K ú p n a z m l u v a
č. 497/2022/OŠaŠ

uzatvorená podľa § 409 a následne zákona č. 513/1991 Zb. Obchodného zákonníka v znení neskorších predpisov a zákona č. 343/2015 o verejnom obstarávaní v znení neskorších predpisov (ďalej len „Zmluva“)

Zmluvné strany

1. Predávajúci:	**TR instruments spol. s r.o.**
Sídlo:	Kameníčkova 28, 616 00 Brno, Česká republika
Štatutárny orgán:	Ing. Jiří Kalvoda, konateľ
IČO:	155 30 779
IBAN:	SK82 1111 0000 0010 8029 5009
Právna forma:	Spoločnosť s ručením obmedzeným

(ďalej ako „*predávajúci*“ alebo aj ako „*dodávateľ*“)

a

2. Kupujúci	**Žilinský samosprávny kraj**
Sídlo:	Komenského 48, 011 09 Žilina
Štatutárny orgán:	Ing. Erika Jurinová, predsedníčka
IČO:	37 808 427
DIČ:	202 162 6695
IČ DPH:	nie je platiteľ DPH
Bankové spojenie:	Štátna pokladnica
IBAN:	SK95 8180 0000 0070 0050 3697
Právna forma:	
Osoby oprávnené jednať v: zmluvných veciach:	Ing. Erika Jurinová, predsedníčka

(ďalej len „kupujúci“)

I. Preambula

1. Kúpna zmluva je výsledkom Verejného obstarávania zákazky s názvom: **MODERNIZÁCIA ODBORNÉHO VZDELÁVANIA V SŠ KYSUCKÉ NOVÉ MESTO,** Kód ITMS: 302021K296.

Článok
II. Predmet zmluvy

1. Touto zmluvou sa za nižšie dojednaných podmienok: predávajúci zaväzuje dodať kupujúcemu predmet kúpy: **Meracie pracovisko prepojené s počítačom v rozsahu prílohy č. 1** (ďalej spolu len „predmet kúpy“) a zároveň sa predávajúci zaväzuje previesť na kupujúceho vlastnícke právo ku predmetu kúpy. Podrobná technická špecifikácia predmetu kúpy je uvedená v prílohe č. 1 tejto zmluvy.

2. Kupujúci sa zaväzuje predmet kúpy od predávajúceho prevziať a zaplatiť zaň kúpnu cenu.

3. Predmet kúpy musí byť nový a pred dodaním nepoužívaný. Predávajúci sa zaväzuje dodať predmet kúpy bez záložného práva ako aj iných práv zodpovedajúcich právam tretích osôb k cudzej veci, v stave spôsobilom na riadne užívanie a v čo najlepšej kvalite.

4. Predávajúci sa touto zmluvou zaväzuje spolu s predmetom kúpy realizovať aj dodanie predmetu kúpy na miesto určenia a dodanie relevantnej dokumentácie (návod na obsluhu v slovenskom jazyku a prípadne ďalšie písomné doklady potrebné na prevzatie a bezpečné užívanie predmetu kúpy). Doklady vzťahujúce

sa na predmet kúpy sa považujú za súčasť predmetu kúpy. Všetky náklady na dodanie dokladov vzťahujúce sa na predmet kúpy sú zahrnuté v kúpnej cene podľa čl. IV zmluvy a predávajúcemu za ich dodanie nepatrí osobitná odmena.

5. V kúpnej cene podľa čl. IV zmluvy sú spolu s nákladmi na dodanie predmetu kúpy na miesto určenia a dodania relevantnej dokumentácie vrátane poskytnutej záruky na predmet kúpy v trvaní 24 mesiacov, rovnako zahrnuté aj prípadné náklady na montáž a inštaláciu predmetu kúpy na mieste dodania, uvedenia do prevádzky, vykonanie skúšok/skúšobnej prevádzky, prvé zaškolenia personálu, a to v závislosti od druhu prístrojov a zariadení uvedených v tomto ods. 1 zmluvy, podľa potreby a požiadaviek kupujúceho, pokiaľ sa zmluvné strany nedohodnú inak.

Článok
III. Dodanie predmetu kúpy

1. Predávajúci sa zaväzuje dodať predmet kúpy kupujúcemu nasledovne:
predmet kúpy uvedený v Čl. II ods. 1 tejto zmluvy **do 90 kalendárnych dní** odo dňa doručenia žiadosti kupujúceho o dodanie predmetu kúpy elektronickou poštou na e-mailovú adresu uvedenú v Čl. VIII bod. 8. písm. b) tejto zmluvy (žiadosť musí byť riadne podpísaná a tvoriť prílohu v PDF formáte). Zároveň pre vylúčenie pochybností sa zmluvné strany dohodli, že kupujúci je povinný doručiť žiadosť o dodanie predmetu kúpy najneskôr do 6 mesiacov odo dňa účinnosti tejto zmluvy.
2. Predávajúci sa zaväzuje dodať predmet kúpy v mieste Stredná priemyselná škola informačných technológií, Nábrežná 1325, 024 01 Kysucké Nové Mesto.
3. Za nedodržanie termínu dodania predmetu kúpy má kupujúci voči predávajúcemu nárok na zmluvnú pokutu vo výške 50,- € za každý deň omeškania. Zaplatením zmluvnej pokuty podľa tohto odseku nie je dotknutý nárok kupujúceho na náhradu spôsobenej škody.
4. Predmet kúpy sa považuje za dodaný až dňom podpisu preberacieho protokolu obidvoma zmluvnými stranami.
5. Kupujúci nie je povinný prevziať predmet kúpy, pokiaľ predávajúci nesplní riadne a včas svoje záväzky vyplývajúce z právneho vzťahu založeného touto zmluvou, najmä pokiaľ nedodá predmet kúpy v dojednanom čase a na určenom mieste, pokiaľ predmet kúpy bude vykazovať vady alebo poškodenia a pokiaľ nebude spĺňať kvalitatívne, kvantitatívne alebo iné stanovené podmienky.
6. Vlastnícke právo a nebezpečenstvo škody na predmete kúpy prechádza na kupujúceho dňom jeho prevzatia, teda dňom podpisu preberacieho protokolu zmluvnými stranami.

Článok
IV. Kúpna cena

1. Kúpna cena predmetu kúpy podľa tejto zmluvy je stanovená na základe ponuky predávajúceho podanej v rámci verejného obstarávania a činí celkovo:

Cena v € bez DPH:	35.543,00 €
Sadzba DPH v %:	20%
Sadzba DPH v €:	7.108,60 €
Cena v € s DPH:	**42.651,60 €**

(ďalej len „kúpna cena").

2. Kupujúci sa zaväzuje uhradiť kúpnu cenu za predmet kúpy predávajúcemu na základe faktúry, ktorá bude obsahovať všetky potrebné náležitosti v zmysle § 74 zákona č. 222/2004 Z. z. o dani z pridanej hodnoty v znení neskorších predpisov. Splatnosť faktúry podľa tejto zmluvy sa určuje na 60 dní odo dňa jej doručenia kupujúcemu. V prípade, že faktúra nebude obsahovať predpísané náležitosti daňového dokladu, resp. budú v nej uvedené nesprávne, alebo neúplné údaje, je kupujúci oprávnený túto faktúru vrátiť pred jej splatnosťou. Opravenej alebo novej faktúre plynie nová 60 – dňová lehota splatnosti od jej doručenia kupujúcemu. Úhrada faktúry sa vykoná bezhotovostným prevodom na účet predávajúceho.
3. Kúpna cena bude uhradená na účet predávajúceho uvedený v záhlaví zmluvy.
4. Kúpna cena je stanovená podľa zákona č. 18/1996 Z. z. o cenách v znení neskorších predpisov dohodou zmluvných strán ako výsledok verejného obstarávania. Kúpna cena je stanovená vrátane colných a daňových poplatkov a ďalších nákladov spojených s dodávkou, vrátane dopravy do miesta plnenia a prípadných ďalších nákladov uvedených v Čl. II ods. 5 tejto zmluvy. V kúpnej cene sú zahrnuté všetky náklady predávajúceho, ktoré vynaložil pri plnení záväzkov vyplývajúcich z právneho vzťahu založeného touto zmluvou,

ako aj jeho odmena za splnenie záväzkov a predávajúci nie je okrem kúpnej ceny oprávnený požadovať za splnenie svojich záväzkov akékoľvek plnenie peňažného alebo nepeňažného charakteru.

Článok
V. Záruka za akosť

1. Predávajúci týmto preberá záruku za akosť predmetu kúpy, pričom záručnou dobou je doba 24 mesiacov. Rozhodujúcim pre začiatok plynutia záručnej doby je okamih protokolárneho prevzatia predmetu kúpy kupujúcim.
2. Predávajúci zodpovedá za to, že počas celej záručnej doby bude predmet kúpy bez vád a kupujúci ho bude môcť riadne používať spôsobom vyplývajúcim zo zmluvy, najmenej však spôsobom zodpovedajúcemu obvyklému spôsobu jeho použitia. Zodpovednosť predávajúceho za právne vady predmetu kúpy nie je dotknutá.
3. Predávajúci nezodpovedá za právne a faktické vady, ktoré vznikli po protokolárnom prevzatí predmetu kúpy kupujúcim, pokiaľ boli spôsobené v dôsledku porušenia povinností kupujúceho.
4. Ak kupujúci v rámci nárokov vyplývajúcich zo zodpovednosti predávajúceho za vady bude požadovať odstránenie vád predmetu kúpy, zaväzuje sa predávajúci pri odstraňovaní vád použiť výlučne nové, originálne komponenty.
5. Uplatnením nárokov kupujúceho vyplývajúcich zo zodpovednosti predávajúceho za vady predmetu kúpy, nie je dotknutá zodpovednosť predávajúceho za škody.

Článok
VI. Záväzok mlčanlivosti

1. Všetky informácie obsiahnuté v tejto zmluve, ako i tie, ktoré si strany pre splnenie predmetu zmluvy navzájom poskytli, sa považujú za dôverné a poskytnúť tieto informácie tretej osobe môže zmluvná strana len po predchádzajúcom písomnom súhlase druhej zmluvnej strany. Tento záväzok mlčanlivosti platí aj po ukončení tohto zmluvného vzťahu.
2. Povinnosť kupujúceho sprístupniť informácie podľa zákona č. 211/2000 Z. z. o slobodnom prístupe k informáciám a o zmene a doplnení niektorých zákonov (zákon o slobode informácií) v znení neskorších predpisov týmto nie je dotknutá.

Článok
VII. Zánik záväzku

1. Záväzky zmluvných strán zo zmluvy zanikajú:
- ich splnením
- dohodou zmluvných strán, ktorá musí mať písomnú formu
- odstúpením od zmluvy z dôvodov ustanovených Obchodným zákonníkom a touto zmluvou.

2. Právo na odstúpenie podľa tejto zmluvy môže oprávnená zmluvná strana uplatniť písomným oznámením doručeným druhej zmluvnej strane, ktoré obsahuje skutkové vymedzenie dôvodu na odstúpenie od zmluvy tak, aby nebolo zameniteľné s iným dôvodom. Odstúpením od zmluvy sa zmluva zrušuje, keď prejav vôle oprávnenej zmluvnej strany odstúpiť od zmluvy je doručený druhej zmluvnej strane. V prípade odstúpenia kupujúci vráti tovar predávajúcemu a predávajúci vráti kupujúcemu kúpnu cenu. Nárok na náhradu škody, nárok na zaplatenie zmluvnej pokuty, ani nároky, ktoré podľa svojej povahy majú trvať aj po zániku zmluvy odstúpením od zmluvy nezanikajú.

3. Okrem práva odstúpiť od zmluvy podľa všeobecne záväzných právnych predpisov je kupujúci oprávnený odstúpiť od zmluvy aj v prípade, ak nastane niektorá zo skutočností uvedená v § 19 ods. 1 až 3 zákona č. 343/2015 Z.z. o verejnom obstarávaní v znení neskorších predpisov alebo podstatného porušenia zmluvy predávajúcim. Za podstatné porušenie zmluvy predávajúcim sa vždy považuje:
- nedodržanie termínu dodania predmetu kúpy o viac ako 15 pracovných dní;
- dodanie tovaru, ktoré nezodpovedá požiadavkám kupujúceho dohodnutým v zmluve;
- ak predávajúci počas záručnej doby neodstráni vady predmetu kúpy.
4. Predávajúci je oprávnený odstúpiť od zmluvy v prípade podstatného porušenia zmluvy kupujúcim. Za podstatné porušenie zmluvy kupujúcim sa vždy považuje:
- omeškanie kupujúceho s úhradou faktúr po dobu dlhšiu ako 90 dní.

Článok
VIII. Záverečné ustanovenia

1. Ak niektoré položky nie sú touto zmluvou upravené, riadia sa podmienkami stanovenými v súťažných podkladoch. V ostatných záležitostiach, bližšie neupravených v tejto zmluve, ani súťažných podkladoch, platia príslušné ustanovenia Obchodného zákonníka v platnom znení.
2. Zmluvné strany sú povinné vyvíjať všetko úsilie k vytvoreniu potrebných podmienok pre realizáciu predmetu zmluvy v súlade s pravidlami poctivého obchodného styku.
3. Zmluvné strany vyhlasujú, že sa budú snažiť riešiť všetky spory, ktoré prípadne vyplynú z výkladu a realizácie tejto zmluvy zmierom. Ak nebude zmierlivé riešenie sporu možné, budú riešené podľa platného právneho poriadku Slovenskej republiky na vecne a miestne príslušnom súde Slovenskej republiky. Táto zmluva sa riadi právom Slovenskej republiky.
4. Kupujúci má v každom jednom prípade porušenia povinnosti predávajúceho nárok na náhradu škody v celom rozsahu, a to popri nárokoch vyplývajúcich zo zodpovednosti predávajúceho za vady predmetu kúpy.
5. Zmluvné strany sa dohodli, že počas trvania zmluvy sa budú vzájomne informovať o všetkých zmenách týkajúcich sa obchodného mena, sídla miesta podnikania, predmetu činnosti, štatutárnych orgánov vrátane spôsobu ich konania voči tretím osobám, ako aj oznamovať všetky rozhodujúce skutočnosti, ktoré môžu mať vplyv na plnenie záväzkov.
6. Zmluvná strana je povinná písomne upovedomiť druhú zmluvnú stranu o hroziacom, resp. zahájenom konkurznom konaní. Kupujúci je oprávnený odstúpiť od zmluvy, ak začne konkurzné alebo reštrukturalizačné konanie na majetok predávajúceho.
7. Všetky podania a iné oznámenia, ktoré sa doručujú zmluvným stranám, je potrebné doručiť osobne, alebo doporučenou listovou zásielkou, alebo elektronickou poštou (písomnosť musí byť riadne podpísaná a tvoriť prílohu v PDF formáte).
8. Ku dňu podpisu tejto zmluvy je:
    a) adresou pre doručovanie kupujúcemu: Žilinský samosprávny kraj, Komenského 48, 011 09 Žilina, obstaravanie@zilinskazupa.sk
    b) adresou pre doručovanie predávajúcemu: TR instruments spol. s r.o., Křižíkova 70, 612 00 Brno, Česká republika, tri@trinstruments.cz

9. Ak je niektoré z ustanovení tejto zmluvy neplatné, odporovateľné alebo nevynutiteľným, lebo sa takým stane v budúcnosti, nedotýka sa to platnosti ostatných ustanovení, pokiaľ z povahy veci nevyplýva, že túto časť nie je možné od obsahu tejto zmluvy oddeliť. Zmluvné strany sa pre takýto prípad zaväzujú vadné ustanovenie neodkladne nahradiť bezvadným, ktoré bude v najvyššie možnej miere zodpovedať obsahu a účelu vadného ustanovenia.
10. Práva a povinnosti vyplývajúce z tejto zmluvy pre zmluvné strany prechádzajú v celom rozsahu na prípadných právnych nástupcov všetkých zmluvných strán.
11. Túto zmluvu je možné zmeniť alebo doplniť len na základe vzájomnej dohody zmluvných strán, a to vo forme písomných očíslovaných dodatkov k zmluve v súlade s ustanoveniami §18 Zákona č. 343/2015 o verejnom obstarávaní v znení neskorších predpisov.
12. Žiadna zmluvná strana nie je oprávnená postúpiť tretej osobe pohľadávku, ktorá jej na základe tejto zmluvy vznikla, bez predchádzajúceho písomného súhlasu druhej zmluvnej strany. Konanie v rozpore s dohodou podľa predchádzajúcej vety je v zmysle ustanovenia § 525 ods. 2 Občianskeho zákonníka absolútne neplatným právnym úkonom.
13. Dodávateľ sa zaväzuje predložiť elektronickú verziu podrobného rozpočtu (vo formáte MS Excel, príloha č. 1 tejto Zmluvy), v prípade zmeny rozpočtu Dodávateľ predloží zmenenú verziu v elektronickej podobe (vo formáte MS Excel).
14. Predávajúci sa zaväzuje, že umožní výkon finančnej kontroly/auditu/overovania, poskytne všetku potrebnú súčinnosť pri výkone finančnej kontroly/auditu/overovania a vytvorí podmienky na výkon finančnej kontroly a auditu alebo overovania v zmysle príslušných právnych predpisov na to oprávneným osobám, najmä (ale nielen): Útvaru hlavného kontrolóra Žilinského samosprávneho kraja, Najvyššiemu kontrolnému úradu SR, Úradu verejného obstarávania, vládnym audítorom/orgánom auditu, povereným zamestnancom kupujúceho, Protimonopolnému úradu SR, príslušným riadiacim, sprostredkovateľským, kontrolným a iným orgánom pre Operačný program Integrovaný regionálny operačný program, Európskemu dvoru audítorov, Európskej komisii, Európskemu úradu pre boj proti podvodom (OLAF).
15. Zmluvné strany prehlasujú, že táto zmluva predstavuje slobodný a vážny prejav ich vôle, je pre ne určitá a zrozumiteľná, neuzatvorená v tiesni a za nápadne nevýhodných podmienok, na znak čoho ju vlastnoručne podpisujú.
16. Táto zmluva je vyhotovená v troch rovnopisoch, z ktorých každý má platnosť originálu. Kupujúci obdrží dve vyhotovenia a predávajúci jedno vyhotovenie.
17. Zmluva nadobúda platnosť dňom jej podpisu oboma zmluvnými stranami.

18. Zmluvné strany si vzhľadom na pravidlá zadávania zákaziek a ich kontroly vydané Ministerstvom investícií, regionálneho rozvoja a informatizácie SR ako Riadiaceho orgánu pre Integrovaný regionálny operačný program v dokumente: Príručka k procesu verejného obstarávania dohodli odkladaciu podmienku účinnosti zmluvy nasledovne:

    Táto zmluva nadobudne účinnosť po ukončení finančnej kontroly, ak Riadiaci orgán neidentifikoval nedostatky, ktoré by mali alebo mohli mať vplyv na výsledok VO, pričom rozhodujúci je dátum doručenia správy z kontroly Žilinskému samosprávnemu kraju. Ak boli v rámci finančnej kontroly VO identifikované nedostatky, ktoré mali alebo mohli mať vplyv na výsledok VO, zmluva nadobudne účinnosť momentom súhlasu Žilinského samosprávneho kraja s výškou ex ante finančnej opravy uvedenej v správe z kontroly a kumulatívneho splnenia podmienky na uplatnenie ex ante finančnej opravy podľa Metodického pokynu CKO č. 5, ktorý upravuje postup pri určení finančných opráv za VO.
    Ak táto zmluva nenadobudne účinnosť do 6 (šiestich) mesiacov od jej uzavretia, zmluvné strany sa ďalej dohodli, že uplynutím 6 (šiestich) mesiacov od jej uzavretia táto zmluva zaniká.
19. Predávajúci vyjadruje podpisom tejto Kúpnej zmluvy súhlas so zverejnením svojich identifikačných údajov v rozsahu, v akom sú uvedené v záhlaví tejto zmluvy.
20. Predávajúci je oprávnený využiť pri realizácii dodávky subdodávateľov uvedených v prílohe č. 2 tejto Zmluvy (zoznam vyplní predávajúci najneskôr pri podpise kúpnej zmluvy) v rozsahu údajov minimálne: Názov subdodávateľa, Adresa sídla / miesta podnikania/ Meno a priezvisko osoby oprávnenej konať za subdodávateľa, Adresa pobytu osoby oprávnenej konať za subdodávateľa, dátum narodenia osoby oprávnenej konať za subdodávateľa.
21. Predávajúci je povinný oznámiť akúkoľvek zmenu údajov o subdodávateľovi kupujúcemu do 5 pracovných dní od vzniku takejto skutočnosti. V prípade zmeny subdodávateľa počas trvania zmluvy medzi kupujúcim a predávajúcim je povinný predávajúci najneskôr v deň, ktorý predchádza dňu, v ktorom má zmena subdodávateľa nastať oznámiť kupujúcemu zmenu subdodávateľa a v tomto oznámení uviesť minimálne nasledovné:
    - podiel zákazky, ktorý má v úmysle zadať subdodávateľovi, navrhovaných subdodávateľov a predmety subdodávok,
    - navrhovaný subdodávateľ spĺňal podmienky účasti týkajúce sa osobného postavenia a neexistovali u neho dôvody na vylúčenie podľa § 40 ods. 6 písm. a) až h) a ods. 7; oprávnenie dodávať tovar, sa preukazuje vo vzťahu k tej časti predmetu zákazky alebo koncesie, ktorý má subdodávateľ plniť.
22. V prípade porušenia ktorejkoľvek z povinností týkajúcich sa subdodávateľov alebo ich zmeny má kupujúci právo odstúpiť od Kúpnej zmluvy.

PRÍLOHY

Príloha č. 1: Špecifikácia a ceny predmetu zmluvy
Príloha č. 2: Zoznam subdodávateľov

V Žiline, dňa 28.06.2022	V Brne, dňa 18.07.2022
Kupujúci: Ing. Erika Jurinová, predsedníčka, v. r.	Predávajúci: Ing. Jiří Kalvoda, konateľ, v. r.

Príloha č. 1 k Zmluve Špecifikácia a ceny predmetu zmluvy

P.č.	Popis a typ	m.j.	Počet m.j	Cena za m.j. bez DPH	Cena za m.j. s DPH	Cena za položku bez DPH	Cena za položku s DPH
1	MERACIE PRACOVISKO PREPOJENÉ S POČÍTAČOM I DC zdroj GW instek GPD-3303D, Osciloskop Rohde&Schwarz RTB2002, Arbitrárny generátor funkcií GW instek MFG-2120.	ks	17	1 797,00	2 156,40	30 549,00	36 658,80
2	MERACIE PRACOVISKO PREPOJENÉ S POČÍTAČOM II DC zdroj GW instek GPD-3303D, Osciloskop Rohde&Schwarz RTB2002, Arbitrárny generátor funkcií GW instek MFG-2120, Spektrálny analyzér GW instek GSP-730.	ks	2	2 497,00	2 996,40	4 994,00	5 992,80

Cena celkom bez DPH	35.543,00 EUR
Cena celkom s DPH	**42.651,60 EUR**

TR instruments spol. s r.o.
Měřicí přístroje a systémy

Křižíkova 70, 612 00 Brno, Česká republika
Tel.: +420 541 633 670, Fax: +420 541 212 413
E-mail: tri@trinstruments.cz

Programovateľný DC zdroj GW Instek GPD-3303D

DC zdroj GPD-3303D, 3 výstupné kanály, veľký displej, LED indikátor, rozlíšenie 1mV / 1mA, pamäť pre 4 nastavenia, USB ovládanie a inteligentný chladiaci systém.

Technická špecifikácia:

- dva nezávislé výstupy: 2x výstup 0-30V / 0-3A + 1x výstup 2,5 / 3,3 / 5,0V / 0-3A
- 4 x LED displej so zobrazením 2 ¾ číslic
- zvlnenie ≤ 1mVrms (5 Hz až 1 MHz)
- rozlíšenie 1mV / 1mA
- regulácia - odchýlka: „Line“ ≤0,01% + 3 mV; „Load“ ≤0,01% + 3 mV pre prúd ≤3 A
- funkcia hrubého / jemného nastavenia
- 4 pamäte pre nastavenie
- zámok predného panela
- tlačidlo zap. výstupu
- možnosť zapojenia do série/paralelne
- riadené otáčky ventilátora
- ľahké a kompaktné prevedenie
- USB rozhranie
- program pre PC
- LabView ovládač

Podrobnejšiu technickú špecifikáciu zariadenia nájdete od strany č.5 tohto dokumentu.

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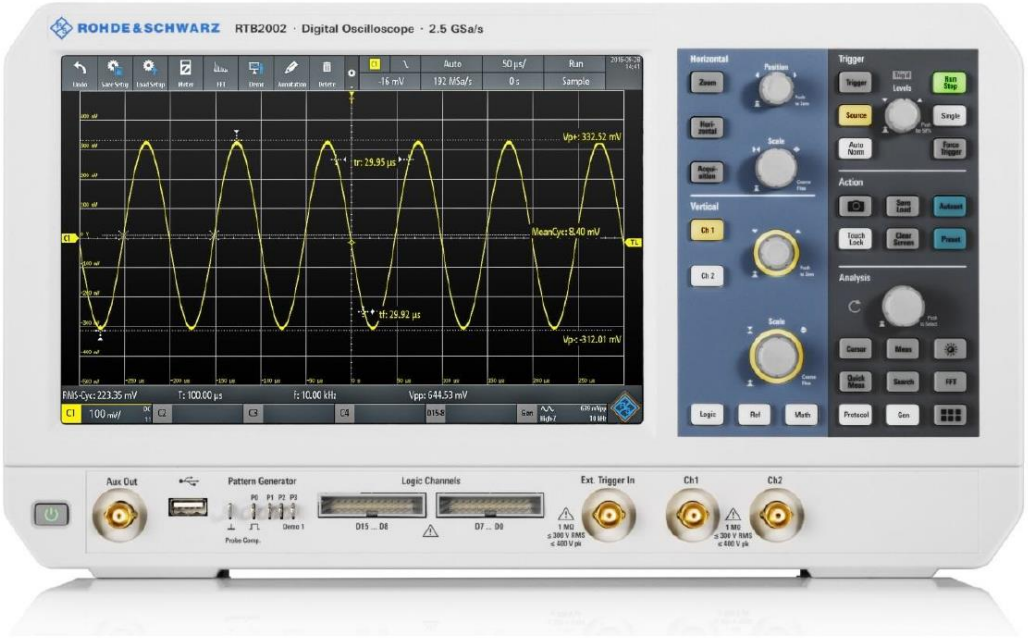
Digitální osciloskop Rohde&Schwarz RTB-2002

Digitálny osciloskop Rohde & Schwarz RTB2002 s 2 kanálmi. Šírka pásma 70 MHz so vzorkovacou rýchlosťou 2,5 GSa/s, 10-bit ADC s rozlíšením 1 mV/div, pamäť 10M bodov, kapacitná dotyková obrazovka 10,1" s rozlíšením 1280x800 px, komunikácia cez USB a LAN.



Technická špecifikácia:

- 2 kanály
- vstupný kanál na externé triggrovanie
- šírka pásma 70 MHz
- vzorkovacia frekvencia 2,5 GSa/s
- dĺžka záznamu 10M bodov na kanál
- 10 bitový A/D prevodník
- rozlíšenie 1 mV/dielik
- impedancia 1 MΩ
- USB port pre ukladanie dát
- možnosť rozšírenia o analýzu I2C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN sériovej komunikácie
- možnosť rozšírenia o 16 kanálový logický analyzátor
- matematické operácie a FFT
- funkcia voltmetra a maskového testu
- 10,1"dotykový displej s rozlíšením 1280x800 px
- Rozhranie USB, LAN
- LabView ovládač
- vzdialené ovládanie cez LAN rozhranie (webový prehliadač)

Podrobnejšiu technickú špecifikáciu zariadenia nájdete od strany č.5 tohto dokumentu.

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Arbitrárny generátor funkcií GW instek MFG-2120

Viackanálový funkčný generátor GW instek MFG-2120 s 1 výstupným kanálom (arbitrárny, funkčný), frekvencia do 20 MHz, vzorkovanie 200 MSa/s, 14 bitové rozlíšenie, navyše 1x 25 MHz pulzný výstup, rozhranie LAN a USB.

Technická špecifikácia:

- Frekvencia kanálu s voliteľným priebehom 1 µHz – 20 MHz
- Generované priebehy: sínus, obdĺžnik, píla, šum vlastné ARB priebehy
- Frekvencia pulzného kanála (generátora) do 25 MHz
- Arbitrárny generátor - vzorkovanie 200 MSa/s, rozlíšenie 14 bitov, 16k bodov pamäti
- Frekvenčné rozlíšenie 1 µHz
- Frekvenčná presnosť ±20 ppm
- Izolované I/O terminály od šasi a zeme
- Generovanie AM, FM, PM, ASK, FSK, PSK, SUM, PWM modulácií
- Generovanie Burstov a frekvenčného rozkmitania (sweep)
- 4,3" farebný LCD displej
- PC softvér pre editáciu ARB priebehov
- Rozhranie USB host, USB device, LAN
- LabView ovládač

Podrobnejšiu technickú špecifikáciu zariadenia nájdete od strany č.5 tohto dokumentu.

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Spektrálny analyzér GW instek GSP-730

Spektrálny analyzátor s rozsahom 150 kHz - 3 GHz, funkcie AutoSet, meranie ACPR/CHPW/OCBW, úroveň šumu < -100dBm, funkcia rozdelených okien, 5,6" TFT LCD displej, rozhranie USB (device/host), RS-232C.

Technická špecifikácia:

- frekvenčný rozsah: 150 kHz – 3 GHz
- maximálna vstupná úroveň signálu +20 dBm až -40 dBm
- úroveň šumu analyzátora: ≤-100 dBm
- SSB fázový šum -85 dBc/Hz
- RBW filter: 30kHz, 100kHz, 300kHz, 1MHz
- meranie ACPR, CHPW, OCBW
- tri stopy v rôznych farbách
- funkcia rozdelenia okien
- funkcia AutoSet
- funkcia limitných čiar
- rozhranie: USB (pre pamäťové médiá/pre pripojenie k PC), RS-232C
- 5,6" TFT LCD displej s VGA výstupom

Podrobnejšiu technickú špecifikáciu zariadenia nájdete od strany č.5 tohto dokumentu.

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Podrobné technické špecifikácie zariadení:

- GW instek GPD-3303D
- Rohde&Schwarz RTB2002
- GW instek MFG-2120
- GW instek GSP-730

MULTIPLE OUTPUT PROGRAMMABLE LINEAR D.C. POWER SUPPLY

GPD-2303S/3303S/4303S
GPD-3303D

CE USB PC Software LabVIEW Driver

FEATURES

- 2,3,and 4 Independent Isolated Output
- 4 LED Display Sets : 3 Digits After Decimal Point (GPD-2303S/3303S/4303S)
- Minimum Resolution : GPD-2303S/3303S/4303S (1mV/1mA) GPD-3303D (100mV/10mA)
- Digital Panel Control (Rotary Encoder Switch, Rubber Key With Indicator)
- User-Friendly Operation, Coarse / Fine Volume Control
- 4 Sets Save / Recall
- Key-Lock
- Output ON/OFF
- Tracking Series and Parallel Mode
- Smart Cooling Fan Achieving Low Noise
- Compact Design
- PC Software & USB Driver
- USB Standard Interface

The GPD-Series contain the superior technology and high quality which GW Instek had established through its long history of power supply design and manufacturing. The GPD-Series offers digital panel control, large display, bright LED indicators, high output resolution, 4 sets of setup memory, USB remote control and smart cooling fan control. Additionally, the GPD-Series provide easy operation, a wide selection of panel settings and the most important for a reasonable price. All these features make the GPD-Series the most promising new comer in the power supply market.

High Resolution

With 1mV/1mA (for GPD-2303S/3303S/4303S) high resolution and coarse/fine volume control the GPD-Series, guarantees clean and stable output. Using the GPD-Series you can easily simulate the device under test's accurate behavior against small changes in voltage or current, which is impossible when using a low resolution power supply.

Tracking Series and Parallel Function

Tracking series and parallel function allows you to use the GPD-Series in wide range of applications. The tracking series mode guarantees higher output voltage, while the tracking parallel mode guarantees higher output current.

Convenience Functions

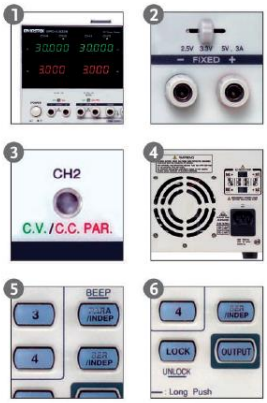
The knobs are digitally controlled, allowing fine or coarse volume setting. The key lock feature locks panel operations, preventing accidental change of the settings which might lead damaging for the equipments.

4 Sets of Save / Recall

The GPD-Series can save and recall panel settings, these feature which can not offered by general power supplies. You can quickly select a panel setting from four memory sets without manual configuration.

USB Remote Control

The USB device port in the GPD-Series allows you to remotely control the power supply according to your application needs.



FUNCTION FEATURES

1. Bright LED display shows settings or actual level of output
2. The independent CH3 output offers three commonly used voltage settings (GPD-3303S/3303D only)
3. C.V./C.C. modes are clearly indicated in different colors
4. Smart cooling fan control offers a well-balanced cooling mechanism, ensuring quiet operation
5. The tracking series and parallel mode can be selected with a single touch
6. Indicators embedded in the keys provide an instant view of the power supply status; the Key Lock feature prevents improper operation

APPLICATIONS

- Laboratories and Educational Facilities
- Product Testing and Quality Assurance
- Service Operation and Post-Sales Support
- Product Development and Debugging

GPD-Series

GW INSTEK
Simply Reliable

SPECIFICATIONS

		GPD-2303S		GPD-3303S			GPD-4303S				GPD-3303D		
OUTPUT	Channel	CH1	CH2	CH1	CH2	CH3	CH1	CH2	CH3	CH4	CH1	CH2	CH3
	Voltage	0~30V	0~30V	0~30V	0~30V	2.5/3.3/5.0V	0~30V	0~30V	0~5V or 5.001V~10V	0~5V	0~30V	0~30V	2.5/3.3/5.0V
	Current	0~3A	0~3A	0~3A	0~3A	0~3A	0~3A	0~3A	0~3A or 0~1A	0~1A	0~3A	0~3A	0~3A
CONSTANT VOLTAGE OPERATION	Regulation	Line regulation ≤ 0.01%+3mV Load regulation ≤ 0.01%+3mV(rating current≤ 3A) ≤ 0.02%+5mV(rating current >3A)											
	Ripple & Noise	≤ 1mVrms (5Hz~1MHz)											
	Recovery Time	≤100 μ S (50%Load change, Minimum load 0.5A)											
	Temp.Coefficient	≤300ppm / ℃											
	Output Range	0 to rating voltage continuously adjustable											
CONSTANT CURRENT OPERATION	Regulation	Line regulation ≤ 0.2%+3mA Load regulation ≤ 0.2%+3mA											
	Ripple Current	≤3mArms											
	Output Range	0 to rating current continuously adjustable											
TRACKING OPERATION	Regulation of PAR.	Line regulation ≤ 0.01%+3mV Load regulation ≤ 0.01%+3mV (rating current≤ 3A) ≤ 0.02%+5mV (rating current >3A)											
	Regulation of SER.	Line regulation ≤ 0.01%+5mV Load regulation ≤ 300mV Tracking error ≤ 0.5%±10mV (10 ~ 30V no load) with load added ≤ 300mV) ≤ 0.5%±30mV (0 ~ 9.99V no load) with load added ≤ 300mV)											
	Tracking error	≤0.5% + 10mV									≤0.5% + 50mV		
METER	Display	Voltage : 4 3/4 digits 0.4" LED Display Current : 3 3/4 digits 0.4" LED Display									Voltage:2 3/4 digits 0.4" LED Display Current:2 3/4 digits 0.4" LED Display		
	Resolution	Voltage : 1mV Current : 1mA									Voltage:100mV Current:10mA		
	Program Accuracy(25±5℃)	Voltage : ±(0.03% of RDG +10 digits) Current : ±(0.3% of RDG +10 digits)									Voltage:±(0.5% of RDG+2 digits) Current:±(0.5% of RDG+2 digits)		
	Readback Aaccuracy(25±5℃)	Voltage : ±(0.03% of RDG +10 digits) Current : ±(0.3% of RDG +10 digits)									Voltage:±(0.5% of RDG+2 digits) Current:±(0.5% of RDG+2 digits)		
CH3 SPECIFICATIONS	Output Voltage	–		(2.5V/3.3V/5V)±8%			0~5V / 5~10V				(2.5V/3.3V/5V)±8%		
	Output Current			3A			0~3A / 0~1A				3A		
	Regulation(25±5℃)			Line regulation ≤ 0.01%+3mV Load regulation ≤ 0.01%+3mV			Line regulation ≤ 0.01%+3mV Load regulation ≤ 0.01%+3mV				Line regulation ≤ 0.01%+3mV Load regulation ≤ 0.01%+3mV		
	Repple & Noise			≤1mVrms(5Hz~1MHz)			≤2mVrms(5Hz~1MHz)				≤1mVrms(5Hz~1MHz)		
KEY LOCK	Yes												
MEMERY SAVE/RECALL	4 sets												
POWER SOURCE	AC100V/120V/220V/230V±10%, 50/60Hz												
DIMENSION & WEIGHT	210(W) x 130 (H) x 265(D) mm ; Approx. 7kg												

Specifications subject to change without notice. PD-0000DGD1DH

ORDERING INFORMATION

GPD-2303S GPD-2303S 2 Channels, 180W Programmable Linear DC Power Supply
GPD-3303S GPD-3303S 3 Channels, 195W Programmable Linear DC Power Supply
GPD-4303S GPD-4303S 4 Channels, 195W Programmable Linear DC Power Supply
GPD-3303D GPD-3303D 3 Channels, 195W Programmable Linear DC Power Supply

ACCESSORIES

User Manual x 1 , Power cord x 1
GPD-2303S Test Lead GTL-104Ax2;European Test Lead GTL-204Ax2, GTL-201Ax1
GPD-3303S Test Lead GTL-104Ax2,GTL-105Ax1;European Test Lead GTL-203Ax1,GTL-204Ax2,GTL-201Ax1
GPD-4303S Test Lead GTL-104Ax2,GTL-105Ax2;European Test Lead GTL-203Ax2,GTL-204Ax2,GTL-201Ax1
GPD-3303D Test Lead GTL-104Ax2,GTL-105Ax1;European Test Lead GTL-203Ax1,GTL-204Ax2,GTL-201Ax1

OPTIONAL ACCESSORIES

GTL-246 USB Cable

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China Subsidiary
GOOD WILL INSTRUMENT (SUHZOU) CO., LTD.
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E-mail: marketing@instek.com.cn

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GW INSTEK
Simply Reliable

www.gwinstek.com

R&S®RTB2000 OSCILLOSCOPE

Specifications

3 year warranty

Data Sheet
Version 13.00

ROHDE&SCHWARZ
Make ideas real

Version 13.00, May 2020

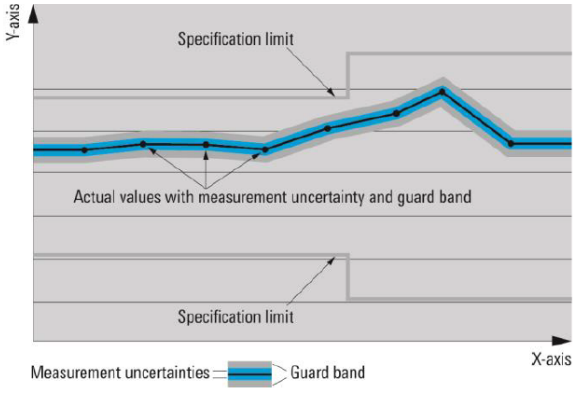
CONTENTS

Definitions

General
Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 20 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

Specifications with limits
Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as <, ≤, >, ≥, ±, or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Specifications without limits
Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)
Characterizes product performance by means of representative information for the given parameter. When marked with <, > or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)
Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)
Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties
Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are indicated as follows: “parameter: value”.

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

Base unit

Vertical system

Input channels	R&S®RTB2002	2 channels
	R&S®RTB2004	4 channels
Input impedance	R&S®RTB2002, R&S®RTB2004	1 MΩ ± 2 % with 9 pF ± 2 pF (meas.)
Analog bandwidth (–3 dB)	R&S®RTB2002 and R&S®RTB2004	> 70 MHz
	R&S®RTB2002 with -B221 option and R&S®RTB2004 with -B241 option	> 100 MHz
	R&S®RTB2002 with -B222 option and R&S®RTB2004 with -B242 option	> 200 MHz
	R&S®RTB2002 with -B223 option and R&S®RTB2004 with -B243 option	> 300 MHz
Lower frequency limit (–3 dB)	at AC coupling	< 2 Hz (meas.)
Analog bandwidth limits (max. –1.8 dB, min. –3.5 dB)	R&S®RTB2002 and R&S®RTB2004	20 MHz
Rise time (10 % to 90 %, calculated)	R&S®RTB2002 and R&S®RTB2004	< 5 ns
	R&S®RTB2002 with -B221 option and R&S®RTB2004 with -B241 option	< 3.5 ns
	R&S®RTB2002 with -B222 option and R&S®RTB2004 with -B242 option	< 1.75 ns
	R&S®RTB2002 with -B223 option and R&S®RTB2004 with -B243 option	< 1.15 ns
Vertical resolution		10-bit, up to 16-bit with high-resolution decimation mode
Invert signal		yes
DC gain accuracy	offset and position = 0, maximum operating temperature change of ±5 °C after self-alignment	
	input sensitivity > 5 mV/div	±1.5 % of full scale
	input sensitivity ≤ 5 mV/div	±2 % of full scale
Offset accuracy		±(0.5 % × |offset| + 0.1 div × input sensitivity + 1 mV)
DC measurement accuracy	after adequate suppression of measurement noise by using high-resolution sampling mode or waveform averaging	±(DC gain accuracy + offset accuracy)
Input coupling		DC, AC, GND
Input sensitivity		1 mV/div to 5 V/div
Maximum input voltage		300 V (RMS), max. 400 V (V_p), derates at 20 dB/decade to 5 V (RMS) above 250 kHz
Position range		±5 div (depends on offset)
Offset range	input sensitivity	
	200 mV/div to ≤ 5 V/div	±(40 V – positon × input sensitivity)
	1 mV/div to < 200 mV/div	±(1.2 V – positon × input sensitivity)
Channel-to-channel isolation (each channel at same input sensitivity)	input frequency < analog bandwidth	> 50 dB

Horizontal system

Timebase range		selectable between 1 ns/div and 500 s/div
Channel deskew		±500 ns
Trigger offset range	min.	memory depth/actual sampling rate
	max.	2^{33}/actual sampling rate
Modes		normal, roll ≥ 50 ms/div
Timebase accuracy	after delivery/calibration, at +23 °C	±2.5 ppm
	during calibration interval	±3.5 ppm

Delta time accuracy	corresponds to time error between two edges on same acquisition and channel; waveform sample rate Fs can be obtained via SCPI command "ACQ:SRAT?"; signal amplitude greater than 5 divisions, measurement threshold set to 50 %, vertical gain 10 mV/div or greater; rise time lower than 4/Fs; waveform acquired in sample mode	±(1.19/Fs + timebase accuracy × |reading|) (peak) (meas.)

Acquisition system

Maximum realtime sampling rate	normal mode	1.25 Gsample/s
	interleaved mode, following channels are not used simultaneously: • channel 1 and channel 2 • channel 3 and channel 4 • logic channels	2.5 Gsample/s
Memory depth per channel	normal	10 Msample per channel
	If following channels are not used simultaneously: • channel 1 and channel 2 • channel 3 and channel 4 • logic channels	20 Msample per channel
Acquisition modes	sample	first sample in decimation interval
	peak detect	largest and smallest sample in decimation interval (800 ps detection)
	high resolution	average value of all samples in decimation interval
	envelope	envelope of acquired waveforms
	average	average over a series of acquired waveforms
	envelope + peak detect	envelope of acquired waveforms with active peak detect
Number of averaged waveforms		2 to 100 000
Waveform acquisition rate	dot display, single channel, auto record length	up to 50 000 waveforms/s

Trigger system

Trigger level	range (min)	±5 div from center of screen
Trigger modes		auto, normal, single, n single with R&S®RTB-K15 option
Hold-off range	time	inactive or 50 ns to 10 s
Trigger types		edge, width, video, pattern, serial bus, timeout, line
Edge trigger	trigger events	rising edge, falling edge, both edges
	sources	
	R&S®RTB2002	channel 1, channel 2, logic channels from D0 to D15 (with R&S®RTB-B1 option), external trigger input
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15 (with R&S®RTB-B1 option), external trigger input
	coupling (analog channels, external trigger input)	DC, AC, HF reject (attenuates > 50 kHz (meas.)), LF reject (attenuates < 50 kHz (meas.)), noise reject (enlarges trigger hysteresis)

Width trigger	trigger events	pulse width is smaller, greater, equal, unequal, inside interval, outside interval
	min. pulse width	6.4 ns
	max. pulse width	13.5 s
	polarity	positive, negative
	sources	
	R&S®RTB2002	channel 1, channel 2, logic channels from D0 to D15 (with R&S®RTB-B1 option)
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15 (with R&S®RTB-B1 option)
Video trigger	trigger events	selectable line, all lines, even frame, odd frame, all frames
	supported standards	PAL, NTSC, SECAM, PAL-M, SDTV 576i, HDTV 720p, HDTV 1080i, HDTV 1080p
	sources	
	R&S®RTB2002	channel 1, channel 2, external trigger input
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, external trigger input
	sync pulse polarity	positive, negative
Pattern trigger	trigger events	logic condition between active channels
	sources	
	R&S®RTB2002	channel 1, channel 2, logic channels from D0 to D15 (with R&S®RTB-B1 option)
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15 (with R&S®RTB-B1 option)
	state of channels	high, low, don't care
	logic between channels	and/or
	condition	true, false
	duration condition	smaller, greater, equal, unequal, inside interval, outside interval, timeout
	min. duration time	6.4 ns
	max. duration time	13.5 s
Serial bus trigger	supported standards	
	R&S®RTB-K1 option	I^2C/SPI (two- and three-wire)
	R&S®RTB-K2 option	UART/RS-232/RS-422/RS-485
	R&S®RTB-K3 option	CAN/LIN
Trigger sensitivity R&S®RTB2002/R&S®RTB2004	with DC, AC, LF reject	
	input sensitivity > 5 mV/div	< 0.8 div (meas.)
	2 mV/div ≤ input sensitivity < 5 mV/div	< 1.5 div (meas.)
	input sensitivity < 2 mV/div	< 2 div (meas.)
	with HF reject	
	all input sensitivities	< 1 div (meas.)
External trigger input	input impedance	
	R&S®RTB2002/R&S®RTB2004	1 MΩ ± 2 % with 9 pF ± 2 pF (meas.)
	maximum input voltage at 1 mΩ	300 V (RMS), max. 400 V (V_p), derates at 20 dB/decade to 5 V (RMS) above 250 kHz
	trigger level	±5 V
	sensitivity	300 mV (V_{pp})
	input coupling	DC, AC, LF reject, HF reject
Trigger output (AUX OUT connector)	functionality	A pulse is generated for every acquisition trigger event.
	output voltage	
	at high impedance	0 V to 4.8 V
	at 50 Ω	0 V to 2.4 V
	pulse polarity	high active
	output delay	depends on trigger settings

Waveform measurements

Automatic measurements	measurements on channels, math waveforms, reference waveforms	burst width, count positive pulses, count negative pulses, count falling edges, count rising edges, mean value, RMS cycle, RMS, mean cycle, peak peak, peak+, peak-, frequency, period, amplitude, top level, base level, positive overshoot, negative overshoot, pulse width+, pulse width-, duty cycle+, duty cycle-, rise time, fall time, delay, phase, crest factor, slew rate+, slew rate-, σ.std. deviation, σ.std. deviation cycle
	measurements on trigger signal	trigger period, trigger frequency implemented by means of six-digit hardware counter
	reference levels	lower, middle and upper level in percentage
	statistics	maximum, minimum, mean, standard deviation and measurement count for each automatic measurement
	number of active measurements	4
Cursor	type	vertical, horizontal, vertical and horizontal, V-marker
	functions	x and y tracking, coupling of cursors, set to trace, set to screen
Quick measurements	function	fast overview of measurements from one channel, some measurements displayed with result lines in diagram
	sources	
	R&S®RTB2002	channel 1, channel 2
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4
	measurements displayed in diagram	mean, max. peak, min. peak, rise time, fall time
	numerically displayed measurements	RMS cycle, peak-to-peak voltage, period, frequency

Digital voltmeter

Accuracy		related to channel settings of voltmeter source
Measurements		DC, AC + DC (RMS), AC (RMS)
Sources	R&S®RTB2002	channel 1, channel 2
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4
Number of measurements		up to 4
Resolution		up to 3 digits
Bandwidth		1 MHz

Frequency counter

Measurements		frequency, period
Sources	R&S®RTB2002	trigger signal source (edge, video): line, channel 1, channel 2, external trigger in
	R&S®RTB2004	trigger signal source (edge, video): line, channel 1, channel 2, channel 3, channel 4, external trigger in
Number of measurements		2
Resolution		6 digits
Frequency range		0. 05 Hz to bandwidth of scope (limited by bandwidth of trigger filter)

Mask testing

Sources	R&S®RTB2002	channel 1, channel 2
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4
Mask definition		acquired waveform with user-defined tolerance, can be stored and restored
Result statistics		completed acquisitions, passed and failed acquisitions (absolute and in percent), test duration
Actions on mask violation		sound, acquisition stop, screenshot, save waveform, pulse out (AUX OUT connector)

Waveform maths

Number of math waveforms		up to 5
Functions		addition, subtraction, multiplication, division, square, square root, absolute value, reciprocal, inverse, log10, ln, derivation, integration
Sources	R&S®RTB2002	channel 1, channel 2, math waveforms 1 to 4
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, math waveforms 1 to 4
FFT	sources	
	R&S®RTB2002	channel 1, channel 2, math waveforms, reference waveform
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, math waveforms, reference waveform
	setup parameters	start frequency, stop frequency, center frequency, frequency span, vertical scale, vertical position, resolution bandwidth, gate (time range and position)
	windows	Hanning, Hamming, Blackman, rectangular, flat top
	waveform arithmetic	none, min. hold, max. hold, average (selectable from 2 to 1024)
	scaling	dBm, dBV, V (RMS)

Search function

Functions	search types	edge, width, peak, rise/fall time, runt, data2clock, pattern, protocol (available with R&S®RTB-K3 option)
	configuration	manual level setting, adjustable hysteresis
	display of search events	in diagram (markers) and in result table
Sources	R&S®RTB2002	channel 1, channel 2, math waveform, D0 to D15 (with R&S®RTB-B1 option)
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, math waveform, D0 to D15 (with R&S®RTB-B1 option)

Display characteristics

Diagram types	manually changeable vertical window size	Yt, XY, zoom, FFT
XY mode		parallel display of XY diagram and Yt diagrams of input signals for X, Y
Zoom		horizontal zoom with fast navigation, split screen with overview signal and zoomed signal
FFT mode		split screen with Yt diagrams and dedicated frequency diagram
Interpolation		sin(x)/x, linear, sample & hold
Waveform display		lines, dots only
Persistence		50 ms to 12.8 s, infinite
Special display mode		inverse brightness, waveform color modes for analog channels (temperature, fire, rainbow)
Diagram grid		lines, reticle, none, with annotation, track grid
Reference signals		up to 4 reference signals
Sources		analog and digital channels, math, reference, spectrum

Protocol and logic

Bus decode	number of bus signals	2 [1]
	bus types	parallel, parallel clocked
	R&S®RTB-K1 option	SPI (2-wire, 3-wire, 4-wire [1]), I^2C
	R&S®RTB-K2 option	UART/RS-232/RS-422/RS-485
	R&S®RTB-K3 option	CAN, LIN
	display types	decoded bus, logical signal, frame table (depends on decoded bus)
	data format of decoded bus	hex, decimal, binary

Miscellaneous

Save/recall	device settings	save and recall on internal file system or USB flash drive or on a PC via web interface or USB-MTP (media transfer protocol)
	reference waveforms	save and recall on internal file system or USB flash drive or on a PC via web interface or USB-MTP
	waveforms	save on USB flash drive or download and save on a PC via web interface or USB-MTP; available file formats: BIN, CSV, TXT float (MSB/LSB first)
	screenshots	save on USB flash drive or download and save on a PC via web interface or USB-MTP; available file formats: BMP, PNG
Camera button (one touch)		configurable button, actions on press: • save device settings (setup) • save waveforms • save screenshot • search/bus/statistic results
Instrument security		secure erasure of internal file system and all settings

[1] If a bidirectional bus is used (e.g. UART RX/TX or SPI MOSI/MISO), two bus decoders are occupied.

Menu languages		available menu languages: • English • German • French • Spanish • Italian • Portuguese • Czech • Polish • Russian • Simplified Chinese • Traditional Chinese • Korean • Japanese
Help		online help, available languages: • English
Undo/redo		undo/redo function

Input and outputs

Front		
Channel inputs		BNC, for details see Vertical system
External trigger input		BNC, for details see Trigger system
AUX OUT (BNC)	trigger out	for details see Trigger system
	reference frequency	10 MHz ± 3.5 ppm (meas.)
	mask violation	pulse
	waveform generator (with R&S®RTB-B6 option only)	for details see Waveform generator
Probe compensation output	signal shape rectangle	V_{low} = 0 V, V_{high} = 2.5 V (meas.)
	frequency	1 kHz during probe adjust setup or manual configurable
Pattern source (with R&S®RTB-B6 option only)	P3 to P0 (with R&S®RTB-B6 option only)	4 lugs, for details see 4-bit pattern generator
Digital channel inputs	D15 to D8, D7 to D0	with R&S®RTB-B1 option only
Ground lug		connected to ground
USB host interface		1 port, type A plug, version 2.0, memory sticks only
Rear		
USB device interface		1 port, type B plug, version 2.0
Ethernet interface		1 port, 1 Gbit
Security slot		for standard Kensington style lock
Fixation loop		for securing the instrument with a cable

General data

Display		
Type		10.1" WXGA display with capacitive touch
Resolution		1280 × 800 pixel (WXGA)
Temperature		
Temperature loading	operating temperature range	0 °C to +50 °C
	storage temperature range	–40 °C to +70 °C
Climatic loading		+25 °C/+40 °C at 85 % rel. humidity cyclic, in line with IEC 60068-2-30
Altitude		
Operating		up to 3000 m above sea level
Nonoperating		up to 4600 m above sea level
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 150 Hz, max. 1.8 g at 55 Hz; 0.5 g from 55 Hz to 150 Hz, in line with EN 60068-2-6 MIL-PRF-28800F, 4.5.5.3.2 sinusoidal vibration, class 3 and 4
	random	10 Hz to 300 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64, MIL-PRF-28800F, 4.5.5.3.1 random vibration, class 3 and 4
Shock		40 g shock spectrum, in line with MIL-STD-810E, method no. 516.4, procedure I, MIL-PRF-28800F, 4.5.5.4.1 functional shock, 30 g, 11 ms, halfsine
Maximum of sound pressure level		28.3/30.2 dB (A) at 1.0/0.8 m distance (at +23 °C, 947 mbar (hPa), 20 % rel. humidity), in line with ISO EN 3744
EMC		
RF emission		in line with CISPR 11/EN 55011 group 1 class A (for a shielded test setup); the instrument complies with the emission requirements stipulated by EN 55011, EN 61326-1 and EN 61326-2-1 class A, making the instrument suitable for use in industrial environments
Immunity		in line with IEC/EN 61326-1 table 2, immunity test requirements for industrial environments [2]
Certifications		VDE, $_{C}$CSA$_{US}$
Calibration interval		1 year
Power supply		
AC supply		100 V to 240 V at 50 Hz to 400 Hz, 0.95 A to 0.5 A
Power consumption		max. 60 W
Safety		in line with IEC 61010-1, EN 61010-1, CAN/CSA-C22.2 No. 61010-1-04, UL 61010-1
Power consumption in stand-by		0.5 W (meas.)
Mechanical data		
Dimensions	W × H × D	390 mm × 220 mm × 152 mm (15.4 in × 8.66 in × 5.98 in)
Weight	(nom.)	2.5 kg (5.5 lb)

[2] Test criterion is displayed noise level within ±1 div for input sensitivity of 5 mV/div.

Options

R&S®RTB-B1

Mixed signal option, additional 16 logic channels		
Vertical system		
Input channels		16 logic channels (D15 to D0)
Arrangement of input channels		arranged in two logic probes with 8 channels each, assignment of the logic probes to the channels D15 to D8 and D7 to D0
Input impedance		100 kΩ ± 2 % || ~4 pF (meas.) at probe tips
Maximum input frequency	signal with minimum input voltage swing and hysteresis setting: normal	300 MHz (meas.)
Maximum input voltage		±40 V (V_p)
Minimum input voltage swing	hysteresis small	300 mV (V_{pp}) (meas.)
	hysteresis medium	800 mV (V_{pp}) (meas.)
	hysteresis large	1500 mV (V_{pp}) (meas.)
Threshold groups		D15 to D8 and D7 to D0
Threshold level	range	–2 V to 8 V in 10 mV steps
	predefined	CMOS 5.0 V, CMOS 3.3 V, CMOS 2.5 V, TTL, ECL
Threshold accuracy		±(100 mV + 3 % of threshold setting) (meas.)
Comparator hysteresis		small, medium, large
Horizontal system		
Channel-to-channel skew		max. 800 ps (meas.)
Acquisition system		
Sampling rate		1.25 Gsample/s for every channel
Memory depth		10 Msample for every channel
Trigger system		see Trigger system
Waveform measurements		
Measurement sources		all channels from D15 to D0
Automatic measurements		positive pulse width, negative pulse width, period, frequency, burst width, delay, phase, positive duty cycle, negative duty cycle, positive pulse count, negative pulse count, rising edge count, falling edge count, value at the cursor position
Additional cursor function		display of decoded parallel bus value at the cursor position
Display characteristics		
Channel activity display		independent of the scope acquisition, the state (stays low, stays high or toggles) of the channels from D15 to D0 is displayed

R&S®RTB-B6

Waveform generator and 4-bit pattern generator		
Waveform generator		
Resolution		14-bit
Sample rate		250 Msample/s
Amplitude	level	
	high Z	20 mV to 5 V (V_{pp})
	50 Ω	10 mV to 2.5 V (V_{pp})
	accuracy	3 %
DC offset	level	
	high Z	±2.5 V
	50 Ω	±1.25 V
	accuracy	3 % or ± 5 mV whatever is greater
Sine	frequency	0.1 Hz to 25 MHz
	SFDR	> 40 dBc (meas.)
	THD	> 40 dBc (meas.)
Rectangle	frequency	0.1 Hz to 10 MHz
Pulse	frequency	0.1 Hz to 10 MHz
	edge time	adjustable
	duty cycle	1 % to 99 %
Ramp, triangle, sinc, exponential	frequency	0.1 Hz to 1 MHz
Arbitrary	sample rate	max. 10 Msample/s
	memory depth	16k points
Noise	bandwidth	max. 25 MHz
	level	0 % to 100 % of signal amplitude
Modulation	AM	
	function	sine, rectangle, triangle, ramp
	frequency	0.1 Hz to 1 MHz
	depth	0 % to 100 %
	FM	
	function	sine, rectangle, triangle, ramp
	frequency	0.1 Hz to 1 MHz
	deviation	depends on modulation frequency
	ASK	
	function	sine, rectangle, triangle, ramp
	frequency	0.1 Hz to 1 MHz
	ASK depth	0 % to 100 %
	FSK	
	function	sine, rectangle, triangle, ramp
	frequency	0.1 Hz to 1 MHz
	FSK rate	0.1 Hz to carrier frequency/2
Sweep	start frequency	1 Hz to 25 MHz
	stop frequency	1 Hz to 25 MHz
	sweep time	1 ms to 10 s
	sweep type	linear, logarithmic, triangle
Burst	number of cycle	1 to 1024
	idle time	28 ns to 17 s
	start phase	0° to 360°
	trigger	continuous, manually
4-bit pattern generator		
Functions		probe adjust/square wave, bus signal source 4-bit counter, programmable 4-bit pattern
Probe adjust		1 kHz/1 MHz square wave signal approx. 2.5 V (V_{pp}) (tr < 4 ns)
Bus signal source		SPI, I^2C, UART, CAN, LIN
	bandwidth	9600 bit/s to 1 Mbit/s
4-bit counter	frequency	1 mHz to 25 MHz
Programmable pattern	sample rate	20 ns to 1 s, up/down
	memory depth	2048 bit
	pattern idle time	50 ns to 1 s

R&S®RTB-Bxx bandwidth upgrades

Option	Model	Analog bandwidth upgrade from 70 MHz to
R&S®RTB-B221	R&S®RTB2002	100 MHz
R&S®RTB-B222	R&S®RTB2002	200 MHz
R&S®RTB-B223	R&S®RTB2002	300 MHz
R&S®RTB-B241	R&S®RTB2004	100 MHz
R&S®RTB-B242	R&S®RTB2004	200 MHz
R&S®RTB-B243	R&S®RTB2004	300 MHz

R&S®RTB-K1

I²C triggering and decoding		
Bus configuration	sources for SCL and SDA	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15
	bit rate	up to 10 Mbps
	size of address	7 bit or 10 bit
	size of data	8 bit
	label list	associate frame identifier with symbolic ID
Trigger	trigger events	start, stop, restart, missing acknowledge, address (7 bit or 10 bit), data, address and data
	offset for trigger on data	0 data byte to 4095 data byte
	data pattern width	up to 3 sequential data byte
Decode	displayed signals	bus signal, logic signal or both
	color coding of bus signal	address, data, start, stop, ACK, NACK; error and trigger event are displayed in different colors
	displayed format of address	hex
	displayed format of data	ASCII, binary, decimal or hex
SPI triggering and decoding		
Bus configuration	sources for CS, CLK, MOSI and MISO	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15
	bit rate	up to 25 Mbps
	chip select (CS)	active low, active high or missing (two-wire SPI)
	clock (CLK) slope	rise or fall
	data symbol size	1 bit to 32 bit
	idle time for two-wire SPI	< 1 ms
Trigger	trigger events	start of frame, end of frame, bit number, data pattern
	selectable bit number	0 to 4095
	offset for trigger on data pattern	0 to 4095 bit
	data pattern size	1 bit to 32 bit
Decode	displayed signals	bus signal, logic signal or both
	color coding of bus signal	data, start, stop; error and trigger event are displayed in different colors
	displayed format of data	ASCII, binary, decimal or hex
	data decoding	MSB or LSB first

R&S®RTB-K2

UART/RS-232/RS-422/RS-485 triggering and decoding		
Bus configuration	source for RX and TX	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15
	bit rate	300/600/1200/2400/4800/9600/19200/ 38400/57600/115200 bps or user-selectable up to 3 Mbps
	end of frame	timeout, none
	signal polarity	idle low, idle high
	data symbol size	5 bit to 9 bit
	parity	none, even or odd
	stop bits	1, 1.5 or 2
Trigger	trigger events	start bit, start of frame, symbol number, any symbol, pattern of symbols, parity error, frame error, break
	offset for trigger on data symbol	0 to 4095 symbols
	data symbol pattern width	1 to floor (32/symbol size) symbols
Decode	displayed signals	bus signal, logic signal or both
	color coding of bus signal	data, start, stop; error and trigger event are displayed in different colors
	displayed format of data	ASCII, binary, decimal or hex

R&S®RTB-K3

CAN triggering and decoding		
Bus configuration	signal type	CAN_H, CAN_L
	sources	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15
	bit rate	10/20/33.3/50/83.3/100/125/250/500/ 1000 kbps or user-selectable in range from 100 bps to 2 Mbps
	sampling point	10 % to 90 % within bit period
	label list	associate frame identifier with symbolic ID
Trigger	trigger events	start of frame, frame type, identifier, identifier + data, error condition (any combination of CRC error, bit stuffing error, form error and ACK error)
	identifier setup	frame type (data, remote or both), identifier type (11 bit or 29 bit); condition =, ≠, >, <; identifier selectable from label list
	data setup	data pattern up to 8 byte (hex or binary); condition =, ≠, >, <
Decode	displayed signals	bus signal, logic signal or both
	color coding of bus signal	start of frame, identifier, DLC, data payload, CRC, ACK, end of frame, error frame, overload frame, CRC error, bit stuffing error, ACK error
	displayed format of data	hex, decimal, binary, ASCII
	frame table	decode results displayed as tabulated list, errors highlighted in red; three table positions (top, bottom, full screen); frame navigation; data export as CSV file

Search	search events	frame, error, identifier, identifier + data, identifier + error
	frame event setup	start of frame, end of frame, overload frame, error frame, data ID 11 bit, data ID 29 bit, remote ID 11 bit, remote ID 29 bit
	error event setup	any combination of CRC error, bit stuffing error, form error and ACK error
	identifier setup	frame type (data, remote or both), identifier type (11 bit or 29 bit); condition =, ≠, >, <; identifier selectable from label list
	data setup	data pattern up to 8 byte (hex or binary); condition =, ≠, >, <
	event table	search results displayed as tabulated list; event navigation

LIN triggering and decoding		
Bus configuration	version	1.3, 2.x or SAE J602; mixed traffic is supported
	bit rate	1.2/2.4/4.8/9.6/10.417/19.2 kbps or user-selectable in range from 1 kbps to 2.5 Mbps
	polarity	active high or active low
	label list	associate frame identifier with symbolic ID
Trigger	source	any input channel
	trigger events	start of frame (sync break), identifier, identifier + data, wakeup frame, error condition (any combination of checksum error, parity error and sync field error)
	identifier setup	range from 0d to 63d; condition =, ≠, >, <; identifier selectable from label list
	data setup	data pattern up to 8 byte (hex or binary); condition =, ≠, >, <
Decode	displayed signals	bus signal, logic signal or both
	color coding of bus signal	frame, frame identifier, parity, data payload, checksum, error condition
	displayed format of data	hex, decimal, binary, ASCII
	frame table	decode results displayed as tabulated list, errors highlighted in red; three table positions (top, bottom, full screen); frame navigation; data export as CSV file
Search	search events	frame, error, identifier, identifier + data, identifier + error
	frame event setup	start of frame, wake up
	error event setup	any combination of checksum error, parity error and sync field error
	identifier setup	range from 0d to 63d; condition =, ≠, >, <; identifier selectable from label list
	data setup	data pattern up to 8 byte (hex or binary); condition =, ≠, >, <
	event table	search results displayed as tabulated list; event navigation

R&S®RTB-K15

History and segmented memory				
Memory segmentation	function	additional memory segments for the acquisition		
	number of segments [3]	record length	segments (up to)	total memory (per channel)
		10 ksample	13 107	131 Msample
		20 ksample	13 107	262 Msample
		50 ksample	4 369	218 Msample
		100 ksample	2 621	262 Msample
		200 ksample	1 456	291 Msample
		500 ksample	624	312 Msample
		1 Msample	319	319 Msample
		2 Msample	159	318 Msample
		5 Msample	64	320 Msample
		10 Msample	32	320 Msample
		20 Msample	16	320 Msample
	Segmentation is active on all analog and logic channels, protocol decoding and spectrum analysis.			
Fast-segmented mode	continuous recording of waveforms in acquisition memory without interruption due to visualization; blind time between consecutive acquisitions less than 2.5 µs (up to 300 000 waveforms/s)			
History mode	function	The history mode always provides access to past acquisitions in the segmented memory.		
	timestamp resolution	6.4 ns		
	history player	replays the recorded waveforms; start and stop waveform could be set; repetition possible		

R&S®RTB-K36

Frequency response analysis – Bode plot (does not require R&S®RTB-B6 option)		
Stimulus	frequency mode	single sweep or repeated sweep
	frequency range	10 Hz to 25 MHz
	amplitude mode	fixed or amplitude profile
	amplitude level	20 mV to 5 V into high Z
		10 mV to 2.5 V into 50 Ω
Input and output sources	R&S®RTB2002	channel 1, channel 2
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4
Number of test points		10 points to 500 points per decade
Dynamic range		typ. > 70 dB based on 0 dBm (630 mV (V_{pp}) into 50 Ω, gain noise < 1 dB, phase noise < 5°)
Measurement		dual pair of tracking gain and phase cursors
Diagram types	manually changeable vertical window size	parallel display of result window and input and output signal view
Result table		navigation and export functions
Scaling	during and after test	auto-scale and manual scaling and positioning

[3] In interleaved mode.

Ordering information

Designation	Type	Order No.
Choose your R&S®RTB2000 base model		
Oscilloscope, 70 MHz, 2 channels	R&S®RTB2002	1333.1005.02
Oscilloscope, 70 MHz, 4 channels	R&S®RTB2004	1333.1005.04
Base unit (including standard accessories: R&S®RT-ZP03 passive probe per channel, power cord, getting started manual and safety instructions)		
Choose your bandwidth upgrade		
Upgrade of R&S®RTB2002 oscilloscopes to 100 MHz bandwidth	R&S®RTB-B221	1333.1163.02
Upgrade of R&S®RTB2002 oscilloscopes to 200 MHz bandwidth	R&S®RTB-B222	1333.1170.02
Upgrade of R&S®RTB2002 oscilloscopes to 300 MHz bandwidth	R&S®RTB-B223	1333.1186.02
Upgrade of R&S®RTB2004 oscilloscopes to 100 MHz bandwidth	R&S®RTB-B241	1333.1257.02
Upgrade of R&S®RTB2004 oscilloscopes to 200 MHz bandwidth	R&S®RTB-B242	1333.1263.02
Upgrade of R&S®RTB2004 oscilloscopes to 300 MHz bandwidth	R&S®RTB-B243	1333.1270.02
Choose your options		
Mixed signal option for non-MSO models, 300 MHz	R&S®RTB-B1	1333.1105.02
Arbitrary waveform generator	R&S®RTB-B6	1333.1111.02
I^2C/SPI serial triggering and decoding	R&S®RTB-K1	1333.1011.02
UART/RS-232/RS-422/RS-485 serial triggering and decoding	R&S®RTB-K2	1333.1028.02
CAN/LIN serial triggering and decoding	R&S®RTB-K3	1333.1034.02
History and segmented memory	R&S®RTB-K15	1333.1040.02
Frequency response analysis (Bode plot)	R&S®RTB-K36	1335.8007.02
Application bundle, consists of the following options: R&S®RTB-K1, R&S®RTB-K2, R&S®RTB-K3, R&S®RTB-K15, R&S®RTB-K36, R&S®RTB-B6	R&S®RTB-PK1	1333.1092.02
Choose your additional probes		
Single-ended passive probes		
300 MHz, 10 MHz, 10:1/1:1, 10 MΩ/1 MΩ, 400 V, 12 pF/82 pF	R&S®RT-ZP03	3622.2817.02
500 MHz, 500 MHz, 10:1, 300 V (RMS), 10 pF	R&S®RT-ZP05	3623.2927.02
500 MHz, 10 MΩ, 10:1, 400 V, 9.5 pF	R&S®RTM-ZP10	1409.7708.02
38 MHz, 1 MΩ, 1:1, 55 V, 39 pF	R&S®RT-ZP1X	1333.1370.02
High-voltage single-ended passive probes		
250 MHz, 100:1, 100 MΩ, 850 V, 6.5 pF	R&S®RT-ZH03	1333.0873.02
400 MHz, 100:1, 50 MΩ, 1000 V, 7.5 pF	R&S®RT-ZH10	1409.7720.02
400 MHz, 1000:1, 50 MΩ, 1000 V, 7.5 pF	R&S®RT-ZH11	1409.7737.02
High voltage probes: passive		
25 MHz, 8 MΩ, 2.75 pF, 10:1/100:1, ±700 V, 1000 V (RMS) CAT III	R&S®RT-ZD002	1337.9700.02
25 MHz, 8 MΩ, 2.75 pF, 20:1/200:1, ±1400 V, 1000 V (RMS) CAT III	R&S®RT-ZD003	1337.9800.02
Current probes		
20 kHz, AC/DC, 10 A/1000 A	R&S®RT-ZC02	1333.0850.02
100 kHz, AC/DC, 30 A	R&S®RT-ZC03	1333.0844.02
10 MHz, AC/DC, 150 A	R&S®RT-ZC10	1409.7750.02
100 MHz, AC/DC, 30 A	R&S®RT-ZC20	1409.7766.02
120 MHz, AC/DC, 5 A	R&S®RT-ZC30	1409.7772.02
Power supply for current probes	R&S®RT-ZA13	1409.7789.02
Active differential probes		
100 MHz, 1000:1/100:1, 8 MΩ, 1000 V (RMS), 3.5 pF	R&S®RT-ZD01	1422.0703.02
200 MHz, 10:1, 1 MΩ, 20 V diff., 3.5 pF	R&S®RT-ZD02	1333.0821.02
Logic probes		
Active 8 channel logic probe	R&S®RT-ZL03	1333.0715.02
Probe accessories		
Feedthrough termination 50 Ω	R&S®HZ22	3594.4015.02
Probe pouch	R&S®RT-ZA19	1335.7875.02
Choose your accessories		
Front cover	R&S®RTB-Z1	1333.1728.02
Soft case	R&S®RTB-Z3	1333.1734.02
Transit case	R&S®RTB-Z4	1335.9290.02
Rackmount kit	R&S®ZZA-RTB2K	1333.1711.02

Warranty		
Base unit and passive probes that are included as standard accessories		3 years
All other items [4]		1 year
Options		
Extended warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	

Extended warranty with a term of one and two years (WE1 and WE2)
Repairs carried out during the contract term are free of charge [5]. Necessary calibration and adjustments carried out during repairs are also covered.

Extended warranty with calibration coverage (CW1 and CW2)
Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs [5] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

Extended warranty with accredited calibration (AW1 and AW2)
Enhance your extended warranty by adding accredited calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated under accreditation, inspected and maintained during the term of the contract. It includes all repairs [5] and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

[4] For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.
[5] Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

Service that adds value

- Worldwide
- Local und personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

Rohde&Schwarz

The Rohde&Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Sustainable product design

- Environmental compatibility and eco-footprint
- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

Rohde&Schwarz training

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Rohde&Schwarz customer support

www.rohde-schwarz.com/support

PD 3607.4270.22 | Version 13.00 | May 2020 (sk)
R&S®RTB2000 Oscilloscope

MFG-2000 Series

Dual Channel Arbitrary Function Generator

FEATURES

- Maximum Five Output Channels
  - * 2 Equivalent Performance Arbitrary Channels Frequency : 1μHz~10/20/30/60MHz
  - * RF Channel Frequency (FG/ARB/MOD) : 160/320MHz
  - * Pulse Generator Frequency : 25MHz
  - * Power Amplifier : Low Frequency, 100kHz, Output 20W
- True Point by Point Output Arbitrary Waveform Function : 200MSa/s, 100MHz Repetition Rate, 14-bit Resolution,16k Point Memory Depth
- Earth Ground Isolation Design Among I/O Terminals and Instrument Chassis
- Frequency Counter : 150MHz, 8 bits
- AM/FM/PM/ASK/FSK/PSK/SUM/PWM Modulation
- USB Host/USB Device/LAN (MFG-22XX only)
- 4.3 Inch TFT Color Display

GW INSTEK
Simply Reliable

GW Instek rolls out the MFG-2000 series multi-channel function generator, which has up to 5 simultaneous output channels, including CH1 and CH2 equivalent performance dual channel arbitrary function generator with the maximum 60MHz for both channels; RF signal generator, a standard AFG, which produces the maximum 320MHz sine wave and various modulation RF signals; pulse generator, whose frequency reaches 25MHz; power amplifier, which is ideal for audio range. The above-mentioned five different functionality channels are separately or totally allocated on 10 models, which extend from the basic single-channel AFG with pulse generator models to five-channel models so as to satisfy various educational and industrial applications.

The AFG channel of the MFG-2000 series outputs sine, square, and triangle, etc. The series features true point by point output arbitrary waveform characteristics of 200 MHz sample rate, 100MHz waveform repetition rate, 14 bit resolution, and 16k point memory depth. Some models provide various modulation methods such as AM/FM/PM/FSK/PWM, Sweep, Burst, Trigger, 150MHz Frequency Counter. Synchronized dual channel models provide correlated functions, including synchronization, delay, sum, and coupling. RF signal generator, a complete AFG signal source (including ARB), features various modulations, Sweep, and digital modulations such as ASK and PSK and its sine wave frequency is up to 320MHz. A full-function pulse generator with 25 MHz is equipped to all models and its pulse width, rise edge time, fall edge time are adjustable that can be applied as trigger signals. Independent input/output power amplifier with 20W, 10dB, DC-100KHz bandwidth, and distortion less than 0.1% can be applied to the audio application.

The overall design of the MFG-2000 series is earth ground isolation among output/input terminals and instrument chassis that can only be found in high-level signal sources. The output channels can sustain maximum isolation voltage up to ±42Vpk (DC+ AC peak value) to earth ground that is ideal for floating circuit tests. Multi-unit outputs can be executed without factoring in grounding reference issue. There is no additional isolation requirement for experiments such as "full-wave rectification" and "voltage doubler" which are easy and safe. An external power supply can bring up the DC bias voltage to ±42Vpk to meet the requirements of higher DC bias voltage such as automotive and educational applications.

The AFG of the MFG-2000 series collocating with AWES (Arbitrary Waveform Editing Software) allows users to easily and quickly edit arbitrary waveforms. DWR (Direct Waveform Reconstruction) allows users to collocate with GDS series digital oscilloscopes to retrieve waveforms and upload them to arbitrary generator to achieve direct waveform reconstruction. 66 built-in waveforms allow users to edit arbitrary waveforms and to output the whole segment or divided segments.

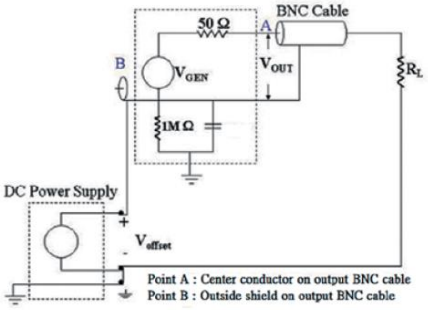
With the multi-functionality channels, the MFG-2000 series provides different industrial sectors with special dual channel waveforms, IQ modulation signals, low-frequency vibration simulation, automotive sensors, AM/FM broadcast signals, PWM motor or fan control signals, pulse synchronized signals, pulse noise, audio circuit or devices such as speaker tests. The series is ideal for various fields, including scientific research, education, research and development, production and quality control.

The MFG-2000 series can maximally and simultaneously output five functional channels. The functionalities of each channel are as follows:

Channel 1	1uHz-60MHz max. FG With 200MSa/s ARB	AM ,FM ,PM,FSK PWM ,Sweep ,Burst , Trigger, Frequency Counter	
Channel 2			
RF Channel	1uHz-320MHz max. FG With 200MSa/s ARB		ASK,PSK
Pulse Generator	**25MHz Full Function pulse Generator** (Frequency /Width/duty Cycle /Rise and Fall Edge adjustable)		
Power Amplifier	**20W Power Amplifier** (20W (RL=8Ω)/20dB/DC-100kHz/<0.1% (Ampl >1Vpp 20Hz~20kHz)		

PANEL INTRODUCTION

A. CIRCUIT DESIGN FOR GROUND ISOLATION AMONG OUTPUT/INPUT TERMINALS AND INSTRUMENT CHASSIS

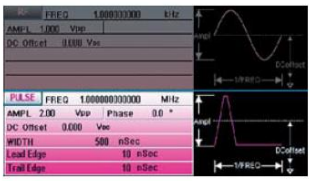


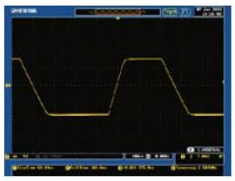
Connection diagram for MFG connecting with a power supply to increase D.C. bias voltage to ±42Vpk (DC+ AC peak value).

Output channels, synchronization and modulation input/output connector grounding are isolated from instrument chassis. These connectors can sustain maximum isolation voltage up to ±42Vpk (DC+ AC peak value) to earth ground that is ideal for floating circuit tests. Multi-unit outputs can be executed without factoring in grounding reference issue.

The built-in DC bias voltage of the MFG-2000 series can be applied on various waveforms. The DC bias voltage is ±5V under 50 ohm load. An external power supply can be used to bring up the DC bias voltage to ±42Vpk (DC+ AC peak value) for higher DC bias applications.

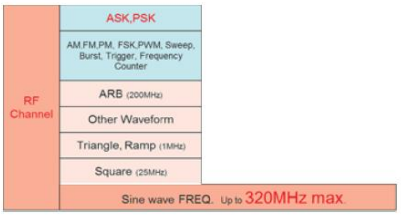
B. PULSE GENERATOR





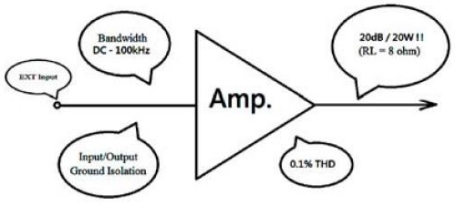
Each model of the series has a built-in pulse generator and its output frequency reaches 25 MHz. Users can set pulse width, duty cycle, rise edge time, and fall edge time to support trigger signal.

C. RF SIGNAL GENERATOR

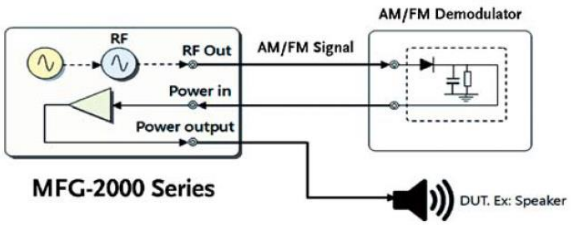


RF signal generator is a full function AFG signal source. Identical to CH1/CH2, it can output sine, square, ramp, pulse, noise, etc. Its sine wave frequency reaches 160MHz or 320MHz. And its true point by point output arbitrary waveform function supports 200 MHz sample rate, 100MHz waveform repetition rate, 14 bit resolution, 16k point memory depth, frequency sweep and various modulation methods such as AM/FM/PM/FSK/PWM/PSK/ASK. RF signal generator can be applied as a high frequency arbitrary waveform generator, simulated signals of analog or digital broadcast stations or carrier signals of local oscillator.

D. POWER AMPLIFIER

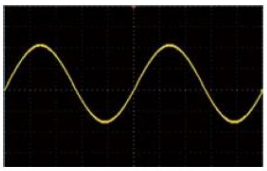


20W/20dB power amplifier, which has a bandwidth of DC ~ 100KHz and less than 0.1% distortion. The low frequency power amplifier can be applied as an audio amplifier or a driver amplifier for piezoelectric components (collocating with an impedance transformer, 20W output) and conducts power component characteristics tests, magnetization characteristics tests (B-H curve) of magnetic materials such as ferrite and amorphous materials (collocating with an impedance transformer, 20W output)

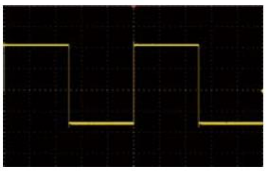


Users can connect a speaker with the low frequency power amplifier of the MFG-2000 series to realize various physics experiments.

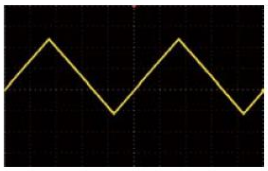
E. VERSATILE OUTPUT WAVEFORM SELECTIONS



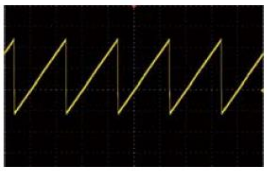
Sine



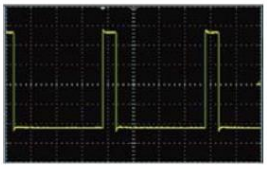
Square



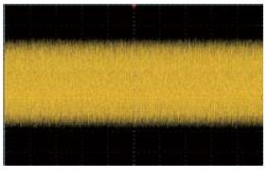
Triangle



Ramp



Pulse



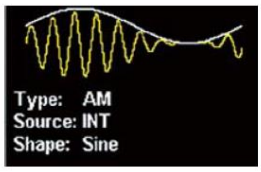
Noise

DC Voltage

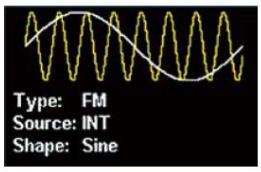
Arbitrary Waveform

There are standard waveforms for the series such as sine, square, triangle, ramp, pulse, noise, DC voltage. In addition, 66 built-in waveforms allow users to easily select desired waveforms.

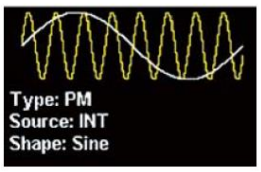
F. VARIOUS MODULATION FUNCTION



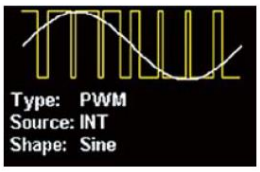
Amplitude Modulation



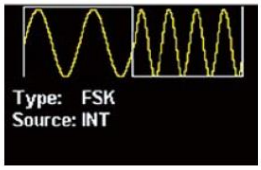
Frequency Modulation



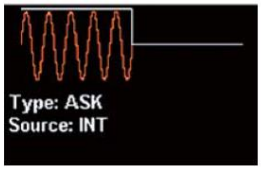
Phase Modulation



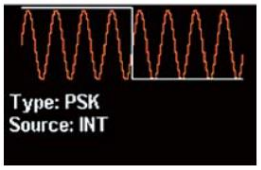
Pulse Width Modulation



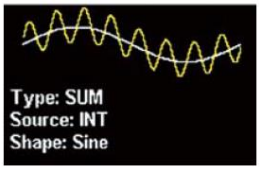
Frequency-shift Keying Modulation



Amplitude-shift Keying Modulation



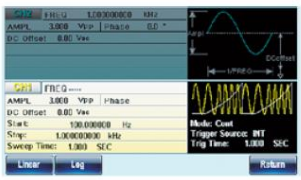
Phase- Shift Keying Modulation

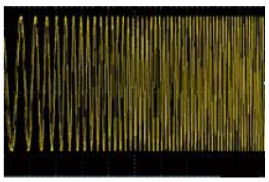


Sum Modulation

The series supports AM, FM, PM, FSK, PWM and SUM modulation. RF channel not only has the above-mentioned modulation capabilities but also supports advanced modulations such as ASK and PSK Modulation. The most modulation sources can be internal or external. Applications include communications systems' base band, motor control and light adjustment.

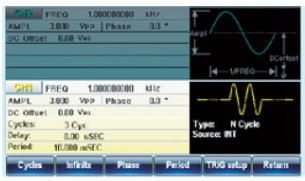
G. SWEEP FUNCTION

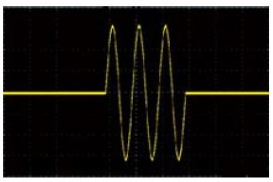




The series supports frequency sweep and amplitude sweep that can also integrate other functions, including linear/logarithm, one-way (saw tooth)/two-way (triangle) waveforms, continuous/ single trigger/gated trigger to meet various application requirements by different sweep methods. Frequency sweep carries out tests on the frequency response of electronic components such as filter and low frequency amplifier.

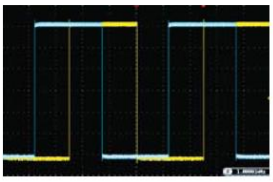
H. BURST FUNCTION



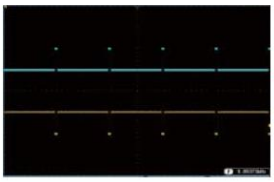


The series supports N-period or gated trigger. Phase angle, duration time, frequency, waveform infinite can be adjusted to meet non-continuous output applications.

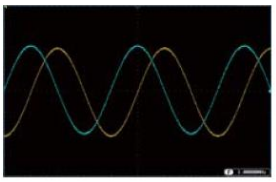
I. THE OUTPUT CORRELATED FUNCTIONS OF EQUIVALENT PERFORMANCE DUAL CHANNEL



Differential Signal



Sine and Cosine Signal

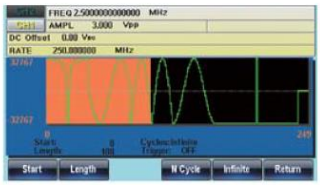


Square Wave Phase Setting

The CH1 and CH2 of MFG-2203M/2206M/2260MFA/2260MRA can be applied separately. These two channels provide four correlated functions, including sum, coupling, tracking and phase.

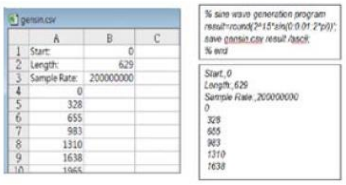
* The coupling function allows users to freely set ratio and offset values for frequency and amplitude of both channels to realize that all parameters are simultaneously effective for both channels. The measurement of the Third-Order Intercept Point for an amplifier and the simulations of two different frequency oscillators outputting signals are two applied examples for coupling function.
* The tracking function can produce 180 degree phase offset differential signals with same frequency and amplitude.
* The phase function allows users to freely set phase parameters for both channels such as sine wave, cosine wave, and square wave signals.
* The sum modulation function can sum up two signals into one and output this signal via one channel. One of the related applications is to sum up sine waveform and noise to execute speaker distortion tests.

J. FOUR METHODS TO OBTAIN ARBITRARY WAVEFORMS



Front Panel Operation

Via single unit's panel, arbitrary waveforms can be selected, edited, stored, recalled, output, triggered from 66 built-in waveforms.

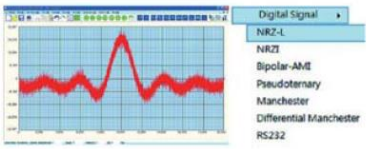


CSV File Upload

Support CSV file upload produced by MATLAB and Excel.

Direct Waveform Reconstruction

Collocate with GDS series digital oscilloscopes to retrieve waveforms and upload them to arbitrary generator to achieve direct waveform reconstruction.



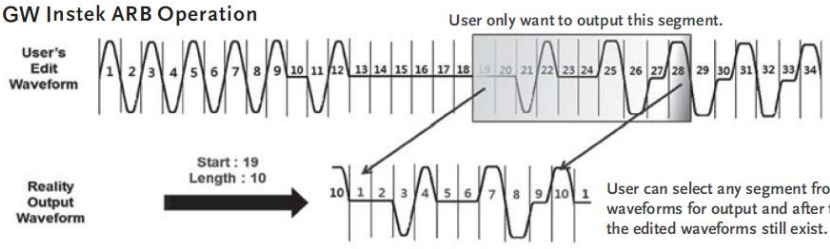
Arbitrary Waveform Editing PC Software

Use AWES to edit complex waveforms. The software supports waveform mathematical operation. The waveform series includes Uniform Noise, Gaussian Noise, Rayleigh Noise, various digital codes such as non zero code, Manchester and RS-232, etc.

K. FLEXIBLE ARBITRARY EDITING

Other Brand's ARB Operation

GW Instek ARB Operation



The Operation Mode Of "user-defined Retrieval Of Segmented Output" Increases Arbitrary Efficiency!

SPECIFICATIONS

	CH1 (Function With ARB)	CH2 (Function With ARB)	25MHz Pulse Generator	RF Generator (Function With ARB)	Power Amplifier	Modulation/Sweep/ Burst/Frequency Counter
MFG-2110	• 10MHz		•			
MFG-2120	• 20MHz		•			
MFG-2120MA	• 20MHz		•		•	•
MFG-2130M	• 30MHz		•			•
MFG-2160MF	• 60MHz		•	• 160MHz		•
MFG-2160MR	• 60MHz		•	• 320MHz		•
MFG-2230M	• 30MHz	• 30MHz	•			•
MFG-2260M	• 60MHz	• 60MHz	•			•
MFG-2260MFA	• 60MHz	• 60MHz	•	• 160MHz	•	•
MFG-2260MRA	• 60MHz	• 60MHz	•	• 320MHz	•	•

CH1/CH2

ARBITRARY FUNCTIONS	Arb Function	Built-in
	Sample Rate	200 MSa/s
	Repetition Rate	100MHz
	Waveform Length	16k points
	Amplitude Resolution	14 bits
	Non-volatile Memory	10sets 16k points(1)
	User-defined Output Section	From point 2 ~ 16384 (uerdefine)
	User-defined Output Marker Section	From point 2 ~ 16384 (uerdefine)
	Output Mode	1~1048575 cycles or infinite mode
FREQUENCY CHARACTERISTICS	Range	Sine 60MHz(max) Square 25MHz(max) Triangle, Ramp 1MHz
	Resolution	1μHz
	Accuracy Stability	±20 ppm
	Aging	±1 ppm, per 1 year
	Tolerance	≤1μHz
OUTPUT CHARACTERISTICS (2)	Amplitude Range	1mVpp to 10 Vpp (into 50Ω) 2mVpp to 20 Vpp (open-circuit)
	Accuracy	±2% of setting ±1 mVpp (at 1 kHz/into 50Ω without DC offset)
	Resolution	0.1mV or 4 digits
	Flatness	± 1% (0.1dB) ≦1MHz ; ± 3% (0.3dB) ≦50 MHz ; ± 10% (0.9dB) ≦160MHz ; ± 30% (3dB) ≦320MHz (sinewave relative to 1 kHz/into 50Ω)
	Units	Vpp, Vrms, dBm
OFFSET	Range	±5 Vpk AC + DC (into 50Ω); ±10Vpk AC + DC (open circuit)
	Accuracy	1% of setting + 5mV + 0.5% of amplitude
WAVEFORM OUTPUT	Impedance	50Ω typical (fixed); > 10MΩ (output disabled)
	Protection	Short-circuit protected; Overload relay automatically disables main output
	Ground Isolation	42Vpk max
SYNC OUTPUT	Range	TTL-compatible into>1kΩ
	Impedance	50Ω standard
	Ground Isolation	42Vpk max
SINE WAVE CHARACTERISTICS (3)	Harmonic Distortion	–60 dBc DC ~ 200kHz, Ampl > 0.1 Vpp –55 dBc 200kHz ~ 1 MHz, Ampl > 0.1 Vpp ; –45 dBc 1MHz ~ 10 MHz, Ampl > 0.1Vpp ; –30 dBc 10MHz ~ 320MHz, Ampl > 0.1Vpp
	Total Harmonic Distortion	< 0.1% (Ampl>1Vpp) DC~100 kHz
SQUARE WAVE CHARACTERISTICS	Rise/Fall Time	<15ns
	Overshoot	<5%
	Asymmetry	1% of period +5 ns
	Variable duty Cycle	0.01% to 99.99% (limited by the current frequency setting)
	Jitter	20ppm +500ps(4)
RAMP CHARACTERISTICS	Linearity	< 0.1% of peak output
	Variable Symmetry	0% ~ 100%
PULSE CHARACTERISTICS	Frequency	1uHz ~ 25MHz
	Pulse Width	≧20nS (limited by the current frequency setting)
	Variable duty Cycle	0.01% ~ 99.99% (limited by the current frequency setting)
	Overshoot	<5%
	Jitter	20ppm + 500ps(4)

PULSE GENERATOR

PULSE GENERATOR	Amplitude	1mVpp ~ 2.5 Vpp (into 50Ω) 2mVpp ~ 5 Vpp (open-circuit)
	Offset	±1 Vpk AC + DC (into 50Ω) ±2Vpk AC + DC (Open circuit)
	Frequency	1uHz ~ 25MHz
	Pulse Width	20nS ~ 999.9ks(limited by the current frequency setting)
	Variable duty Cycle	0.01% ~ 99.99%(limited by the current frequency setting)
	Leading and Trailing Edge Time(5)	10nS ~ 20S(1ns resolution) (limited by the current frequency and pulse width settings)
	Overshoot	<5%
	Jitter	100ppm + 500ps(4)

SPECIFICATIONS

RF GENERATOR

	Waveforms	Sine, Square, Ramp, Pulse, Noise, ARB
	Amplitude (into 50Ω)	1mVpp to 2 Vpp (MFG-2XXXMF); 1mVpp to 1 Vpp (MFG-2XXXMR)
	Offset	±1 Vpk AC + DC (into 50Ω); ±2Vpk AC + DC (Open circuit)
	Frequency	1uHz ~ 160MHz (MFG-2XXXMF); 1uHz ~ 320MHz (MFG-2XXXMR)
MODULATI0N/ SWEEP	Modulation Type	AM, FM, PM, FSK, PWM (The detail same as CH1 modulation specification)
	Sweep Type	Frequency
	Source	INT/EXT(INT only for AM, FM, PM, PWM)
PSK	Carrier Waveforms	Sine, Square, Triangle, Ramp, Pulse
	Modulating Waveforms	50% duty cycle square
	Internal Frequency	2 mHz to 1 MHz
	Phase Range	0°~ 360.0°
	Source	Internal/External
ASK	Carrier Waveforms	Sine, Square, Triangle, Ramp, Pulse
	Modulating Waveforms	50% duty cycle square
	Internal Frequency	2 mHz to 1 MHz
	Amplitude Range	0% ~ 100.0%
	Source	Internal/Externa
ARB function	Sample Rate	200 MSa/s
	Waveform Length	16k points
	Amplitude Resolution	14 bits
	User-defined output section	From point 2 ~ 16384 (optional)
	Jitter	20ppm +5ns

POWER AMPLIFIER

POWER AMPLIFIER	Input Impedance	10KΩ
	Input Voltage	1.25Vpmax
	Working Mode	Constant Voltage
	Gain	20dB
	Output Power (RL=8Ω)	20W (Square)
	Output Voltage	12.5Vpmax
	Output Current	1.6Amax
	Rise/Fall Time	<2.5uS
	Full Power Bandwidth	DC-100KHz
	Overshoot	5%
	Total Harmonic Ddistortion	< 0.1% (Ampl >1Vpp); 20Hz ~ 20 kHz
	Ground Isolation	42Vpk max

ADVANCED FUNCTIONS

AM MODULATION	Carrier Waveforms	Sine, Square, Triangle, Ramp, Pulse, Arb
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp
	Modulating Frequency	2mHz ~ 20kHz (Int) DC ~ 20kHz (Ext)
	Depth	0% ~ 120.0%
	Source	Internal / External
FM MODULATION	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp
	Modulating Frequency	2mHz ~ 20kHz (Int) DC ~ 20kHz (Ext)
	Peak Deviation	DC to max frequency
	Source	Internal / External
PM	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp
	Modulation Frequency	2mHz ~ 20kHz (Int) DC ~ 20kHz (Ext)
	Phase Deviation	0° ~ 360.0°
	Source	Internal / External
SUM	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp
	Modulation Frequency	2mHz ~ 20kHz (Int) DC ~ 20kHz (Ext)
	SUM Depth	0% ~ 100.0%
	Source	Internal / External
PWM	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle,Upramp, Dnramp
	Modulation Frequency	2mHz ~ 20kHz (Int) DC ~ 20kHz (Ext)
	Phase Deviation	0% ~ 100.0% pulse width
	Source	Internal / External
FSK	Carrier Waveforms	Sine, Square, Triangle, Ramp, Pulse
	Modulating Waveforms	50% duty cycle square
	Internal Frequency	2 mHz to 1 MHz
	Frequency Range	1μHz to max frequency
	Source	Internal / External
SWEEP	Waveforms	Sine, Square, Triangle, Ramp
	Type	Linear or Logarithmic
	Sweep Direction	Sweep up or sweep down
	Start/Stop Freq	1uHz to max frquency
	Sweep Time	1ms to 500s
	Source	Internal / External
	Trigger	Single, External, Internal
	Marker	Marker signal on falling edge (programmable)
	Source	Internal / External
BURST	Waveforms	Sine, Square, Triangle, Ramp
	Frequency	1uHz ~ Max Frequency
	Pulse Count	1~1000000 Cycles or intfinite
	Start/Stop Phase	-360.0°~ +360.0°
	Internal Frequency	1 us ~ 500 s
	Gate Source	External Trigger
	Trigger Source	Single, External, Internal

SPECIFICATIONS

TRIGGER DELAY	NCycle, Infinite	0s ~ 100 s
EXTERNAL TRIGGER INPUT	Type Input Level Slope Pulse Width Input Impedance	For FSK, Burst, Sweep TTL Compatibility Rising or Falling(Selectable) >100ns 10kΩ, DC coupled
EXTERNAL MODULATION INPUT	Type Voltage Range Input Impedance Frequency Ground Isolation	For AM, FM, PM, SUM, PWM ±5V full scale 10kΩ DC to 20kHz 42Vpk max
TRIGGER OUTPUT	Type Level Pulse Width Maximum Rate Fan-out Impedance	For FSK, Burst, Sweep TTL Compatible into 50Ω >450ns 1MHz ⩾4 TTL Load 50Ω Typical
FREQUENCY COUNTER	Range Accuracy Time Base Resolution Input Impedance Sensitivity Ground Isolation	5Hz ~ 150MHz Time Base accuracy±1count ±20ppm (23˚C ±5˚C) The maximum resolution is : 100nHz for 1Hz, 0.1Hz for 100MHz 1kΩ/1pf 35mVrms ~ 30Vms (5Hz ~ 150MHz) 42Vpk max
Dual Channel Function (CH1/CH2)	Phase Track Coupling Dsolink	-180◦ ~180◦ Synchronize phase CH2=CH1 Frequency (Ratio or Difference) Amplitude & DC Offset √
OTHER	Store/Recall Interface Display	10 Groups of Setting Memories LAN, USB 4.3 inch TFT LCD, 480 × 3 (RGB) × 272
GENERAL SPECIFICATIONS	Power Source Power Consumption Operating Environment Operating Altitude Pollution Degree Storage Temperature Dimensions & Weight	AC 100 ~ 240V, 50 ~ 60Hz or AC 100 ~ 120V, AC 220 ~ 240V, 50 ~ 60Hz 30W or 80W(With power amplifier) Temperature to satisfy the specification : 18 ~ 28˚C ; Operating temperature : 0 ~ 40˚C ; Relative Humidity: ⩽ 80%, 0 ~ 40˚C, ⩽ 70%, 35 ~ 40˚C ; Installation category : CAT II 2000 Meters IEC 61010 degree 2, Indoor use -10 ~ 70˚C, Humidity : ⩽70% 266(W) x 107(H) x 293(D) mm ; Approx. 2.5kg

The specifications apply when the function generator is powered on for at least 30 minutes under +20°C~+30°C. Specifications subject to change without notice. MFG-2000GD1BH

Note : 1. A total of ten waveforms can be stored. (Every waveform can be composed of a maximum of 16k points.)
2. Add 1/10th of output amplitude and offset specification per °C for operation outside of 0°C to 28°C range (1-year specification).
3. DC offset set to zero
4. Jitter specification for RF Generator: 20ppm +5ns
5. Only Pluse channel support

ORDERING INFORMATION

MFG-2110	10MHz Single Channel Arbitrary Function Generator with Pulse Generator
MFG-2120	20MHz Single Channel Arbitrary Function Generator with Pulse Generator
MFG-2120MA	20MHz Single Channel Arbitrary Function Generator with Pulse Generator, Modulation, Power Amplifier
MFG-2130M	30MHz Single Channel Arbitrary Function Generator with Pulse Generator, Modulation
MFG-2160MF	60MHz Single Channel Arbitrary Function Generator with Pulse Generator, Modulation, 160MHz RF Aignal Generator
MFG-2160MR	60MHz Single Channel Arbitrary Function Generator with Pulse Generator, Modulation, 320MHz RF Signal Generator
MFG-2230M	30MHz Dual Channel Arbitrary Function Generator with Pulse Generator, Modulation
MFG-2260M	60MHz Dual Channel Arbitrary Function Generator with Pulse Generator, Modulation
MFG-2260MFA	60MHz Dual Channel Arbitrary Function Generator with Pulse Generator, Modulation, 160MHz RF Signal Generator, Power Amplifier
MFG-2260MRA	60MHz Dual Channel Arbitrary Function Generator with Pulse Generator, Modulation, 320MHz RF Signal Generator, Power Amplifier

ACCESSORIES

Quick Start Guide x 1, CD-ROM with MFG Software and User Manual x 1

GTL-110 BNC Cable x 1 (MFG-2110/2120/2120MA/2130M/2160MF/2160MR)

GTL-110 BNC Cable x 2 (MFG-2230M/2260M/2260MFA/2260MRA)

OPTIONAL ASSESSORIES

GTL-246 USB Type A to Type B cable

FREE DOWNLOAD

Arbitrary Waveform Editing Software

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CE USB RS-232 VGA Output PC Software

Turn-key Solution for RF and Communication Experiment Courses

GW Instek GSP-730 is a 3 GHz Spectrum Analyzer developed mainly to fulfill the demands of RF Communication educations. The budget constraint and the lack of teaching tools are normally the two hurdles for schools to draw back from providing good courses for RF communication experiments. GSP-730, featuring full functions a moderate spectrum analyzer should provide, along with GRF-1300 training kit possesses a unique position in the field as an **economic turn-key solution** for 3GHz RF Communication Experiment courses.

With its components, GSP-730 Spectrum Analyzer, GRF-1300 Trainer and a PC, properly connected, a tangible system is integrated for performing on-the-fly experiments while the lecture is being given. Using a PC, the teacher can present teaching material with ppt. files and at the same time control GSP-730 and GRF-1300 to perform experiments and get spectrum displays and parameter readings on the PC screen. A ppt. file teaching material, a remote control software, a student's textbook, and a teacher's textbook are available to support this E-teaching system.

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The combination of GSP-730 and GRF-1300 forms a fundamental training system for RF communication and telecommunication classes in the universities, colleges, vocational schools, and the training centers of military and private companies. GSP-730 and GRF-1300 together provide an economic solution to clear away two obstacles, budget constraint and the lack of teaching tools, for the installation of an expensive training system.

GSP-730 & GRF-1300

FEATURES

GSP-730 SPECTRUM ANALYZER

- Frequency Range : 150kHz ~ 3GHz
- Autoset Function
- Noise level : ≤-100dBm
- RBW Range : 30kHz, 100kHz, 300kHz, 1MHz
- ACPR/CHPW/OCBW Measurement
- 3 Traces in Different Colors
- Split Window Function
- Limit Line Function
- Remote Control Software
- Presentation Material for Training Courses
- Support Interface : USB Device/Host, RS-232C
- 5.6" TFT LCD with VGA Output

GRF-1300 COMMUNICATION TRAINER

- Waveform Support :
  Sine Wave : 0.1 ~ 3MHz
  Square Wave : 0.1 ~ 3MHz
  Triangle Wave : 0.1 ~ 3MHz
- RF Frequency : 870 ~ 920MHz
- AM Modulation & FM Modulation
- 5 On/Off Switches and 5 Test Points to Simulate 8 Failure Conditions for Trouble-Shooting Study
- USB Interface to Provide Remote Control

APPLICATIONS

- Education, Training
- Fourier Theory Investigation
- Motherboard Circuit Measurement
- Wireless Communication Signal Measurements
  - GSM, 3G, 4G Mobile Phone
  - Bluetooth, Zigbee, Wi-Fi
  - AM/FM Modulation
- Remote Controller Mainteinance

SPECIFICATIONS

GSP-730

FREQUENCY	**Frequency Range**	Setting Range	150kHz ~ 3GHz
	Center Frequency	Setting Resolution	0.1MHz
		Accuracy	within ±50kHz (frequency span : 0.3GHz ~ 2.6GHz, 20 ±5°C)
	Frequency Span	Setting range	1MHz ~ 3GHz
		Accuracy	within ±3% (frequency span : 0.3GHz ~ 2.6GHz, 20 ±5°C)
	Resolution Bandwidth	Setting Range	30KHz, 100KHz, 300KHz,1MHz
	SSB Phase Noise	-85dBc/Hz (typical, 500kHz offset, RBW : 30kHz, Sweep time : 1.5s, Span : 1MHz@1GHz)	
	Inherent Spurious Response	less than -45dBc@-40dBm Ref. Level (typical less than -50dBc)	
AMPLITUDE	**Reference Level**	Input Range	+20 ~ -40dBm
		Accuracy	Within ±2dB (1GHz) ; SPAN : 5MHz
		Unit	dBm, dBV, dBμV
	Average Noise Level	≤ -100dBm (typical, center frequency : 1GHz RBW : 30kHz)	
	Frequency Characteristic	within ±3.0dB@300MHz ~ 2.6GHz	
		within ±6.0dB@80 ~ 300MHz, 2.6 ~ 3GHz	
	Input	Input Impedance	50Ω
		Input VSWR	less than 2.0@input att ≥10dB
		Input damage level	+30dBm (CW average power), 25VDC
		Input connector	N connector
SWEEP	**Sweep Time**	Setting Range	300ms ~ 8.4s, auto (not adjustable)
		Accuracy	within ±2% (frequency span : full span)
GENERAL	**Communication Interface**	Display	640 x 480 RGB color LCD
		RS-232C	Sub-D female-D 9 pins
		USB Connector	USB Host/Device full speed supported
	VGA Output	Sub-D female 15 pins	
	Power Source	AC 100~240V, 50/60Hz	
OTHER	**Operating Temperature**	5 ~ 45°C (Guaranteed at 25 ±5°C, without soft carrying case)	
	Operating Humidity	Less than 45°C / 90%RH	
	Storage Temperature	-20 ~ 60°C, less than 60°C / 70%RH	
	Dimensions	296 (L) x 153 (W) x 105 (H) mm	
	Weight	Approx. 2.2kg	

GRF-1300

BASE BAND	**Waveforms**	Sine, Square, Triangle
	Frequency Range	0.1 ~ 3MHz ; Step : 10kHz
	Amplitude	≥ 1.5Vpp
	Harmonics Distortion	≥ -30dBc
RF/FM ANALYSIS	**Frequency Accuracy**	±0.15MHz
	Adjustable Range	≥ 45MHz (870M ~ 920MHz) ; Step: 1MHz
	Power Range	≥ -15dBm
FM	**Max Frequency Deviation**	>3MHz
AM	**Peak Difference**	≥ -18dBm
INTERFACE	**USB**	USB Device
DIMENSIONS & WEIGHT		165(W) x 155(H) x 90(D)mm, 1.2kg

Specifications subject to change without notice. SP-730GD1DH

ORDERING INFORMATION

GSP-730 3GHz Spectrum Analyzer
GRF-1300 RF and Communication System Trainer

ACCESSORIES

GSP-730 Quick start manual x 1, User manual CD x 1, Power cord x1
GRF-1300 Experiment text book of student version, Power point file and remote control software CD, RF cable x 3, Antenna x 1, N to SMA adaptor connector, Power cord x 1

OPTION

Experiment text book of teacher version

FREE DOWNLOAD

PC Software Remote Monitor Software

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Príloha č. 2: Zoznam subdodávateľov

Názov subdodávateľa	IČO	Predmet subdodávky	Podiel subdodávky k hodnote zmluvy vyjadrený sumou vrátane DPH
			0

Názov subdodávateľa	Osoba oprávnená konať za subdodávateľa (meno, priezvisko, adresa pobytu, dátum narodenia)

Podpis : .....

Ing. Jiří Kalvoda, konateľ, v. r.

Dátum: 18.07.2022

V prípade, že víťazný uchádzač neuvažuje so subdodávateľmi, prílohu č. 2 predloží tiež a v stĺpci „Podiel subdodávky k hodnote zmluvy vyjadrený sumou“ uvedie hodnotu 0.