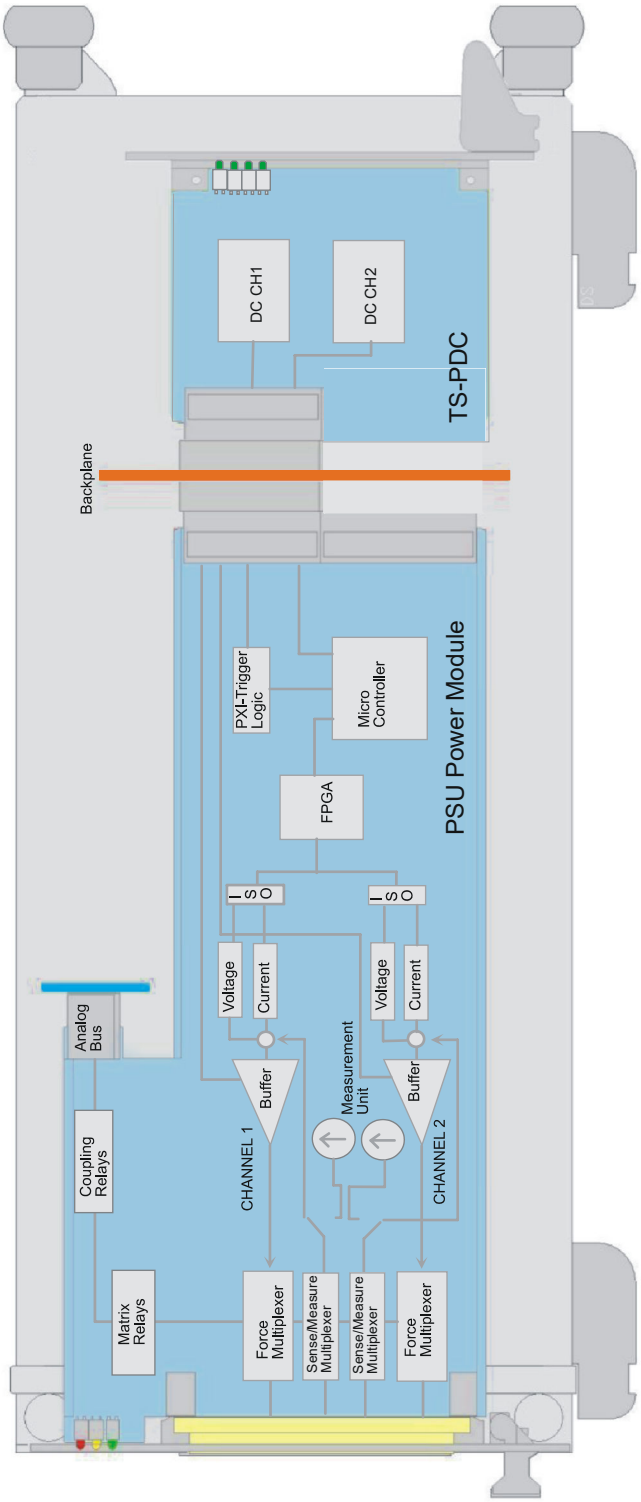

Figure B-1: Functional block diagram R&S TS-PSU12

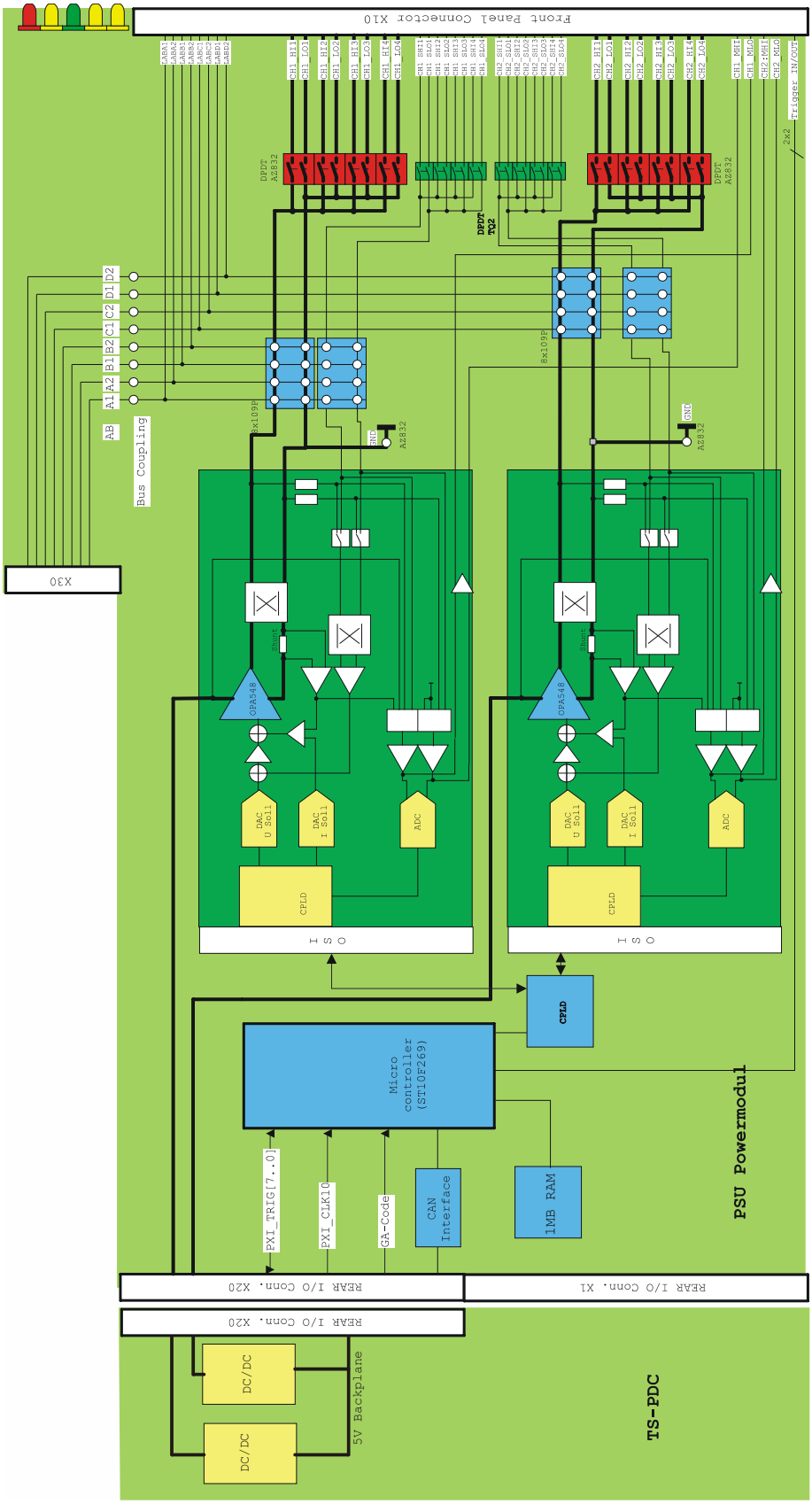

Figure B-2: Block diagram R&S TS-PSU12

C Interface description

C.1 PSU power module

C.1.1 Connector X1

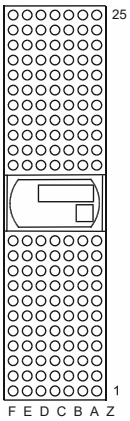

Figure C-1: Connector X1 (view: mating side)

Pin	F	E	D	C	B	A	Z
25	GND	+5V				+5V	GND
24	GND				+5V		GND
23	GND		+5V				GND
22	GND				GND		GND
21	GND						GND
20	GND				GND		GND
19	GND		GND				GND
18	GND				GND		GND
17	GND		GND				GND
16	GND				GND		GND
15	GND		GND				GND
12..14							
11	GND		GND				GND
10	GND				GND		GND
9	GND		GND				GND
8	GND				GND		GND
7	GND		GND				GND
6	GND				GND		GND
5	GND		GND				GND
4	GND				GND		GND
3	GND		+5V				GND
2	GND				+5V		GND
1	GND	+5V				+5V	GND
Pin	F	E	D	C	B	A	Z

Figure C-2: Assignment of X1

C.1.2 Connector X10

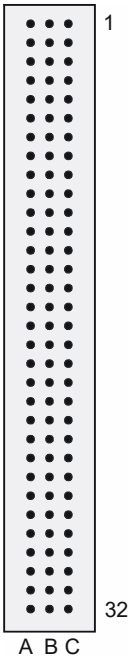

Figure C-3: Connector X10 (view: mating side)

Table C-1: Assignment of x10

Pin	A	B	C
1	LABA1	GND	LABA2
2	LABB1	GND	LABB2
3	LABC1	GND	LABC2
4	LABD1	GND	LABD2
5			
6	CH1_HI1	CH1_HI1	CH1_HI1
7	CH1_LO1	CH1_LO1	CH1_LO1
8	CH1_HI2	CH1_HI2	CH1_HI2
9	CH1_LO2	CH1_LO2	CH1_LO2
10	CH1_HI3	CH1_HI3	CH1_HI3
11	CH1_LO3	CH1_LO3	CH1_LO3
12	CH1_HI4	CH1_HI4	CH1_HI4
13	CH1_LO4	CH1_LO4	CH1_LO4
14	CH1_SHI1		CH1_SLO1
15	CH1_SHI2	CH1_MHI	CH1_SLO2
16	CH1_SHI3	CH1_MLO	CH1_SLO3
17	CH1_SHI4		CH1_SLO4
18	CH2_HI1	CH2_HI1	CH2_HI1
19	CH2_LO1	CH2_LO1	CH2_LO1
20	CH2_HI2	CH2_HI2	CH2_HI2
21	CH2_LO2	CH2_LO2	CH2_LO2
22	CH2_HI3	CH2_HI3	CH2_HI3
23	CH2_LO3	CH2_LO3	CH2_LO3
24	CH2_HI4	CH2_HI4	CH2_HI4
25	CH2_LO4	CH2_LO4	CH2_LO4
26	CH2_SHI1		CH2_SLO1
27	CH2_SHI2	CH2_MHI	CH2_SLO2
28	CH2_SHI3	CH2_MLO	CH2_SLO3
29	CH2_SHI4		CH2_SLO4
30			
31	XTI1	XTI2	GND
32	XTO1	XTO2	CHA_GND

The CHA_GND signal is connected with the front plate of the module and via two 10 nF capacitors with GND. The front plate itself has no direct connection to GND. When a test object is connected, the test object GND should be connected to GND. To avoid ripple loops, do not connect GND and CHA_GND.

C.1.3 Connector X20

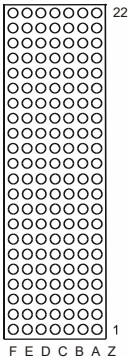

Figure C-4: Connector X20 (view: mating side)

Pin	F	E	D	C	B	A	Z
22		GA0	GA1	GA2	GA3	GA4	
21					GA5		
20		+5V (PWA)	GND	+5V (PWA)			
19				+5V (PWA)	GND		
18		PXI_TRIG6	CAN_EN in PCA3 V4.0	PXI_TRIG5	PXI_TRIG4	PXI_TRIG3	
17		PXI_CLK10			GND	PXI_TRIG2	
16		PXI_TRIG7	GND		PXI_TRIG0	PXI_TRIG1	
15			+5V (PWA)		GND		
14							
13							
12	NP	PGND1	PACCTL_CH1	+5VRIO_CH1		+VPA_CH1	NP
11	NP						NP
10		PGND2	PACCTL_CH2	+5VRIO_CH2		+VPA_CH2	
9					+VPA_CH2	+VPA_CH2	
8		PGND1	PGND1	PGND1			
7					+VPA_CH1	+VPA_CH1	
6		PGND2	PGND2	PGND2			
5							
4							
3			RRST#		GND	RSDO	
2			RSDI			RSCLK	
1		+5V (PWA)	CAN_L	CAN_H	GND	RCS#	
Pin	F	E	D	C	B	A	Z

Figure C-5: Assignment of X20 (NP = not populated)

C.1.4 Connector X30

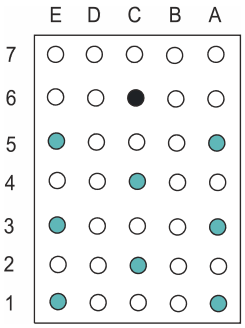

Figure C-6: Connector X30 (mating side)

Table C-2: X30 pinning schedule

Pin	E	D	C	B	A
7					
6			GND		
5	ABC1				ABA1
4			ABB1		
3	ABC2				ABB2
2			ABA2		
1	ABD2				ABD1

C.2 R&S TS-PDC

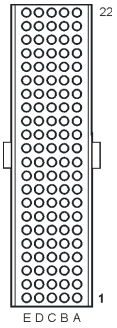

Figure C-7: Connector X20 (R&S TS-PDC mating side)

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)