



Došlo na právní oddělení ČZU dne:

2 0. 02. 2019

## KUPNÍ SMLOUVA na dodávku sestavy pro měření hodnot stavební fyziky – akustiky a vibrací

uzavřená ve smyslu § 2079 a násl. zákona č. 89/2012 Sb., občanský zákoník, ve znění pozdějších předpisů (dále jen „občanský zákoník“)

### I.

#### Smluvní strany

- 1.1. **Kupující:** **Česká zemědělská univerzita v Praze**  
Sídlo: Kamýcká 129, 165 00 Praha – Suchbátka  
Zastoupený: Ing. Jana Vohralíková, kvestorka  
bank. spojení: Česká spořitelna, a. s.  
číslo účtu: 500022222/0800  
IČO: 60460709  
DIČ: CZ60460709

(dále jen „kupující“) na straně jedné

a

- 1.2. **Prodávající:** **SVMTech s.r.o.**  
Sídlo: Počernická 272/96, 108 00 Praha 10 - Malešice  
Zastoupený: Ing. Radovan Zdražil  
bank. spojení: Komerční banka, a.s.  
číslo účtu: 107-9936220247/0100  
IČO: 04004205  
DIČ: CZ04004205  
zapsaný v OR vedeném Městským soudem v Praze oddíl C vložka 240418

(dále jen „**prodávající**“) na straně druhé

(společně dále také jako „smluvní strany“)

uzavírají níže uvedeného dne, měsíce a roku na základě výsledku zadávacího řízení veřejné zakázky malého rozsahu s názvem „Sestava pro měření hodnot stavební fyziky – akustiky a vibrací“ tuto kupní smlouvu na dodávku sestavy pro měření hodnot stavební fyziky – akustiky a vibrací (dále jen „**smlouva**“)

## II. Předmět smlouvy

- 2.1. Předmětem této smlouvy je závazek prodávající dodat kupujícímu 1 ks sestavy pro měření hodnot stavební fyziky – akustiky a vibrací (nové, nepoužívané, originální) vč. všech součástí, příslušenství a dokladů nezbytných k jejich řádnému užívání (dále jen „zboží“) a poskytnout kupujícími s tím spojené služby, zejména zajištění dopravy do místa plnění dle čl. III. této smlouvy a ekologické likvidace obalového materiálu a jiného odpadu vzniklého v důsledku dodávky zboží, a to v rozsahu a za podmínek stanovených touto smlouvou. Předmětem této smlouvy je dále závazek prodávajícího převést na kupujícího vlastnické právo k řádně dodanému a kupujícím převzatému zboží. Předmětem této smlouvy je rovněž závazek kupujícího řádně dodané zboží od prodávajícího převzít a za převzaté zboží uhradit prodávajícímu kupní cenu způsobem a v termínu sjednaném touto smlouvou.
- 2.2. Přesná specifikace zboží je uvedena v příloze této smlouvy, která tvoří její nedílnou součást.

## III. Doba a místo plnění

- 3.1. Prodávající se zavazuje, že sjednané zboží předá kupujícímu **nejpozději do 8 týdnů** od nabytí účinnosti uzavřené smlouvy.
- 3.2. Zboží bude předáno prodávajícím a převzato kupujícím na základě oboustranně podepsaného předávacího protokolu, uzavřeném dle podmínek uvedených dále v této smlouvě.
- 3.3. Místem plnění je budova Dřevařského pavilonu Fakulty lesnické a dřevařské, v areálu sídla kupujícího: Kamýčká 129, 165 00 Praha – Suchdol, kontaktní osobou je Ing. Kamil Trgala, Ph.D., e-mail: [trgala@fld.czu.cz](mailto:trgala@fld.czu.cz).

## IV. Cena a platební podmínky

- 4.1. Kupní cena za zboží dodané v souladu s touto smlouvou a její přílohou je stanovena dohodou smluvních stran.
- 4.2. Kupující se zavazuje uhradit prodávajícímu za zboží dle čl. II. této smlouvy sjednanou kupní cenu ve výši 1.142.992,30 Kč bez DPH, tj. 1.383.021,00 Kč vč. DPH.
- 4.3. Kupní cena je sjednána jako nejvýše přípustná a nepřekročitelná. Prodávající prohlašuje, že kupní cena obsahuje veškeré poplatky a další náklady spojené s plněním předmětu této smlouvy, zejména náklady na dopravu do místa plnění uvedeného v čl. III. této smlouvy, odvoz a ekologickou likvidaci obalových materiálů a jiného odpadu vzniklého v důsledku dodávky, náklady spojené s montáží a uvedením zboží do provozu, náklady na testovací provoz, předvedení plné funkčnosti zboží, zaškolení obsluhy **minimálně v rozsahu 2 hodin pro neomezený počet pracovníků fakulty**, náklady spojené s případným odstraněním vad dodaného zboží, zajištěním záručního servisu apod.
- 4.4. Prodávající prohlašuje, že kupní cena zahrnuje i případné náklady na správní poplatky, daně, cla, schvalovací řízení, provedení předepsaných zkoušek, zabezpečení prohlášení o shodě, certifikátů a atestů, převod práv, pojištění, manipulační poplatky apod.

- 4.5. Kupní cena bude kupujícím uhrazena v české měně na základě daňového dokladu – faktury, a to bezhotovostním převodem na bankovní účet prodávajícího. Fakturu je prodávající povinen vystavit do 15 dnů po řádném a včasném dodání a převzetí zboží kupujícím dle této smlouvy na základě předávacího protokolu.
- 4.6. Daňový doklad – faktura musí obsahovat všechny náležitosti řádného účetního a daňového dokladu ve smyslu příslušných právních předpisů, zejména zákona č. 235/2004 Sb., o dani z přidané hodnoty, ve znění pozdějších předpisů. Zároveň musí být na faktuře uvedeno označení projektu a operačního programu, z něhož je dodávka spolufinancována: "Excelentní Výzkum jako podpora Adaptace lesnictví a dřevařství na globální změnu a 4. průmyslovou revoluci" s reg. č. CZ.02.1.01/0.0/0.0/16\_019/0000803" spolufinancovaného z Operačního programu Výzkum, vývoj a vzdělávání. V případě, že faktura nebude mít odpovídající náležitosti, je kupující oprávněn ji vrátit ve lhůtě splatnosti zpět prodávajícímu k doplnění, aniž se tak dostane do prodlení se splatností. Lhůta splatnosti počíná běžet znovu od opětovného doručení náležitě doplněné či opravené faktury kupujícímu.
- 4.7. Splatnost faktury je 30 dnů ode dne jejího vystavení. Fakturu je prodávající povinen doručit do 3 pracovních dnů od jejího vystavení na adresu: Česká zemědělská univerzita v Praze, Ekonomický odbor, Kamýcká 129, PSČ 165 00, Praha – Suchbátka. V případě pozdějšího doručení je objednatel oprávněn žádat o přiměřené prodloužení splatnosti faktury. Jiné doručení nebude považováno za řádné s tím, že objednateli nevznikne povinnost fakturu doručitou jiným způsobem uhradit.
- 4.8. Za den platby se považuje den odepsání fakturované částky z bankovního účtu kupujícího ve prospěch bankovního účtu prodávajícího.
- 4.9. Úhrada kupní ceny nebo její části bude prodávajícímu převedena na jeho účet zveřejněný správcem daně podle § 98 zákona č. 235/2004 Sb., o dani z přidané hodnoty, ve znění pozdějších předpisů, a to i v případě, že na faktuře bude uveden jiný bankovní účet. Pokud prodávající nebude mít bankovní účet zveřejněný podle § 98 zákona č. 235/2004 Sb., o dani z přidané hodnoty, ve znění pozdějších předpisů, provede kupující úhradu na bankovní účet až po jeho zveřejnění správcem daně, aniž by byl kupující v prodlení s úhradou. Zveřejnění bankovního účtu správcem daně oznámí prodávající bezodkladně kupujícímu. Toto ustanovení se neuplatní v případě, že prodávající k tomuto není povinen dle zákona č. 235/2004 Sb., o dani z přidané hodnoty, ve znění pozdějších předpisů.

## V.

### Práva a povinnosti smluvních stran

- 5.1. Prodávající je povinen dodat zboží v dohodnutém množství, jakosti a provedení. Veškeré zboží dodávané prodávajícímu kupujícímu z titulu této smlouvy musí splňovat kvalitativní požadavky dle této smlouvy a její přílohy.
- 5.2. Prodávající je povinen dodat zboží bez vad kupujícímu v souladu s podmínkami této smlouvy, přičemž za řádné dodání zboží se považuje jeho převzetí kupujícím, a to na základě potvrzení této skutečnosti v protokolu o předání a převzetí zboží. Předávací protokol může být podepsán nejdříve v okamžiku, kdy bude beze zbytku realizována samotná fyzická dodávka zboží prodávajícímu, včetně všech souvisejících výkonů a služeb sjednaných touto smlouvou, s výjimkou záručního servisu (viz též čl. 5.3 této smlouvy).

- 5.3. Prodávající je povinen před předáním a převzetím zboží zajistit odvoz obalových materiálů (a následně provést jejich ekologickou likvidaci), provést montáž zboží a uvést zboží do provozu, provést testovací provoz, předvést kupujícímu plnou funkčnost zboží, provést zaškolení obsluhy kupujícího a předat kupujícímu doklady, které jsou nutné k převzetí a k užívání zboží (zejména technická dokumentace, uživatelská dokumentace a záruční listy, vše výlučně v českém jazyce a podle předpisů platných v ČR, manuál v anglickém jazyce).
- 5.4. Kupující nabývá vlastnického práva ke zboží dnem převzetí zboží od prodávajícího na základě předávacího protokolu. Stejným okamžikem přechází na kupujícího také nebezpečí škody na věci.
- 5.5. Prodávající odpovídá kupujícímu za škodu či jinou újmu způsobenou porušením povinností podle této smlouvy nebo povinností stanovené obecně závazným právním předpisem.
- 5.6. Smluvní strany se dohodly a prodávající určil, že osobou oprávněnou k jednání za prodávajícího ve věcech, které se týkají této smlouvy a její realizace je:
- jméno a příjmení: Ing. Pavla Vaňková  
e-mail: [pavla.vankova@svmtech.cz](mailto:pavla.vankova@svmtech.cz)  
tel.: 602 544 661
- 5.7. Smluvní strany se dohodly a kupující určil, že osobou oprávněnou k jednání za kupujícího ve věcech, které se týkají této smlouvy a její realizace je:
- jméno a příjmení: Ing. Martin Prajer, Ph.D.  
e-mail: [prajer@fld.czu.cz](mailto:prajer@fld.czu.cz)  
tel.: 603 421 914
- nebo
- jméno a příjmení: Ing. Radek Rinn  
e-mail: [rinn@fld.czu.cz](mailto:rinn@fld.czu.cz)  
tel.: 602 298 240
- 5.8. Veškerá korespondence, pokyny, oznámení, žádosti, záznamy a jiné dokumenty vzniklé na základě této smlouvy mezi smluvními stranami nebo v souvislosti s ní budou vyhotoveny v písemné formě v českém jazyce a doručují se buď osobně nebo doporučenou poštou, faxem či e-mailem, k rukám a na doručovací adresy oprávněných osob dle této smlouvy.

## VI.

### Záruka na zboží

- 6.1. Prodávající přebírá záruku za zboží na dobu 24 měsíců. Záruční doba počíná běžet dnem dodání zboží kupujícímu, tj. dnem podpisu předávacího protokolu kupujícím.
- 6.2. Kupující je povinen písemně ohlásit prodávajícímu záruční vady neprodleně. Záruční opravy provede prodávající bezplatně ve lhůtě maximálně 30 pracovních dnů od ohlášení vady, případně prodávající dohodne s kupujícím jinou dobu odstranění reklamované vady. V případě nedodržení tohoto prováděcího termínu je kupující dále oprávněn nedostatky nechat odstranit třetí osobou na náklady prodávajícího, a to i bez předchozího upozornění na tuto skutečnost.

- 6.3. V případě opravy v záruční době se tato prodlužuje o dobu od oznámení vady kupujícím do jejího odstranění prodávajícím, případně třetí osobou na náklady prodávajícího ve smyslu poslední věty čl. 6.2. této smlouvy.
- 6.4. Reklamací lze uplatnit nejpozději do posledního dne záruční doby, přičemž i reklamacie odeslaná v poslední den záruční doby se považuje za včas uplatněnou.
- 6.5. Záruka se nevztahuje na vady způsobené neodbornou manipulací nebo mechanickým poškozením zboží, pokud tyto vady nezpůsobil sám prodávající.
- 6.6. Kupující si vyhrazuje právo místo záruční opravy požadovat odstranění reklamovaných vad dodáním náhradního zboží za zboží vadné, a to ve lhůtě dle čl. VI. bodu 6.2 této smlouvy.
- 6.7. V případě takové vady zboží nebo jeho části, která je neopravitelná a zároveň pokud prodávající nedisponuje zbožím stejného druhu a kvality, je kupující oprávněn od této smlouvy částečně odstoupit, a to v rozsahu vadného plnění, a žádat vrácení části kupní ceny, odpovídající ceně vadné části plnění.

## VII.

### Sankční ujednání

- 7.1. V případě, že prodávající nedodá zboží v termínu dle této smlouvy, zavazuje se kupujícímu uhradit smluvní pokutu ve výši 0,5 % z kupní ceny za každý i jen započatý den prodlení.
- 7.2. Prodávající je povinen kupujícímu uhradit smluvní pokutu ve výši 0,05 % z kupní ceny za každý započatý den prodlení s odstraněním reklamovaných vad ve lhůtě dle čl. VI. bodu 6.2 této smlouvy.
- 7.3. V případě prodlení kupujícího s úhradou faktury je prodávající oprávněn uplatnit vůči kupujícímu úrok z prodlení ve výši 0,05 % z dlužné částky za každý i jen započatý den prodlení s úhradou faktury.
- 7.4. Okolnosti vylučující odpovědnost nemají vliv na povinnost platit smluvní pokutu.
- 7.5. Kupující je oprávněn jakoukoli smluvní pokutu jednostranně započítat proti jakékoli pohledávce prodávajícího vůči kupujícímu (včetně pohledávky prodávajícího na zaplacení kupní ceny).
- 7.6. Úhradou smluvní pokuty zůstávají nedotčena práva kupujícího na náhradu škody či jiné újmy v plné výši.

## VIII.

### Platnost a účinnost smlouvy

- 8.1. Tato smlouva nabývá platnosti dnem podpisu smlouvy oprávněnými zástupci obou smluvních stran. Tato smlouva nabývá účinnosti okamžikem uveřejněním v registru smluv v souladu se zákonem č. 340/2015 Sb., o zvláštních podmínkách účinnosti některých smluv, uveřejňování těchto smluv a o registru smluv (zákon o registru smluv), ve znění pozdějších předpisů.
- 8.2. Smlouvu je možné ukončit:
- a) písemnou dohodou smluvních stran;
  - b) písemnou výpovědí ze strany kupujícího;
  - c) odstoupením od smlouvy.

- 8.3. Smlouvu je možné ukončit výpovědí kupujícího, a to i bez udání důvodu. Výpovědní lhůta činí 1 měsíc a začíná běžet 1. dnem měsíce, který následuje po měsíci, ve kterém obdržela smluvní strana výpověď.
- 8.4. Odstoupit od smlouvy lze pouze z důvodů stanovených ve smlouvě nebo příslušných právních předpisech. Od této smlouvy může smluvní strana dotčená porušením povinnosti jednostranně odstoupit pro podstatné porušení této smlouvy, přičemž za podstatné porušení této smlouvy se zejména považuje:
- na straně kupujícího nezaplacení kupní ceny podle této smlouvy ve lhůtě delší 30 kalendářních dnů po dni splatnosti příslušné faktury;
  - na straně prodávajícího, jestliže nedodá řádně a včas předmět této smlouvy a nezjedná nápravu do 5 pracovních dnů od písemného upozornění kupujícím na neplnění této smlouvy;
  - na straně prodávajícího, postupuje-li prodávající při plnění smlouvy v rozporu s ujednáními této smlouvy, s pokyny oprávněného zástupce kupujícího, či v rozporu s právními předpisy.
- 8.5. Kupující je oprávněn od smlouvy odstoupit v případě, že podle údajů uvedených v registru plátců DPH se prodávající stane nespolehlivým plátcem DPH.
- 8.6. Skončením účinnosti smlouvy zanikají všechny závazky smluvních stran ze smlouvy. Skončením účinnosti nebo jejím zánikem nezanikají nároky na náhradu škody či jiné škody a zaplacení smluvních pokut sjednaných pro případ porušení smluvních povinností vzniklé před skončením účinnosti smlouvy, a ty závazky smluvních stran, které podle smlouvy nebo vzhledem ke své povaze mají trvat i nadále, nebo u kterých tak stanoví zákon.
- 8.7. Proávající přebírá riziko změny okolností dle občanského zákoníku.

## IX.

### Závěrečná ustanovení

- 9.1. Vztahy mezi smluvními stranami se řídí českým právním řádem. Ve věcech smlouvou výslovně neupravených se právní vztahy z ní vznikající a vyplývající řídí příslušnými ustanoveními občanského zákoníku a ostatními obecně závaznými právními předpisy.
- 9.2. Veškeré změny či doplnění smlouvy lze učinit pouze na základě písemné dohody smluvních stran. Takové dohody musí mít podobu datovaných, číslovaných a oběma smluvními stranami podepsaných dodatků smlouvy.
- 9.3. Vztahuje-li se důvod neplatnosti jen na některé ustanovení smlouvy, je neplatným pouze toto ustanovení, pokud z jeho povahy, obsahu anebo z okolností, za nichž bylo sjednáno, nevyplývá, že jej nelze oddělit od ostatního obsahu smlouvy.
- 9.4. Smluvní strany budou vždy usilovat o přátelské urovnání případných sporů vzniklých ze smlouvy. Pokud nebylo dosaženo přátelského urovnání sporu ani do 30 pracovních dnů po jeho prvním oznámení druhé smluvní straně, je kterákoliv ze smluvních stran oprávněna obrátit se svým nárokem k příslušnému soudu.
- 9.5. Smlouva se vyhotovuje ve 4 (čtyřech) stejnopisech, z nichž každý má platnost originálu. Každá ze smluvních stran obdrží po 2 (dvou) stejnopisech.

- 9.6. Nedílnou součástí této smlouvy je prodávajícím zpracovaná příloha s názvem Technická specifikace předmětu plnění.
- 9.7. Prodávající bezvýhradně souhlasí se zveřejněním plného znění této smlouvy tak, aby tato smlouva mohla být předmětem poskytnuté informace ve smyslu zákona č. 106/1999 Sb., o svobodném přístupu k informacím, ve znění pozdějších předpisů. Prodávající rovněž souhlasí se zveřejněním plného znění této smlouvy dle § 219 zákona č. 134/2016 Sb., o zadávání veřejných zakázek, ve znění pozdějších předpisů a zákona č. 340/2015 Sb., o zvláštních podmínkách účinnosti některých smluv, uveřejňování těchto smluv a o registru smluv (zákon o registru smluv).
- 9.8. Prodávající bere na vědomí a souhlasí, že je osobou povinnou ve smyslu § 2 písm. e) zákona č. 320/2001 Sb., o finanční kontrole, ve znění pozdějších předpisů. Prodávající je povinen plnit povinnosti vyplývající pro něho jako osobu povinnou z výše citovaného zákona.
- 9.9. Smluvní strany prohlašují, že si smlouvu před jejím podpisem přečetly a s jejím obsahem bez výhrad souhlasí. Smlouva je vyjádřením jejich pravé, skutečné, svobodné a vážné vůle. Na důkaz pravosti a pravdivosti těchto prohlášení připojují oprávnění zástupci smluvních stran své vlastnoruční podpisy.

V Praze dne .....12.02.2019

V Praze dne 12.2.2019

Za kupujícího:  
Česká zemědělská univerzita v Praze

Za prodávajícího:  
SVMTech s.r.o.

.....  
Ing. Jana Vohralíková, kvestorka

.....  
Ing. Radovan Zadražil, jednatel společnosti



Prověřeno právním odd. ČZU v Praze  
Ak

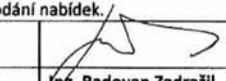
### Obsah nabídky:

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## Sestava pro měření hodnot stavební fyziky – akustiky a vibrací

Česká zemědělská universita v Praze,  
Kamýnská 129, 165 00 Praha - Suchbát

## Krycí list nabídky

<b>KRYCÍ LIST NABÍDKY</b>	
<i>1. Veřejná zakázka</i>	
Název:	„Sestava pro měření hodnot stavební fyziky – akustiky a vibrací“
<i>2. Základní identifikační údaje</i>	
<b>2.1. Zadavatel</b>	
Název:	Česká zemědělská univerzita v Praze
Sídlo:	Kamýcká 129, 165 00 Praha – Suchbát
IČO:	60460709
Osoba oprávněná za zadavatele jednat:	Prof. Ing. Marek Turčáni, PhD., děkan Fakulty lesnické a dřevařské
<b>2.2. Účastník zadávacího řízení</b>	
Obchodní firma nebo název/ Obchodní firma nebo jméno a příjmení:	SVMTech s.r.o.
Sídlo / Místo podnikání, popř. místo trvalého pobytu:	Počernická 272/96
IČO:	04004205
Osoba oprávněná jednat jménem či za účastníka:	Ing. Radovan Zadražil
Spisová značka v obchodním rejstříku či jiné evidenci, je-li účastník v ní zapsán:	Městský soud v Praze, oddíl C, vložka 240418
Kontaktní osoba:	Ing. Pavla Vaňková
Tel./fax:	296411900 / 296411901
E-mail:	info@svmtech.cz
<i>3. Osoba oprávněná jednat jménem či za účastníka</i>	
Svým podpisem potvrzuji, že nabídka je podaná v souladu se zadávacími podmínkami stanovenými zadavatelem včetně všech vysvětlení, změn či doplnění zadávacích podmínek, které byly uveřejněny zadavatelem v průběhu lhůty pro podání nabídek.	
Podpis osoby oprávněné jednat jménem či za účastníka:	
Titul, jméno, příjmení	Ing. Radovan Zadražil
Funkce:	Jednatel společnosti
Datum:	19. 12. 2018

**Doklady k prokázání specifikace**

**Čestné prohlášení účastníka o splnění základní  
způsobilosti**

### ČESTNÉ PROHLÁŠENÍ ÚČASTNÍKA O SPLNĚNÍ KVALIFIKAČNÍCH KRITÉRIÍ

Společnost: SVMTech s.r.o. IČ:04004205, jednající Ing. Radovan Zadražil, dat. nar. 19. března 1977 jakožto účastník veřejné zakázky malého rozsahu zadávané ve výběrovém řízení mimo režim zákona č. 134/2016 Sb., o zadávání veřejných zakázek, v účinném znění a zadávané dle Směrnice kvestora č. 5/2017 ze dne 1. 7. 2017 a dále dle Pravidel pro žadatele a příjemce – obecná část, Operační program Výzkum, vývoj a vzdělávání, Programové období 2014-2020, verze 5, datum účinnosti: 9. listopadu 2017 vydává toto čestné prohlášení.

Účastník zadávacího řízení na plnění veřejné zakázky malého rozsahu s názvem „Sestava pro měření hodnot stavební fyziky – akustiky a vibrací“ čestně prohlašuje, že splňuje základní způsobilost, tj. že:

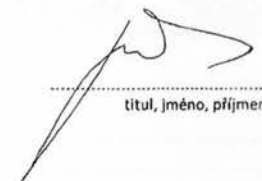
- a) nebyl v zemi svého sídla v posledních 5 letech před zahájením zadávacího řízení pravomocně odsouzen pro trestný čin uvedený v příloze č. 3 ZZVZ nebo obdobný trestný čin podle právního řádu země sídla dodavatele; k zaházeným odsouzením se nepřihlíží,
- b) nemá v České republice nebo v zemi svého sídla v evidenci daní zachycen splatný daňový nedoplatek,
- c) nemá v České republice nebo v zemi svého sídla splatný nedoplatek na pojistném nebo na penále na veřejné zdravotní pojištění,
- d) nemá v České republice nebo v zemi svého sídla splatný nedoplatek na pojistném nebo na penále na sociální zabezpečení a příspěvku na státní politiku zaměstnanosti,
- e) není v likvidaci, proti němuž nebylo vydáno rozhodnutí o úpadku, vůči němuž nebyla nařizována nucená správa podle jiného právního předpisu nebo v obdobné situaci podle právního řádu země sídla dodavatele.
- f) Je-li účastníkem právnická osoba, splňuje podmínku dle písm. a) tato právnická osoba a zároveň každý člen statutárního orgánu. Je-li členem statutárního orgánu právnická osoba, splňuje podmínku dle písm. a) tato právnická osoba, každý člen statutárního orgánu této právnické osoby a osoba zastupující tuto právnickou osobu ve statutárním orgánu účastníka.
- g) Je-li účastníkem pobočka závodu zahraniční právnické osoby, splňuje podmínku dle písm. a) tato právnická osoba a vedoucí pobočky závodu.
- h) Je-li účastníkem pobočka závodu české právnické osoby, splňují podmínku dle písm. a) osoby uvedené v písm. f) a vedoucí pobočky závodu.

Účastník zadávacího řízení na plnění veřejné zakázky malého rozsahu s názvem „Sestava pro měření hodnot stavební fyziky – akustiky a vibrací“ čestně prohlašuje, že splňuje technickou způsobilost, tj. že v posledních 3 letech před dnem zahájení zadávacího řízení realizoval významné dodávky, jejichž předmětem byla dodávka alespoň 1 obdobné sestavy.

Informace o jednotlivých významných dodávkách:		
Významná dodávka č.1	<b>Objednatel</b> Vysoká škola technická a ekonomická v Českých Budějovicích	<b>Identifikace předmětu plnění</b> Měřicí systém pro stavební akustiku
	<b>Kontaktní osoba objednatel:</b> Vojtěch Stehel	<b>Doba realizace (dd.mm.yyyy – dd.mm.yyyy):</b> 26.9.2018
		<b>Hodnota realizované významné dodávky:</b> 976 822,00 Kč bez DPH

V Praze dne 18.12.2018

Podpis osoby oprávněné zastupovat účastníka zadávacího řízení



.....  
titul, jméno, příjmení

Výpis z obchodního rejstříku

**Výpis**

z obchodního rejstříku, vedeného  
Městským soudem v Praze  
oddíl C, vložka 240418

<b>Datum vzniku a zápisu:</b>	20. dubna 2015
<b>Spisová značka:</b>	C 240418 vedená u Městského soudu v Praze
<b>Obchodní firma:</b>	SVMTech s.r.o.
<b>Sídlo:</b>	Počernická 272/96, Malešice, 108 00 Praha 10
<b>Identifikační číslo:</b>	040 04 205
<b>Právní forma:</b>	Společnost s ručením omezeným
<b>Předmět podnikání:</b>	Výroba, obchod a služby neuvedené v přílohách 1 až 3 živnostenského zákona Montáž, opravy, revize a zkoušky elektrických zařízení Výroba, instalace, opravy elektrických strojů a přístrojů, elektronických a telekomunikačních zařízení
<b>Statutární orgán:</b>	
<b>Jednatel:</b>	Ing. RADOVAN ZADRAŽIL, dat. nar. 19. března 1977 Milana Kadlece 1092/11, Dolní Chabry, 184 00 Praha 8 Den vzniku funkce: 20. dubna 2015
<b>Počet členů:</b>	1
<b>Způsob jednání:</b>	Jednatel zastupuje společnost samostatně.
<b>Společníci:</b>	
<b>Společník:</b>	Ing. RADOVAN ZADRAŽIL, dat. nar. 19. března 1977 Milana Kadlece 1092/11, Dolní Chabry, 184 00 Praha 8
<b>Podíl:</b>	<b>Vklad:</b> 100 000,- Kč <b>Splaceno:</b> 100% <b>Obchodní podíl:</b> 100% <b>Druh podílu:</b> základní <b>Kmenový list:</b> není
<b>Základní kapitál:</b>	100 000,- Kč

Veřejný rejstřík

Ověřuji pod pořadovým číslem 110085\_025079, že tato listina, která vznikla převedením výstupu platných údajů z informačního systému veřejné správy z elektronické podoby do podoby listinné, skládající se z 1 listu, se obsahově shoduje s obsahem výstupu z informačního systému veřejné správy v elektronické podobě.

Praha 108

dne 06.12.2018 v 10:54

Podpis ..... 

Razítko:



Rybinová Bianka

Výpis z veřejné části Živnostenského rejstříku



## Výpis z veřejné části Živnostenského rejstříku

Platnost k 06.12.2018 10:55:50

Obehoďní firma: **SVMTech s.r.o.**  
Adresa sídla: **Počernická 272/96, 108 00, Praha 10 - Malešice**  
Identifikační číslo osoby: **04004205**  
Datum doručení výpisu podle §10 odst.4 Živnostenského zákona: **25.03.2015**

*Statutární orgán nebo jeho členové:*

Jméno a příjmení: **Ing. Radovan Zadražil (2)**  
Vznik funkce: **20.04.2015**

### *Živnostenské oprávnění č.1*

Předmět podnikání: **Výroba, obchod a služby neuvedené v přílohách 1 až 3 Živnostenského zákona**  
Obory činnosti: **Výroba měřicích, zkušebních, navigačních, optických a fotografických přístrojů a zařízení**  
**Výroba elektronických součástek, elektrických zařízení a výroba a opravy elektrických strojů, přístrojů a elektronických zařízení pracujících na malém napětí**  
**Zprostředkování obchodu a služeb**  
**Veľkoobchod a maloobchod**  
**Pronájem a půjčování věcí movitých**  
**Poradenská a konzultační činnost, zpracování odborných studií a posudků**  
**Mimoškolní výchova a vzdělávání, pořádání kurzů, školení, včetně lektorské činnosti**  
**Výroba, obchod a služby jinde nezařazené**

Druh živnosti: **Ohlašovací volná**  
Vznik oprávnění: **20.04.2015**  
Doba platnosti oprávnění: **na dobu neurčitou**

### *Živnostenské oprávnění č.2*

Předmět podnikání: **Montáž, opravy, revize a zkoušky elektrických zařízení**  
Druh živnosti: **Ohlašovací řemeslná**  
Vznik oprávnění: **07.12.2015**  
Doba platnosti oprávnění: **na dobu neurčitou**

*Odpovědný zástupce:*

Jméno a příjmení: **Jan Mastný (1)**

### *Živnostenské oprávnění č.3*

Předmět podnikání: **Výroba, instalace, opravy elektrických strojů a přístrojů, elektronických a telekomunikačních zařízení**  
Druh živnosti: **Ohlašovací řemeslná**  
Vznik oprávnění: **07.12.2015**  
Doba platnosti oprávnění: **na dobu neurčitou**

*Odpovědný zástupce:*

Jméno a příjmení: **Jan Mastný (1)**

### *Seznam zúčastněných osob*

Jméno a příjmení: **Jan Mastný (1)**  
Datum narození: **22.06.1989**  
Občanství: **Česká republika**

Jméno a příjmení: **Ing. Radovan Zadražil (2)**  
Datum narození: **19.03.1977**

Úřad příslušný podle §71 odst.2 Živnostenského zákona: **Úřad městské části Praha 10**

Ministerstvo průmyslu a obchodu osvědčuje, že údaje uvedené v tomto výpisu jsou k datu platnosti výpisu zapsány v živnostenském rejstříku.



**SVT tech**

Živnostenský rejstřík

Ověřuji pod pořadovým číslem 110085\_025080 , že tato listina, která vznikla převedením výstupu z informačního systému veřejné správy z elektronické podoby do podoby listinné, skládající se z 2 listů, se doslovně shoduje s obsahem výstupu z informačního systému veřejné správy v elektronické podobě.

Praha 108

dne 06.12.2018 v 10:57

Podpis ..... 

Razítka:

Rytíňová Blanka



**Návrh kupní smlouvy**

## KUPNÍ SMLOUVA

### na dodávku sestavy pro měření hodnot stavební fyziky – akustiky a vibrací

uzavřena ve smyslu § 2079 a násl. zákona č. 89/2012 Sb., občanský zákoník, ve znění pozdějších předpisů (dále jen „občanský zákoník“)

#### I.

##### Smluvní strany

- 1.1. **Kupující:** Česká zemědělská univerzita v Praze  
Sídlo: Kamýčká 129, 165 00 Praha – Suchdol  
Zastoupený: Ing. Jana Vohralíková, kvestorka  
bank. spojení: Česká spořitelna, a. s.  
číslo účtu: 50002222/0800  
IČO: 60460709  
DIČ: CZ60460709

(dále jen „kupující“) na straně jedné

a

- 1.2. **Prodávající:** SVMTech s.r.o.  
Sídlo: Počernická 272/96  
Zastoupený: Ing. Radovan Zadražil  
bank. spojení: Komerční banka, a.s.  
číslo účtu: 107-9936220247/0100  
IČO: 04004205  
DIČ: CZ04004205  
zapsaný v OR vedeném v MS Praha, oddíl C, vložka 240418

(dále jen „prodávající“) na straně druhé

(společně dále také jako „smluvní strany“)

uzavírají níže uvedeného dne, měsíce a roku na základě výsledku zadávacího řízení veřejné zakázky malého rozsahu s názvem „Sestava pro měření hodnot stavební fyziky – akustiky a vibrací“ tuto kupní smlouvu na dodávku sestavy pro měření hodnot stavební fyziky – akustiky a vibrací (dále jen „smlouva“)

#### II.

#### Předmět smlouvy

- 2.1. Předmětem této smlouvy je závazek prodávající dodat kupujícímu 1 ks sestavy pro měření hodnot stavební fyziky – akustiky a vibrací (nové, nepoužívané, originální) vč. všech součástí, příslušenství a dokladů nezbytných k jejich řádnému užívání (dále jen „zboží“) a poskytnout kupujícímu s tím spojené služby, zejména zajištění dopravy do místa plnění dle čl. III. této smlouvy a ekologické likvidace obalového materiálu a jiného odpadu vzniklého v důsledku dodávky zboží, a to v rozsahu a za podmínek stanovených touto smlouvou. Předmětem této smlouvy je dále závazek prodávajícího převést na kupujícího vlastnické právo k řádně dodanému a kupujícím převzatému zboží. Předmětem této smlouvy je rovněž závazek kupujícího řádně dodané zboží od prodávajícího převzít a za převzaté zboží uhradit prodávajícímu kupní cenu způsobem a v termínu sjednaném touto smlouvou.
- 2.2. Přesná specifikace zboží je uvedena v příloze této smlouvy, která tvoří její nedílnou součást.

#### III.

##### Doba a místo plnění

- 3.1. Prodávající se zavazuje, že sjednané zboží předá kupujícímu **nejpozději do 8 týdnů** od nabytí účinnosti uzavřené smlouvy.
- 3.2. Zboží bude předáno prodávajícím a převzato kupujícím na základě oboustranně podepsaného předávacího protokolu, uzavřeném dle podmínek uvedených dále v této smlouvě.
- 3.3. Místem plnění je budova Dřevařského pavilonu Fakulty lesnické a dřevařské, v areálu sídla kupujícího: Kamýčká 129, 165 00 Praha – Suchdol, kontaktní osobou je Ing. Kamil Trgala, Ph.D., e-mail: [trgala@fld.czu.cz](mailto:trgala@fld.czu.cz).

#### IV.

##### Cena a platební podmínky

- 4.1. Kupní cena za zboží dodané v souladu s touto smlouvou a její přílohou je stanovena dohodou smluvních stran.
- 4.2. Kupující se zavazuje uhradit prodávajícímu za zboží dle čl. II. této smlouvy sjednanou kupní cenu ve výši 1 142 992,30 Kč bez DPH, tj. 1 383 021,- Kč vč. DPH.
- 4.3. Kupní cena je sjednána jako nejvýše přípustná a nepřekročitelná. Prodávající prohlašuje, že kupní cena obsahuje veškeré poplatky a další náklady spojené s plněním předmětu této smlouvy, zejména náklady na dopravu do místa plnění uvedeného v čl. III. této smlouvy, odvoz a ekologickou likvidaci obalových materiálů a jiného odpadu vzniklého v důsledku dodávky, náklady spojené s montáží a uvedením zboží do provozu, náklady na testovací provoz, předvedení plně funkčního zboží, zaškolení obsluhy **minimálně v rozsahu 2 hodin pro neomezený počet pracovníků fakulty**, náklady spojené s případným odstraněním vad dodaného zboží, zajištěním záručního servisu apod.
- 4.4. Prodávající prohlašuje, že kupní cena zahrnuje i případné náklady na správní poplatky, daně, cla, schvalovací řízení, provedení předepsaných zkoušek, zabezpečení prohlášení o shodě, certifikátů a atestů, převod práv, pojištění, manipulační poplatky apod.
- 4.5. Kupní cena bude kupujícím uhrazena v české měně na základě daňového dokladu – faktury, a to bezhotovostním převodem na bankovní účet prodávajícího. Fakturu je prodávající

povinen vystavit do 15 dnů po řádném a včasném dodání a převzetí zboží kupujícím dle této smlouvy na základě předávacího protokolu.

- 4.6. Daňový doklad – faktura musí obsahovat všechny náležitosti řádného účetního a daňového dokladu ve smyslu příslušných právních předpisů, zejména zákona č. 235/2004 Sb., o dani z přidané hodnoty, ve znění pozdějších předpisů. Zároveň musí být na faktuře uvedeno označení projektu a operačního programu, z něhož je dodávka spolufinancována: "Excelentní Výzkum jako podpora Adaptace lesnictví a dřevařství na globální změnu a 4. průmyslovou revoluci" s reg. č. CZ.02.1.01/0.0/0.0/16\_019/0000803" spolufinancovaného z Operačního programu Výzkum, vývoj a vzdělávání. V případě, že faktura nebude mít odpovídající náležitosti, je kupující oprávněn ji vrátit ve lhůtě splatnosti zpět prodávajícímu k doplnění, aniž se tak dostane do prodlení se splatností. Lhůta splatnosti počíná běžet znovu od opětovného doručení náležitě doplněné či opravené faktury kupujícím.
- 4.7. Splatnost faktury je 30 dnů ode dne jejího vystavení. Fakturu je prodávající povinen doručit do 3 pracovních dnů od jejího vystavení na adresu: Česká zemědělská univerzita v Praze, Ekonomický odbor, Kamýcká 129, PSČ 165 00, Praha – Suchbátka. V případě pozdějšího doručení je objednatel oprávněn žádat o přiměřené prodloužení splatnosti faktury. Jiné doručení nebude považováno za řádné s tím, že objednateli nevznikne povinnost fakturu doručitou jiným způsobem uhradit.
- 4.8. Za den platby se považuje den odepsání fakturované částky z bankovního účtu kupujícího ve prospěch bankovního účtu prodávajícího.
- 4.9. Úhrada kupní ceny nebo její části bude prodávajícímu převedena na jeho účet zveřejněný správcem daně podle § 98 zákona č. 235/2004 Sb., o dani z přidané hodnoty, ve znění pozdějších předpisů, a to i v případě, že na faktuře bude uveden jiný bankovní účet. Pokud prodávající nebude mít bankovní účet zveřejněný podle § 98 zákona č. 235/2004 Sb., o dani z přidané hodnoty, ve znění pozdějších předpisů, provede kupující úhradu na bankovní účet až po jeho zveřejnění správcem daně, aniž by byl kupující v prodlení s úhradou. Zveřejnění bankovního účtu správcem daně oznámí prodávající bezodkladně kupujícímu. Toto ustanovení se neuplatní v případě, že prodávající k tomuto není povinen dle zákona č. 235/2004 Sb., o dani z přidané hodnoty, ve znění pozdějších předpisů.

#### V.

##### Práva a povinnosti smluvních stran

- 5.1. Prodávající je povinen dodat zboží v dohodnutém množství, jakosti a provedení. Veškeré zboží dodávané prodávajícím kupujícímu z titulu této smlouvy musí splňovat kvalitativní požadavky dle této smlouvy a její přílohy.
- 5.2. Prodávající je povinen dodat zboží bez vad kupujícímu v souladu s podmínkami této smlouvy, přičemž za řádné dodání zboží se považuje jeho převzetí kupujícím, a to na základě potvrzení této skutečnosti v protokolu o předání a převzetí zboží. Předávací protokol může být podepsán nejdříve v okamžiku, kdy bude beze zbytku realizována samotná fyzická dodávka zboží prodávajícím, včetně všech souvisejících výkonů a služeb sjednaných touto smlouvou, s výjimkou záručního servisu (viz též čl. 5.3 této smlouvy).
- 5.3. Prodávající je povinen před předáním a převzetím zboží zajistit odvoz obalových materiálů (a následně provést jejich ekologickou likvidaci), provést montáž zboží a uvést zboží do provozu, provést testovací provoz, předvést kupujícímu plnou funkčnost zboží, provést zaškolení

obsluhy kupujícího a předat kupujícímu doklady, které jsou nutné k převzetí a k užívání zboží (zejména technická dokumentace, uživatelská dokumentace a záruční listy, vše výlučně v českém jazyce a podle předpisů platných v ČR, manuál v anglickém jazyce).

- 5.4. Kupující nabývá vlastnického práva ke zboží dnem převzetí zboží od prodávajícího na základě předávacího protokolu. Stejným okamžikem přechází na kupujícího také nebezpečí škody na věci.
- 5.5. Prodávající odpovídá kupujícímu za škodu či jinou újmu způsobenou porušením povinností podle této smlouvy nebo povinností stanovené obecně závazným právním předpisem.
- 5.6. Smluvní strany se dohodly a prodávající určil, že osobou oprávněnou k jednání za prodávajícího ve věcech, které se týkají této smlouvy a její realizace je:  
jméno a příjmení: Ing. Pavla Vaňková  
e-mail: pavla.vankova@svmtech.cz  
tel.: 602 544 661
- 5.7. Smluvní strany se dohodly a kupující určil, že osobou oprávněnou k jednání za kupujícího ve věcech, které se týkají této smlouvy a její realizace je:

jméno a příjmení: Ing. Martin Prajer, Ph.D.  
e-mail: [prajer@fd.czu.cz](mailto:prajer@fd.czu.cz)  
tel.: 603 421 914

nebo

jméno a příjmení: Ing. Radek Rinn  
e-mail: [rinn@fd.czu.cz](mailto:rinn@fd.czu.cz)  
tel.: 602 298 240

- 5.8. Veškerá korespondence, pokyny, oznámení, žádosti, záznamy a jiné dokumenty vzniklé na základě této smlouvy mezi smluvními stranami nebo v souvislosti s ní budou vyhotoveny v písemné formě v českém jazyce a doručují se buď osobně nebo doporučenou poštou, faxem či e-mailem, k rukám a na doručovací adresy oprávněných osob dle této smlouvy.

#### VI.

##### Záruka na zboží

- 6.1. Prodávající přebírá záruku za zboží na dobu 24 měsíců. Záruční doba počíná běžet dnem dodání zboží kupujícímu, tj. dnem podpisu předávacího protokolu kupujícím.
- 6.2. Kupující je povinen písemně ohlásit prodávajícímu záruční vady neprodlouženě. Záruční opravy provede prodávající bezplatně ve lhůtě maximálně 30 pracovních dnů od ohlášení vady, případně prodávající dohodne s kupujícím jinou dobu odstranění reklamované vady. V případě nedodržení tohoto prováděcího termínu je kupující dále oprávněn nedostatky nechat odstranit třetí osobou na náklady prodávajícího, a to i bez předchozího upozornění na tuto skutečnost.
- 6.3. V případě opravy v záruční době se tato prodlužuje o dobu od oznámení vady kupujícím do jejího odstranění prodávajícím, případně třetí osobou na náklady prodávajícího ve smyslu poslední věty čl. 6.2. této smlouvy.

- 6.4. Reklamací lze uplatnit nejpozději do posledního dne záruční doby, přičemž i reklamace odeslaná v poslední den záruční doby se považuje za včas uplatněnou.
- 6.5. Záruka se nevztahuje na vady způsobené neodbornou manipulací nebo mechanickým poškozením zboží, pokud tyto vady nezpůsobil sám prodávající.
- 6.6. Kupující si vyhrazuje právo místo záruční opravy požadovat odstranění reklamovaných vad dodáním náhradního zboží za zboží vadné, a to ve lhůtě dle čl. VI. bodu 6.2 této smlouvy.
- 6.7. V případě takové vady zboží nebo jeho části, která je neopravitelná a zároveň pokud prodávající nedisponuje zbožím stejného druhu a kvality, je kupující oprávněn od této smlouvy částečně odstoupit, a to v rozsahu vadného plnění, a žádat vrácení části kupní ceny, odpovídající ceně vadné části plnění.

#### VII. Sankční ujednání

- 7.1. V případě, že prodávající nedodá zboží v termínu dle této smlouvy, zavazuje se kupujícímu uhradit smluvní pokutu ve výši 0,5 % z kupní ceny za každý i jen započatý den prodlení.
- 7.2. Proávající je povinen kupujícímu uhradit smluvní pokutu ve výši 0,05 % z kupní ceny za každý započatý den prodlení s odstraněním reklamovaných vad ve lhůtě dle čl. VI. bodu 6.2 této smlouvy.
- 7.3. V případě prodlení kupujícího s úhradou faktury je prodávající oprávněn uplatnit vůči kupujícímu úrok z prodlení ve výši 0,05 % z dlužné částky za každý i jen započatý den prodlení s úhradou faktury.
- 7.4. Okolnosti vylučující odpovědnost nemají vliv na povinnost platit smluvní pokutu.
- 7.5. Kupující je oprávněn jakoukoli smluvní pokutu jednostranně započítat proti jakékoli pohledávce prodávajícího vůči kupujícímu (včetně pohledávky prodávajícího na zaplacení kupní ceny).
- 7.6. Úhradou smluvní pokuty zůstávají nedotčena práva kupujícího na náhradu škody či jiné újmy v plné výši.

#### VIII. Platnost a účinnost smlouvy

- 8.1. Tato smlouva nabývá platnosti dnem podpisu smlouvy oprávněnými zástupci obou smluvních stran. Tato smlouva nabývá účinnosti okamžikem uveřejněním v registru smluv v souladu se zákonem č. 340/2015 Sb., o zvláštních podmínkách účinnosti některých smluv, uveřejňování těchto smluv a o registru smluv (zákon o registru smluv), ve znění pozdějších předpisů.
- 8.2. Smlouvu je možné ukončit:
- a) písemnou dohodou smluvních stran;
  - b) písemnou výpovědí ze strany kupujícího;
  - c) odstoupením od smlouvy.

- 8.3. Smlouvu je možné ukončit výpovědí kupujícího, a to i bez udání důvodu. Výpovědní lhůta činí 1 měsíc a začíná běžet 1. dnem měsíce, který následuje po měsíci, ve kterém obdržela smluvní strana výpověď.
- 8.4. Odstoupit od smlouvy lze pouze z důvodů stanovených ve smlouvě nebo příslušných právních předpisech. Od této smlouvy může smluvní strana dotčená porušením povinnosti jednostranně odstoupit pro podstatné porušení této smlouvy, přičemž za podstatné porušení této smlouvy se zejména považuje:
- a) na straně kupujícího nezaplacení kupní ceny podle této smlouvy ve lhůtě delší 30 kalendářních dnů po dni splatnosti příslušné faktury;
  - b) na straně prodávajícího, jestliže nedodá řádně a včas předmět této smlouvy a nezjedná nápravu do 5 pracovních dnů od písemného upozornění kupujícího na neplnění této smlouvy;
  - c) na straně prodávajícího, postupuje-li prodávající při plnění smlouvy v rozporu s ujednáními této smlouvy, s pokyny oprávněného zástupce kupujícího, či v rozporu s právními předpisy.
- 8.5. Kupující je oprávněn od smlouvy odstoupit v případě, že podle údajů uvedených v registru plátců DPH se prodávající stane nespolehlivým plátcem DPH.
- 8.6. Skončením účinnosti smlouvy zanikají všechny závazky smluvních stran ze smlouvy. Skončením účinnosti nebo jejím zánikem nezanikají nároky na náhradu škody či jiné škody a zaplacení smluvních pokut sjednaných pro případ porušení smluvních povinností vzniklé před skončením účinnosti smlouvy, a ty závazky smluvních stran, které podle smlouvy nebo vzhledem ke své povaze mají trvat i nadále, nebo u kterých tak stanoví zákon.
- 8.7. Proávající přebírá riziko změny okolností dle občanského zákoníku.

#### IX. Závěrečná ustanovení

- 9.1. Vztahy mezi smluvními stranami se řídí českým právním řádem. Ve věcech smlouvy výslovně neupravených se právní vztahy z ní vznikající a vyplývající řídí příslušnými ustanoveními občanského zákoníku a ostatními obecně závaznými právními předpisy.
- 9.2. Veškeré změny či doplnění smlouvy lze učinit pouze na základě písemné dohody smluvních stran. Takové dohody musí mít podobu datovaných, číslovaných a oběma smluvními stranami podepsaných dodatků smlouvy.
- 9.3. Vztahuje-li se důvod neplatnosti jen na některé ustanovení smlouvy, je neplatným pouze toto ustanovení, pokud z jeho povahy, obsahu anebo z okolností, za nichž bylo sjednáno, nevyplývá, že jej nelze oddělit od ostatního obsahu smlouvy.
- 9.4. Smluvní strany budou vždy usilovat o přátelské urovnání případných sporů vzniklých ze smlouvy. Pokud nebylo dosaženo přátelského urovnání sporu ani do 30 pracovních dnů po jeho prvním oznámení druhé smluvní straně, je kterákoliv ze smluvních stran oprávněna obrátit se svým nárokem k příslušnému soudu.
- 9.5. Smlouva se vyhotovuje ve 4 (čtyřech) stejnopisech, z nichž každý má platnost originálu. Každá ze smluvních stran obdrží po 2 (dvou) stejnopisech.

- 9.6. Nedílnou součástí této smlouvy je prodávajícím zpracovaná příloha s názvem Technická specifikace předmětu plnění.
- 9.7. Proávající bezvýhradně souhlasí se zveřejněním plného znění této smlouvy tak, aby tato smlouva mohla být předmětem poskytnuté informace ve smyslu zákona č. 106/1999 Sb., o svobodném přístupu k informacím, ve znění pozdějších předpisů. Proávající rovněž souhlasí se zveřejněním plného znění této smlouvy dle § 219 zákona č. 134/2016 Sb., o zadávání veřejných zakázek, ve znění pozdějších předpisů a zákona č. 340/2015 Sb., o zvláštních podmínkách účinnosti některých smluv, uveřejňování těchto smluv a o registru smluv (zákon o registru smluv).
- 9.8. Proávající bere na vědomí a souhlasí, že je osobou povinnou ve smyslu § 2 písm. e) zákona č. 320/2001 Sb., o finanční kontrole, ve znění pozdějších předpisů. Proávající je povinen plnit povinnosti vyplývající pro něho jako osobu povinnou z výše citovaného zákona.
- 9.9. Smluvní strany prohlašují, že si smlouvu před jejím podpisem přečetly a s jejím obsahem bez výhrad souhlasí. Smlouva je vyjádřením jejich pravé, skutečné, svobodné a vážné vůle. Na důkaz pravosti a pravdivosti těchto prohlášení připojují oprávnění zástupci smluvních stran své vlastnoruční podpisy.

V Praze dne .....

V Praze dne.....

Za kupujícího:  
Česká zemědělská univerzita v Praze

Za prodávajícího:  
SVMTech s.r.o.

.....  
Ing. Jana Vohralíková, kvestorka

.....  
Ing. Radovan Zadražil, jednatel společnosti

## Technická specifikace nabízené sestavy – příloha č.1

# PRODUCT DATA

## Sound Sources and Impact Sound Source for Building Acoustics:

Sound Sources: OmniSource™ Type 4295 and OmniPower™ Type 4292-L

Impact Sound Source: Tapping Machine Type 3207

Power Amplifiers Type 2734-A and 2734-B

For proper building acoustics measurements, a sound source which fulfils the relevant standards (for example, ISO 140) is required. Brüel & Kjær offers a complete range of sound sources for building acoustics measurements, including Tapping Machine Type 3207, single-speaker omnidirectional OmniSource™ Type 4295 and 12-speaker omnidirectional OmniPower™ Type 4292-L. Power Amplifier Type 2734 can drive both OmniPower and OmniSource. Optional carrying cases for the sound sources are available, as well as wireless control systems for use with Hand-held Analyzer Type 2250 and the dual channel Type 2270.



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### Uses and Features

#### Uses

- Architectural and building acoustics
- Measurement of:
  - Airborne sound insulation
  - Reverberation time
  - Impact sound level

#### Features

- Part of a complete building acoustics system featuring Brüel & Kjær's Hand-held Analyzer Type 2250 or 2270
- Two omnidirectional noise sources
- Tapping machine for impact sound level measurements
- Remote operation via cable or wireless remote control
- Satisfies national and international standards
- Robust
- Easily portable

### Introduction

Architectural and building acoustic measurements require a range of noise sources for airborne noise and impact noise transmission measurements.

For airborne noise transmission measurements, an omnidirectional sound source is needed. Brüel & Kjær offers two solutions: OmniPower Sound Source Type 4292-L and OmniSource Sound Source Type 4295.

For impact sound measurements, Brüel & Kjær offers Tapping Machine Type 3207, a robust and portable device that fulfils national and international standards.

For a complete measurement system, combine the sound sources with a driving amplifier (such as Type 2734-A or 2734-B), a sound level analyzer (such as Type 2250 or 2270), and a PC with Building Acoustic analysis and reporting software.

Brüel & Kjær supplies all of these items and a range of carrying cases for storage and transportation:

- OmniPower Type 4292-L, 12-speaker high-power omnidirectional sound source
- OmniSource Type 4295, lightweight single-speaker omnidirectional sound source
- Tapping Machine Type 3207
- Power Amplifier Type 2734-A or 2734-B, amplifiers for driving sound sources
- Flight Case KE-0449 and Carrying Cases KE-0364 and KE-0392 for packing and transportation
- Cables and Wireless Remote Control accessories
- Battery Kit UA-1477 for Type 3207

### Omnidirectional Sound Sources

For most building acoustics measurements, the sound source must radiate sound evenly in all directions to give reproducible and reliable results; therefore, the relevant building acoustics measurements standards (ISO 140 and ISO 3382) require the use of an omnidirectional sound source.

#### OmniPower Sound Source Type 4292-L



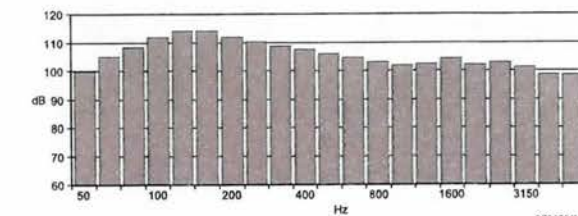
100110

OmniPower Omnidirectional Sound Source Type 4292-L (see Fig. 1) uses a cluster of 12 loudspeakers in a dodecahedral configuration that radiates sound evenly with a spherical distribution. All 12 speakers are connected in a series-parallel network to ensure both in-phase operation and an impedance that matches the power amplifier. The entire assembly weighs no more than 8 kg and is fitted with a convenient lifting handle that does not measurably interfere with the sound field.

Powered by Power Amplifier Type 2734-A or 2734-B, the Sound Source can deliver a maximum sound power of 122 dB re 1 pW (100–3150 Hz). The high power output of Type 4292-L makes it ideal for sound insulation measurements.

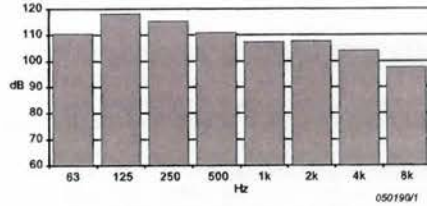
Type 4292-L satisfies the requirements of DIN 52210, ISO 140 and ISO 3382 standards (see Fig. 2 through Fig. 5). Its directional response for the horizontal plane is shown in Fig. 6.

Fig. 2  
Frequency response for 1/3-octave sound power levels for OmniPower Type 4292-L using Power Amplifier Type 2734 and its internal pink noise generator

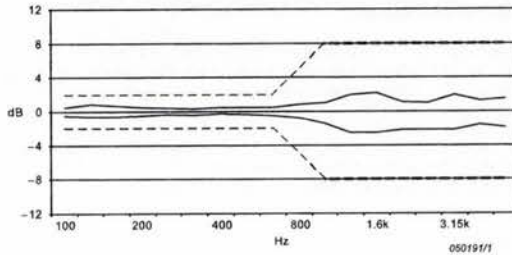


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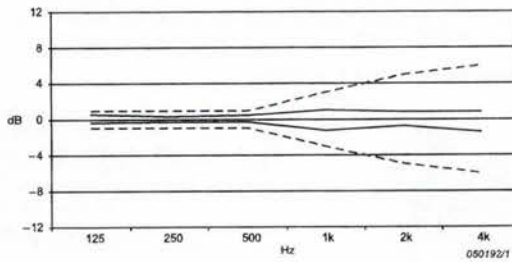
**Fig. 3**  
Frequency response for  $1/1$ -octave sound power levels for OmniPower Type 4292-L using Power Amplifier Type 2734 and its internal pink noise generator



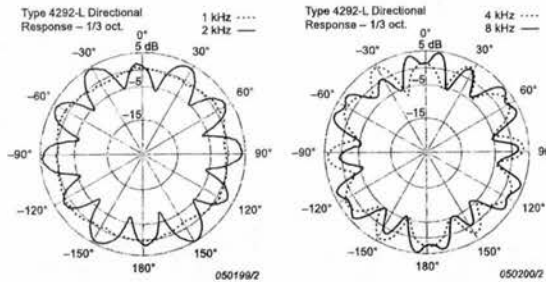
**Fig. 4**  
Directivity for OmniPower Type 4292-L according to ISO 140: maximum deviation from mean for 'gliding' 30° arc. Upper and lower curves are the ISO 140 tolerances



**Fig. 5**  
Directivity for OmniPower Type 4292-L according to ISO 3382: maximum deviation from mean for 'gliding' 30° arc. Upper and lower curves are the ISO 3382 tolerances



**Fig. 6**  
Type 4292-L's directional response for the horizontal plane, measured in  $1/3$ -octaves. Below 1 kHz there is no significant deviation from omnidirectionality



**OmniSource Sound Source Type 4295**

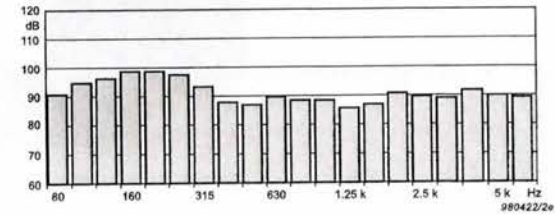
**Fig. 7**  
OmniSource Sound Source Type 4295



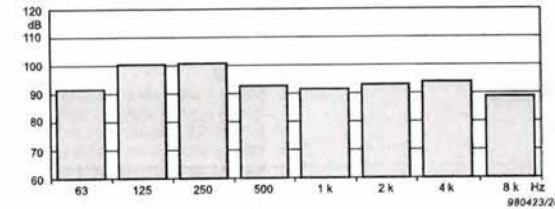
OmniSource Sound Source Type 4295 (see Fig. 7) presents a new solution to omnidirectional sound source design. Type 4295 is optimised for the measurement of room acoustic quantities such as reverberation time, sound distribution and spatial decay. The patented principle of the OmniSource Sound Source uses a single high-power loudspeaker, which directs the sound signal through a conical coupler to a circular orifice, and despite its compact dimensions and low weight, OmniSource Type 4295 is still capable of emitting a sound power of 105 dB re 1 pW (see Fig. 8 and Fig. 9).

The size of the orifice and the shape have been carefully engineered to radiate sound evenly in all directions. Thus, Type 4295 fulfils the national and international standards for omnidirectional sound sources (see Fig. 10 and Fig. 11). Type 4295's directional response for the plane through the axis is shown in Fig. 12.

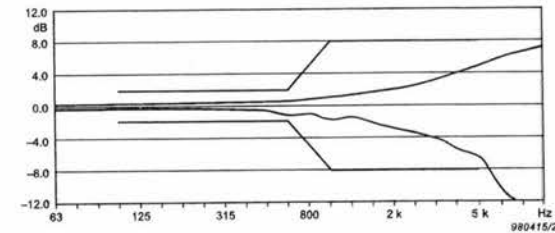
**Fig. 8**  
Maximum  $1/3$ -octave sound power levels for OmniSource Type 4295 using Power Amplifier Type 2734



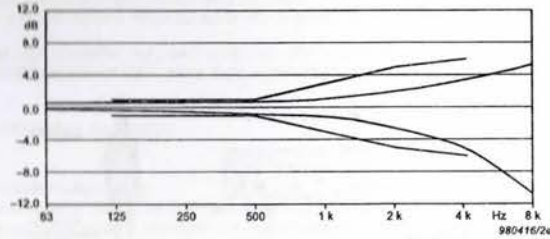
**Fig. 9**  
Maximum  $1/1$ -octave sound power levels for OmniSource Type 4295 using Power Amplifier Type 2734



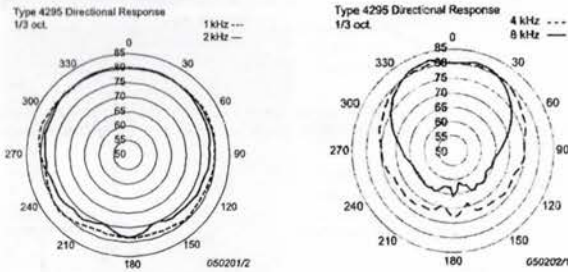
**Fig. 10**  
Directivity for OmniSource Type 4295 according to ISO 140 maximum deviation from mean for 'gliding' 30° arc. Upper and lower curves are the ISO tolerances



**Fig. 11**  
Directivity for  
OmniSource Type  
4295 according to  
ISO 3382: maximum  
deviation from mean  
for 'gliding' 30° arc.  
Upper and lower  
curves are the  
ISO tolerances



**Fig. 12**  
Type 4295 directional  
response for the plane  
through the axis,  
measured in 1/3-  
octaves. Below 1 kHz  
and in the plane  
perpendicular to the  
axis, there is no  
significant deviation  
from omnidirectionality



## Impact Sound Source

### Tapping Machine Type 3207

Tapping Machine Type 3207 is an impact sound generator (see Fig. 13). It can be used for impact sound measurements to national and international standards. The unit is available with an optional battery kit and a remote control.

Type 3207 uses five hammers each weighing 500 g and operating at 2 Hz dropping from a height of 40 mm, giving an operating frequency of 10 Hz. This fulfils national and international standards. The hammers are operated via tappets on a single shaft. The shaft is driven by a DC motor via a toothed belt and gearbox.

**Fig. 13**  
Tapping Machine  
Type 3207



The unit is based around a welded aluminium chassis. Both size and weight have been minimised for easy transportation. Three extendable legs support the unit during operation with rubber feet that are height adjustable with supplied gauges. This gives stable and level mounting during operation in accordance with the relevant standards.

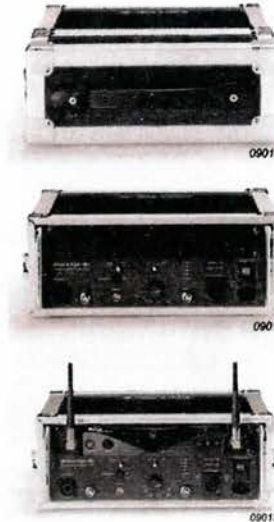
The unit is powered via the supplied mains adaptor or the optional battery kit (see Fig. 14), and can be remotely switched on and off via cable AQ-0633 or Wireless Remote Control Option UA-1476 (see Fig. 14).

**Fig. 14**  
Accessories for  
Tapping Machine.  
Battery Kit  
UA-1477 (right)  
and Wireless  
Remote Control  
UA-1476 (left), which  
may also be used to  
control the internal  
generator of Power  
Amplifier Type 2734



## Power Amplifier Types 2734-A and 2734-B

**Fig. 15**  
Top: Types 2734-A  
and 2734-B are built  
into robust flight cases  
Middle: Type 2734-A  
showing front mounted  
controls and  
connectors  
Bottom: Type 2734-B  
includes wireless audio  
system UL-0256



Type 2734 is designed to power sound sources during building and room acoustic field measurements. Compact, light weight and built into a robust flight case, it is easy and safe to carry and transport to the measurement location. All connectors and controls are on the front for easy access.

It is simple to get the output level right and reproduce previous settings using the power amplifier's calibrator controls and level indicators. For flexibility, it has XLR, jack and BNC input sockets and BNC line and speaker output sockets. A sensitivity selector in 10 dB steps allows the amplifier to adapt to a variety of source signal levels and sound source ratings. Hand-held Analyzer Type 2250/2270's generator signal can be connected to the amplifier input, to provide the pink or white noise used in building acoustics.

In addition, Type 2734-B includes a wireless audio system (Fig. 23) to accommodate cable-free transmission of the building acoustics test signal, which could be white, pink or band-limited noise; or swept sine. Wireless operation also makes source and receiver position changes more convenient. Type 2734-A can be upgraded to Type 2734-B by installing optional Wireless Audio System UL-0256.

Type 2734 has a built-in generator providing pink or white noise in the 50–5000 Hz range. It can be controlled from the front panel, or with the optional Wireless Remote Control UA-1476 (the same control used to control Tapping Machine Type 3207, Fig. 14). Transmitter UA-1476 has a pushkey for manual control, and a cable connection for automatic control from an analyzer.

**Carrying Case KE-0392**

**Fig. 16**  
Carrying Case  
KE-0392



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OmniSource Sound Source Type 4295 has an optional, custom-designed carrying case with shoulder strap, KE-0392 (see Fig. 16), for easy storage and transportation. The case is foam lined and provides impact protection for the OmniSource inside.

**Flight Case KE-0449**

An optional transportation and storage case, KE-0449 is available for OmniPower Sound Source Type 4292-L (see Fig. 18, left). It is custom designed, features a foam lining to protect Type 4292-L and has two handles for ease of carriage.

**Carrying Bag KE-0462**

Carrying Bag KE-0462 is included with OmniPower Sound Source Type 4292-L. Padded and with handles as well as a shoulder strap, it offers basic protection (see Fig. 17).

**Fig. 17**  
Carrying Bag KE-0462



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**Carrying Case KE-0364**

For the OmniPower tripod, Carrying Case KE-0364 (see Fig. 18, right) is equipped with both a shoulder strap and handles.

**Fig. 18**  
Flight Case  
KE-0449 (left)  
and Carrying Case  
KE-0364 (right)



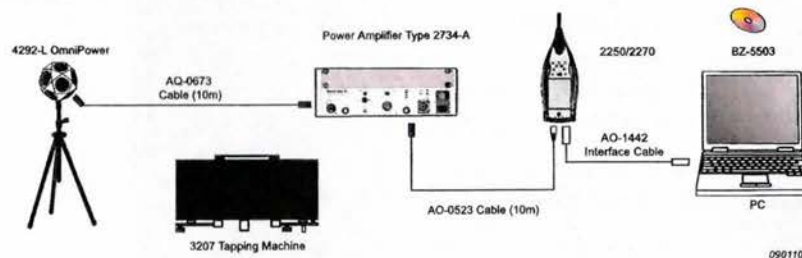
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**Complete Systems**

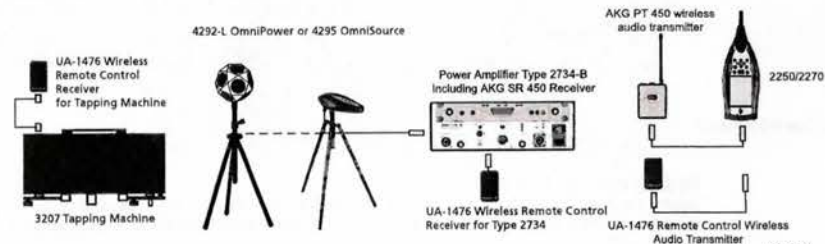
**Fig. 19 Complete system**



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The sound sources mentioned above belong to a range of complete measurement systems from Brüel & Kjær, including power amplifiers, sound-level analyzers, and PC-software for analysing documenting results.

**Fig. 20 Sound sources with wireless remote control options**



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**Hand-held Analyzer Types 2250 and 2270**

**Fig. 21**  
Hand-held Analyzer  
Types 2250 and 2270



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Types 2250 and 2270 are robust, hand-held instrument platforms designed to host a wide range of sound and vibration measurement applications. Their uses range from assessing environmental and workplace noise to industrial quality control and product development.

Easy to use, their robust, light and ergonomic design make them easy to grip, hold and operate with one hand. Their high-resolution colour touch screens show the instrument setup, status and data at a glance, and let you select what you want to see with the tap of a stylus. The "traffic light" indicator, positioned centrally on the push button panel, shows you the current measurement status, even from a distance.

The hand-held analyzers are built for the tough environment of field measurements. They will work reliably in rain, dust, heat, frost, day or night, and can be placed on a tripod.

For documentation, you can add spoken or written comments to your measurements, and make sound recordings during any of the measurements. (Note that sound recording requires Sound Recording Option BZ-7226.)

Type 2250 is a single-channel analyzer, while Type 2270 is dual-channel and has additional features such as a built-in camera allowing you to attach photos to your measurements and a LAN interface.

The high precision hand-held analyzers offer a wide range of optional software application modules, including prominent applications such as Reverberation Time Software and Building Acoustics Software.

## Reverberation Time and Building Acoustics

### Reverberation Time

Reverberation time is an important feature of spaces where sound level, the intelligibility of speech, or perception of music is important. It is the time that it takes for a sound to decay by 60 dB. Usually, the time taken for the signal to drop 20 or 30 dB is measured and extrapolated to find the time that it would take the signal to dissipate by 60 dB.

Fig. 22  
Reverberation Time measurement – measured using the interrupted noise method

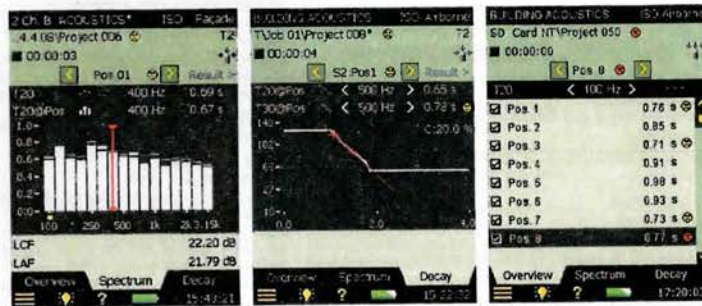


Reverberation time is measured, using an impulse or an interrupted noise, at several positions, which are then averaged together.

To measure reverberation time, simply press the Start/Pause push button on the hand-held analyzer and, if you are using impulse excitation, burst the balloon.

A yellow 'smiley' icon indicates that you may be able to improve the measurement at one (or more) frequency bands, a red smiley indicates that the measurement should be retaken. Tap the relevant smiley icon to read the explanation.

Fig. 23  
Reverberation time spectrum (left); Reverberation decay curve (centre); and Overview of results (right)



### Building Acoustics

Building acoustics is the assessment of airborne, façade or impact sound insulation in buildings. The assessment is based on measured 1/1-octave or 1/3-octave spectra within the 50–5000 Hz range. Measurements may be serial (one frequency band at a time) or parallel (all bands simultaneously).

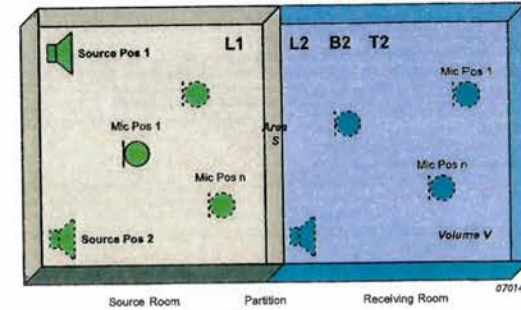
#### Airborne Sound Insulation

Fig. 24 shows a typical airborne task setup using a loudspeaker (emitting pink noise) and a number of microphone positions to measure the average source room spectrum L1, and the average receiving room spectrum L2. The average background noise spectrum B2 is measured to verify the true L2 spectrum. The average reverberation time spectrum T2 is measured, to correct for the amount of absorption in the receiving room. Finally the single number result (for example  $D_{nTw}$ ) is calculated from the L1, L2, B2 and

T2 spectra, and the result can then be compared with the minimum requirements stated in the building regulations.

Fig. 24  
Sound source and microphone positions for measuring airborne sound insulation

L1 = Source room level  
L2 = Receiving room level  
B2 = Background level  
T2 = Reverberation Time



The sound level depends on the position in the rooms, so several microphone positions are used to measure the average of the source room level, L1, the average of the receiving room level L2 and the average of the background noise level B2. The average reverberation time T2 is also measured using several positions.

Examples of measurements and results are shown in Fig. 25.

Fig. 25  
Examples of building acoustic measurements using Type 2250/2270: L2 average and L2 at one position (Left) Overview of measurements (Centre) Final result (Right)



#### Façade Sound Insulation

Façade sound insulation is a variant of airborne sound insulation, with its own standards. The 'source room' is the space outside the façade, and the sound source may be road traffic or a loudspeaker representing outdoor noise. When using traffic noise, the indoor and outdoor sound levels must be measured simultaneously, requiring dual-channel measurements (Type 2270). The outdoor microphone positions are flush with the façade, or 2 m in front of it. Calculations are similar to those of airborne sound insulation, but take the pressure increase at the microphone positions into account.

#### Impact Sound Insulation

Impact sound is typically caused by footsteps, and to measure impact sound insulation a standardised impact sound source (tapping machine) is placed in the source room. The receiving room levels are measured as for airborne sound insulation, with several positions of the tapping machine. Calculations are like those for airborne sound insulation, except the results represent absolute (not relative) levels.

### Compliance with Environmental Standards for Types 4292-L and 4295

<b>Temperature</b>	IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing, Cold and Dry Heat. Operating Temperature: +5 to +40°C (41 to 104°F) Storage Temperature: -25 to +70°C (-13 to 158°F) IEC 60068-2-14: Change of Temperature: -10 to +40°C (2 cycles, 1°C/min.)
<b>Humidity</b>	IEC 60068-2-78: Damp Heat: 93% RH (non-condensing at 40°C (104°F))
<b>Mechanical</b>	Non-operating: IEC 60068-2-6: Vibration: 0.3 mm, 20 m/s <sup>2</sup> , 10-500 Hz IEC 60068-2-27: Shock: 1000 m/s <sup>2</sup> IEC 60068-2-29: Bump: 1000 bumps at 250 m/s <sup>2</sup>

### Specifications – OmniPower Sound Source Type 4292-L

#### STANDARDS

Conforms to the following:  
ISO 140-3  
ISO 3382  
DIN 52210

#### NOMINAL IMPEDANCE

6 Ω

#### POWER HANDLING

300 W continuous broadband  
1000 W short duration (duty cycle 1/10, on time 10 s)

#### OPERATING FREQUENCY RANGE

50-5000 Hz (1/3-octave band centre frequencies)

#### CONNECTION

Four-pin Neutrik® Speakon® socket, pins 1 + and 1-

#### SOUND POWER LEVEL

(with Power Amplifier Type 2734, duty cycle 1/3,  
100-3150 Hz pink-noise signal)  
Broadband: 122 dB re 1 pW  
Spectral: Min. 100 dB/1 pW in each 1/3-octave band

#### TRIPOD

Adjustable to give a speaker height of between 131 and 207 cm

#### FLOOR MOUNTING

Rubber feet provided for floor mounting

#### DIAMETER

Speaker Enclosure: 39 cm (15.35")

#### WEIGHT

Speaker Enclosure: 8.0 kg (17.6 lb.)  
Tripod: 2.3 kg (5.1 lb.)

### Specifications – OmniSource Sound Source Type 4295

#### STANDARDS

Conforms to the following:  
ISO 140-3  
ISO 3382  
DIN 52210  
ISO 14257 (Draft)

#### OPERATING FREQUENCY RANGE

80-6300 Hz

#### NOMINAL IMPEDANCE

6 Ω

#### POWER HANDLING

50 W continuous

#### SOUND POWER LEVEL

(with Power Amplifier Type 2734, 80-6300 Hz pink-noise signal)

Broadband: 105 dB re 1 pW

Spectral: Min. 85 dB in each 1/3-octave band

#### CONNECTION

Four-pin Neutrik® Speakon® socket, pins 1 + and 1-

#### TRIPOD THREADS (LARGE TYPE)

One at rear end, one below centre of gravity


#### CARRYING CASE

Nylon with padded inlay, adjustable carrying strap

#### MECHANICAL SPECIFICATIONS

Material: Dense polyurethane plastic, painted black  
Dimensions: 145 × 560 mm (25.7 × 22")  
Weight: 3.5 kg (7.7 lb.)

### Compliance with Regulations and Environmental Standards for Type 3207

	CE-mark indicates compliance with: EMC Directive, Low Voltage Directive and Machinery Directive Remote Control UA-1476: CE-mark means compliance with R&TTE Directive C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand
<b>Safety</b>	EN/IEC 61010-1 and UL 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use
<b>EMC Emission</b>	EN/IEC 61000-6-3: Generic emission standard for residential, commercial and light-industrial environments CISPR 22: Radio disturbance characteristics of information technology equipment. Class B limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device This ISM device complies with Canadian ICES-001
<b>EMC Immunity</b>	EN/IEC 61000-6-2: Generic standards – Immunity for industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements Note: The above is only guaranteed using accessories listed in this Product Data Sheet.
<b>Temperature</b>	IEC 60068-2-1 & IEC 60068-2-2: Environmental testing, Cold and dry heat. Operating Temperature: 0 to +40°C (32 to 104°F) Storage Temperature: -25 to +70°C (-13 to 158°F)
<b>Humidity</b>	IEC 60068-2-78: Damp heat: 90% RH (non-condensing at 40°C (104°F))
<b>Mechanical</b>	Non-operating: IEC 60068-2-6: Vibration: 0.3 mm, 20 m/s <sup>2</sup> , 10-500 Hz IEC 60068-2-27: Shock: 500 m/s <sup>2</sup> , 6 directions IEC 60068-2-29: Bump: 1000 bumps at 250 m/s <sup>2</sup>
<b>Enclosure</b>	IEC 60529: Protection provided by enclosures: IP 20

### Specifications – Tapping Machine Type 3207

#### STANDARDS

ISO 140  
ISO 717  
DIN 52210  
BS 5821  
ASTME 492

#### HAMMERS

Five in line, 100 mm between each hammer, single hammer weight  
500±12 g

#### IMPACT FREQUENCY

Each hammer operates at 2 Hz, tapping frequency for unit is 10±0.5 Hz

#### IMPACT DYNAMICS

Equivalent free-fall height of hammers 40 mm, extra drop below impact plane at least 4 mm

#### REMOTE OPERATION

Socket: LEMO 4-pole

Pin 1: 0 VDC, GND

Pin 2: Power supply for external unit, max. 24 VDC, 1 A

Pin 3: For "On": +5 VDC (TTL-Level)

Pin 4: For "On": connect to Pin 1

Housing: Shield

#### REMOTE OPERATION WIRELESS CONTROL KIT UA-1476

(OPTIONAL)

Operating Frequency: 433.92 MHz

Transmitter Unit:

- Connector: LEMO-coaxial socket

- Centre pin: +5 VDC for "on"; Outer ring 0 VDC

- Batteries: 2 × AAA/LR03/Micro 1.5 V

- Dimensions: 105 × 58 × 18.5 mm (4.13 × 2.28 × 0.73")

- Weight: 90 g

Receiver Unit

Connector: LEMO 4-pole plug with cable

For details of pin connections see "Remote Operation"

- Power supply: From the remote control socket

- Dimensions: 85 × 46 × 16 mm (3.35 × 1.81 × 0.63")

- Weight: 80 g

#### BATTERY KIT UA-1477 (OPTIONAL)

Mounting Position: Internally in unit housing

Battery Life: 1.5 hours

Battery Type: Maintenance free 12 V/2 Ah Lead Acid battery

Charger Type: Same as Mains Adaptor (see below)

Charging Time: 24 hours for a completely discharged battery

#### ON/OFF SWITCH

3 Positions: Remote, Off, On

#### MAINS ADAPTOR

10.5-35 VDC, min. 25 W

Socket: LEMO coaxial (can also be used as charging socket)

Middle Pin: +10.5-35 VDC, Outer ring: 0 V

Mains Adaptor: Mains Adaptor ZG-0429

100-240 V AC input, 24 V DC output, max. 45 W

Operating temperature max. +40°C

Can also be used to charge optional battery pack

#### SUPPORTS

3 extendable and height adjustable feet

#### DIMENSIONS

W × H × D: 480 × 273 × 155 mm (18.9 × 10.7 × 6.1")

(feet retracted)

W × H × D: 590 × 273 × 285 mm (23.2 × 10.7 × 11.2")


(feet extended)

Weight: 11.5 kg (25 lb.) with Mains Adaptor

#### MAINTENANCE REQUIREMENTS

After 24 hr operation or once a year (whichever comes first), lubricate with the supplied sewing machine oil according to instructions

## Compliance with Regulations and Environmental Standards for Type 2734

	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand
<b>Safety</b>	EN/IEC 61010-1 and ANSI/UL 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use.
<b>EMC Emission</b>	EN/IEC 61000-6-4: Generic emission standard for industrial environments. CISPR 22: Radio disturbance characteristics of information technology equipment. Class A Limits. FCC Rules, Part 15: Complies with the limits for a Class A digital device
<b>EMC Immunity</b>	EN/IEC 61000-6-1: Generic standards - Immunity for residential, commercial and light-industrial environments. EN/IEC 61000-6-2: Generic standards - Immunity for industrial environments. EN/IEC 61326-1: Electrical equipment for measurement, control and laboratory use - EMC requirements Note: The above is only guaranteed using accessories included in this Product Data.
<b>Temperature</b>	IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: 0 to +50°C (32 to 122°F) Storage Temperature: 0 to +70°C (32 to 158°F)
<b>Humidity</b>	IEC 60068-2-78: Damp Heat: 90% RH (non-condensing at 40°C (104°F))
<b>Mechanical</b>	Non-operating: IEC 60068-2-6: Vibration: 2 g <sub>rms</sub> 3 x 20 minutes IEC 60068-2-27: Bump: 1000 bumps at 10 g, 6 directions IEC 60068-2-27: Shock: 70 g, 6 directions
<b>Enclosure</b>	IEC 60529 (1989): Protection provided by enclosures: IP 20

## Specifications - Power Amplifier Types 2734-A and 2734-B

### MAXIMUM OUTPUT POWER

(TA = 25 °C, 1 kHz, 0.1% THD)  
4 Ω: 500 W  
6 Ω: 330 W  
8 Ω: 250 W

### CONTINUOUS OUTPUT POWER (1 kHz, 6 Ω)

With Air Filter: TA = 25 °C: 250 W

Without Air Filter:

- TA = 25 °C: 330 W  
- TA = 35 °C: 175 W

### INPUT VOLTAGE

Nominal voltage @ Sensitivity =  
0 dB: 0.3 V

-10 dB: 1 V

-20 dB: 3 V

Headroom at nominal input voltage

Balanced: 18 dB

Unbalanced @ Sensitivity =

0 dB: 17 dB

-10 dB: 15 dB

-20 dB: 12 dB

Common Mode Rejection (1 kHz): > 50 dB

Maximum DC Voltage: ±25 V

### INPUT IMPEDANCE

1 kHz:

- Balanced: 20 kΩ ±1%

- Unbalanced: 10 kΩ ±1%

DC:

- Balanced: 220 kΩ ±1%

- Unbalanced: 110 kΩ ±1%

### OUTPUT VOLTAGE

Line Output Peak Voltage: 9 V

Power Output Peak Voltage: 80 V

Power Output DC Voltage: 40 V

### OUTPUT IMPEDANCE (1 kHz)

Line Output: 100 Ω

Line Output Load: ≥20 Ω

Power Output: 10 mΩ

Power Output Load: ≥2 Ω

### FREQUENCY RESPONSE (20 Hz - 20 kHz)

Line Output: +0, -1 dB

Power Output: ±1 dB

See also figure 1 below

### SNR (MAX POWER 1 kHz)/(SILENCE 0...20 kHz)

Line Output: 101 dB

Power Output: 90 dB

### THD+N (20 Hz - 20 kHz)

Line Output: 1 kHz: < -78 dB

Power Output: 1 - 500 W, 4 Ω: < -60 dB

### SENSITIVITY, ATTENUATION AND GAIN

Sensitivity: -20, -10, 0 dB

Sensitivity Error (no error @ 0 dB): ±0.1 dB

Attenuation: -30, -24, -18, -12, -9, -6, -5, -4, -3, -2, -1, 0 dB

Attenuation Error (no error @ 0 dB): ±0.1 dB

Total Gain (Sensitivity = Attenuation = 0 dB):

- Any Input to Line Output: 16 ±0.2 dB

- Any Input to Power Output: 43.1 ±0.4 dB

### LEVEL INDICATOR

Trigger levels re power output clip level

Red LED: +3 dB

Yellow LED: 0 dB (Power Output clip indicator)

Green LED: -6 dB

Blue LED: -30 dB (Signal Present indicator)

### FAN

Switch On Heatsink Temperature: 40 °C

L<sub>w</sub> at Min Speed: 25 dB re 1 pW

L<sub>w</sub> at Max Speed: 52 dB re 1 pW

### NOISE GENERATOR

Noise Types: white, pink

Frequency Range: 50 - 5000 Hz 1/3 octave bands

Crest Factor: 12 dB

Period Time: 22.5 s

Third Octave Spectral Error: ±0.3 dB

Line Output Voltage (Sensitivity = Attenuation = 0 dB): 2.16 V<sub>rms</sub>

Switch Off: Equivalent RT in 1/3 octaves: <50 ms @ 50 Hz, <4 ms @ 5 kHz

### CONNECTORS

Balanced Input Socket: Neutrik® Combo XLR-type: 3-pin and 1/4" jack

Unbalanced Input Socket: BNC

Unbalanced Line Output Socket: BNC

Power (Speaker) Output Socket: Neutrik® 4-pole Speakon® type

Mains Power Inlet: IEC type

### CONTROLS

Generator Button: Toggling between On and Off

Generator Slide Switch: 2-state, White/Pink noise Sensitivity slide

switch: 3-state, -20, -10, 0 dB

Attenuation Rotary Knob: 12-state, -30, -24, -18, -12, -9, -6, -5, -4,

-3, -2, -1, 0 dB

Mains Power Rocker Switch: 2-pole

### STATUS INDICATORS

Protect Indicator: Red LED, power output over-current, overheat,

overload or long-term high frequency

Power On Indicator: Green LED

### MAINS POWER

Voltage Selector (Rear Panel): 230/115 V

Mains Voltage Range:

- @ 230 V: 200 - 240 V

- @ 115 V: 100 - 125 V

Mains Frequency Range: 45 - 65 Hz

Fuse: Wickmann/Littlefuse series 215 (or 181)

- @ 230 V: T 3.15 AH 250 V

- @ 115 V: T 6.3 AH 125 V

Maximum Power Consumption: 650 W

### MECHANICAL

Weight (including mains cord in lid):

- Type 2734-A: 6.0 kg

- Type 2734-B: 7.0 kg

Dimensions W x H x D: 330 x 130 x 310 mm (13 x 5.1 x 12.2")

### TRANSMITTER AKG PT 450 (OPTIONAL)

Specifications from manufacturer's technical data

RF Carrier Frequency Ranges: 7 channels over 650 - 865 MHz

Modulation: FM

Audio Bandwidth: 35 to 20000 Hz

THD (typical at rated deviation/1 kHz): <0.7%

S/N Ratio: 120 dB(A)

RF Output: 50 mW max. (ERP)

Battery Life:

1.5 V AA Dry Battery: 6 hours; 1.2 V NiMH, 2100 mAh AA size

Rechargeable Battery: 8 hrs

- Size: 60 x 73.5 x 30 mm (2.4 x 2.9 x 1.2")

- Net weight: 90 g (3.2 oz.)

### RECEIVER AKG SR 450 (OPTIONAL)

Specifications from manufacturer's technical data

RF Carrier Frequency Ranges: 7 channels over 650 - 865 MHz

Modulation: FM

Audio Bandwidth: 35 to 20000 Hz

THD at 1 kHz: <0.3%

S/N Ratio: 120 dB(A)

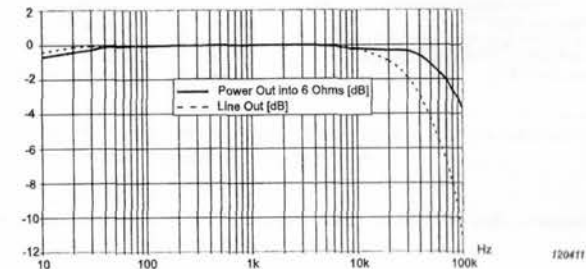
Audio Outputs: Balanced XLR and unbalanced TS 1/4" jack, balanced level switchable to -30 or 0 dBm

### MECHANICAL

Dimensions: 200 x 44 x 190 mm (7.8 x 1.7 x 7.4")

Weight: 972 g (2.2 lbs)

Fig. 27 Frequency Responses measured at a 0 dB output power of 300 W into 6 Ω up to 20 kHz and of 20 W up from 20 kHz



## Ordering Information

Type 4292-L OmniPower Sound Source  
Type 4295 OmniSource Sound Source  
Type 3207 Tapping Machine

## Included Accessories

### ACCESSORIES INCLUDED WITH TYPE 4292-L

- KE-0462 Carrying Bag for Type 4292-L
- UA-1690 Tripod

### ACCESSORIES INCLUDED WITH TYPE 3207

- ZG-0429 Mains adaptor (mains cable country dependent)
- 2 Gauges for drop height adjustment
- Oil canister for maintenance

## OPTIONAL ACCESSORIES

Type 2734-A Power Amplifier  
Type 2734-B Power Amplifier with built-in UL-0256 Wireless Audio System  
UL-0256 Wireless Audio System  
KE-0392 Carrying Case for Type 4295  
KE-0449 Flight Case for Type 4292-L  
KE-0364 Carrying Case for Type 4292 Tripod (UA-1690)  
UA-0801 Lightweight Tripod  
AO-0523 Signal cable from Hand-held analyzer to Power Amplifier, 10 m (32.8 ft)  
AO-0524 Signal cable from Hand-held Analyzer to BNC, 10 m (32.8 ft)  
AQ-0673 Speaker cable from Type 2734 to Types 4292, 4295 or equivalent, 10 m (32.8 ft)  
Type 2250-F Hand-held Analyzer Type 2250 with Sound Level Meter Software BZ-7222 and Reverberation Time Software BZ-7227  
Type 2270-F Hand-held Analyzer Type 2270 with Sound Level Meter Software BZ-7222 and Reverberation Time Software BZ-7227  
Type 2250-J Hand-held Analyzer Type 2250 with Sound Level Meter Software BZ-7222 and Building Acoustics Software BZ-7228

Type 2270-J Hand-held Analyzer Type 2270 with Sound Level Meter Software BZ-7222 and Building Acoustics Software BZ-7228  
Type 2270-K Hand-held Analyzer Type 2270 with Sound Level Meter Software BZ-7222 and Dual-channel Building Acoustics Software BZ-7229  
Type 2250-J-001 Building Acoustics System including Type 2250-J, OmniPower Sound Source Type 4292 and Power Amplifier Type 2734-A  
Type 2270-J-001 Building Acoustics System including Type 2270-J, OmniPower Sound Source Type 4292 and Power Amplifier Type 2734-A  
Type 2270-K-001 Dual-channel Building Acoustics System including Type 2270-K, OmniPower Sound Source Type 4292 and Power Amplifier Type 2734-A  
BZ-7228-200 Building Acoustics Kit as per Type 2250-J-001, or Type 2270-J-001, excluding Hand-held Analyzer (for Types 2250 and 2270 users intending to upgrade to a full Building Acoustics measurement system)  
BZ-7229-200 Dual-channel Building Acoustics Kit as per Type 2270-K-001, excluding Type 2270 (for Type 2270 users intending to upgrade to a full Dual-channel Building Acoustics measurement system)  
Type 8780 PULSE Reflex Building Acoustics Software  
Type 7830 Qualifier PC Software for Building Acoustics reporting  
Type 7831 Qualifier Light PC Software for reverberation time reporting  
Go to [www.bksv.com](http://www.bksv.com) for more information on Types 2250 and 2270 and Brüel & Kjær's Building Acoustics applications.  
**OPTIONAL ACCESSORIES FOR TYPE 3207**  
AQ-0633 Remote Cable connecting Type 2260 Investigator to Type 3207, 10 m (32.8 ft)  
UA-1476 Wireless Remote Control (includes AO-1439 Cable for Hand-held Analyzer Types 2250 and 2270)  
UA-1477 Battery Kit  
QB-0055 Replacement battery

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Telephone: +45 7741 2000 · Fax: +45 4580 1405 · [www.bksv.com](http://www.bksv.com) · [info@bksv.com](mailto:info@bksv.com)

Local representatives and service organisations worldwide

Brüel & Kjær 



## PRODUCT DATA

Investigator™ — Type 2260-D with BZ-7204 and Qualifier Type 7830,  
Investigator — Type 2260-G with BZ-7207 and Qualifier Light Type 7831

The combined features of Investigator Types 2260-D with Qualifier Type 7830 PC Software, or 2260-G with Qualifier Light Type 7831 provide ideal facilities for architectural and building acoustic measurements.



### USES AND FEATURES

#### USES

- Architectural and building acoustic measurements of:
  - Airborne sound insulation
  - Impact sound insulation
  - Reverberation time

#### FEATURES (2260-D)

- Complete hand-held building acoustics analyzer
- Measures level and reverberation time spectra
- Built-in pink and white noise generator
- On the spot calculation of airborne sound insulation curves and indexes
- Façade insulation calculations
- Satisfies ISO and national standards
- 2-channel measurements
- Measures reverberation time with impulse or interrupted noise excitation
- Displays reverberation time and decay curves
- Serial measurement
- Complete system using available accessories

#### FEATURES (2260-G)

- Measures reverberation time with impulse or interrupted noise excitation
- Displays reverberation time and decay curves
- Interrupted noise or impulse excitation
- Calculates broadband average reverberation time
- Economical and compact solution

#### FEATURES (7830)

- Calculates sound insulation curves and indexes
- Edits measurement results, including manual input of data
- Documentation and reporting facilities

#### FEATURES (7831)

- Calculates reverberation time
- Edits measurement results, including manual input of data
- Documentation and reporting facilities

Brüel & Kjær 

### A Complete Measurement System for Architectural and Building Acoustics

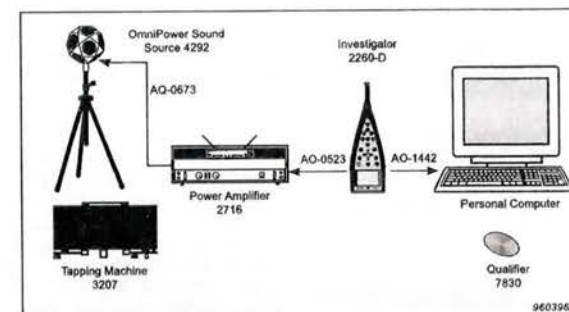
The combination of well proven, reliable hardware and tailor-made software effectively avoids the necessity of a PC in the field. In addition, the calculation of sound insulation curves and indexes can be provided on-the-spot.

The following additional components complete the system:

- OmniPower Sound Source™ Type 4292
- Power Amplifier Type 2716
- Flight Case KE-0348
- Tapping Machine Type 3207

See also Sound Sources for Building Acoustics Product Data (BP 1689). A typical configuration is shown in Fig. 1.

Fig. 1  
Typical measurement setup also showing optional equipment available from Brüel & Kjær to cover your requirements for measuring and analysing architectural and building acoustics



### Investigator 2260-D

This is the standard Investigator loaded with the supplied BZ-7204 software. The use of this software for a typical application is described here.

#### Using 2260-D/BZ-7204

The main purposes of BZ-7204 software are to measure the building-acoustic parameters needed, and to make sound insulation calculations.

#### Measurement

Calculation of airborne sound insulation normally requires measurement of:

- L1: Source room level
- L2: Receiving room level
- B2: Background noise in receiving room
- T2: Reverberation time in receiving room

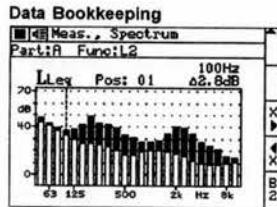
Depending upon standard and calculation formula, it may not be necessary to measure B2 and/or T2. Also, L1 measurements are not used in impact sound insulation.

BZ-7204 allows measurement of all these parameters in any order required.

In level measurements (L1, L2 and B2) it is the  $L_{eq}$ -value that is recorded. The measurement time can be specified in steps of 1 second.

In reverberation time measurements (T2) a short-time  $L_{eq}$  (down to 8ms) is used to record a multispectrum for calculating reverberation time.

Fig. 2  
Screen shot showing the measurements of L2 and B2



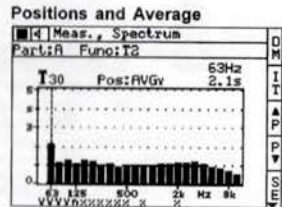
BZ-7204 has an automatic data bookkeeping system, that saves you the task of remembering file names, etc. It is a hierarchical system with a "Job" record at the top level. A Job is denoted by a four digit number. As an example, this could relate to a certain measurement location.

Within a Job, one Task is performed, e.g., airborne sound insulation, impact sound insulation or reverberation time.

Measurements for several partitions (denoted by a letter, A to Z), for example, walls and floors, can be contained in one job. Each partition has a set of (L1), L2, B2 and T2 that consist of one or more positions of each. For each partition the sound insulation can be calculated on the basis of the average of all positions of (L1), L2, B2 and T2.

Four measurement displays are available in airborne sound insulation: L1, L2, B2 and T2. A clear indication of which one has been selected is shown on the 2260 screen. It is easy to change between them by pressing a key.

Fig. 3  
Screen shot showing the spectrum of reverberation times

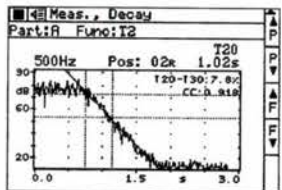


It is possible to measure and store up to 25 positions each for L1, L2, B2 and T2. The positions are measured one at a time and the spectra can be viewed continuously on the screen. Positions can be stored automatically with automatically incremented position numbers. Alternatively, positions can be stored manually in any position number. When the first position is stored (either manually or automatically) some setup parameters, for example, the bandwidth, are "frozen" to make sure that all the positions for the job will be compatible. Every time a new position is stored the average is calculated.

In level measurements (L1, L2 and B2) it is possible to view the following displays:

- Instantaneous level
- Current position
- Single positions
- Average of all positions

Fig. 4  
Decay at 500 Hz for a typical measurement



These are shown as spectra. When looking at L2, the B2-curve may also be shown (and vice versa) to indicate the distance to the background noise.

Reverberation time measurement is made using interrupted noise or impulse excitation (e.g., pistol shot). With impulsive noise, the user enters a trigger level, and the 2260 will, when triggered, automatically record the decay and perform backwards integration (Schroeder method). This method gives a smooth decay comparable to the average of a large number of interrupted noise decays.

With interrupted noise, ensemble averaging is used on multiple decays in the same position. Averaging of reverberation times (T20 and T30) is used across positions to provide fast

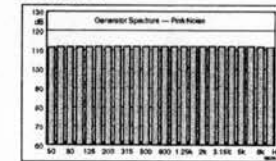
averaging results. To check the quality of decays, it is possible for each position to look at the decay in each frequency band.

The broadband average T20 and T30 of user selected frequency bands can be calculated.

### Reuse

To save measurement time, L1, B2 and T2 may be copied from another measurement. This is relevant when several partitions have common source- or receiving room.

### Generator

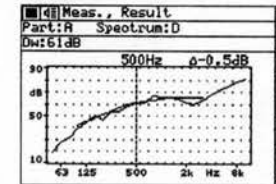


The built-in generator can supply pink noise or white noise in the bandwidth used for the measurement. The signal is switched on and off automatically in accordance with the performed measurement.

The noise signal may be connected to a power amplifier and loudspeaker. Alternatively, an on/off output signal can be selected, to control an external generator.

Fig. 5  
1/3-octave spectrum of the internal generator output for pink noise set to 50 Hz - 10 kHz. Measured in 1/3-octaves 50 Hz - 10 kHz

### Calculations



As soon as just one position of L1, L2, (B2) and T2 has been measured, the sound reduction index (spectrum and weighted) can be calculated. Generally the sound insulation is calculated (for each partition) from the average of all the positions of L1, L2, B2 and T2. It is possible to exclude positions from the average to see what effect certain positions have on the result. Several calculation formulae can be selected, depending on the selected standard.

The following standards can be selected: ISO, DIN, BS, SS, ÖNORM, Sia, UNI, NF, NBE, NEN, BREW and ASTM. For standards and parameters, see Tables 1 and 2.

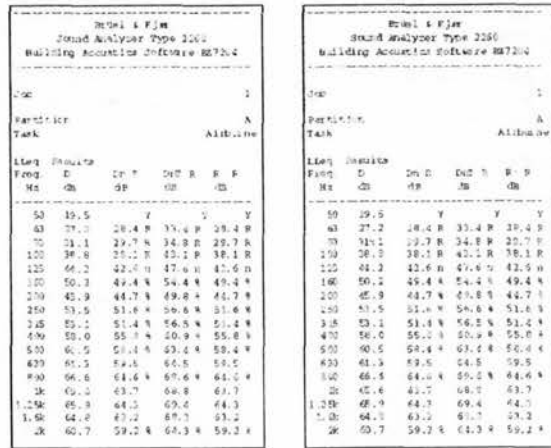
### Printing

Printing is possible in several formats for on-the-spot documentation. All screen pictures can be sent to a printer from Type 2260-D. The type of print-out depends on the current display - Spectrum, Overview, Result or Setup. The scope of printed data may be selected as one Partition, or the entire Job.

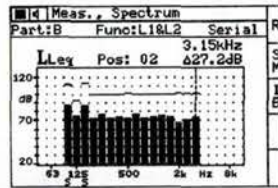
### Data Transfer to a PC

Measurement data can be transferred to a PC for post processing using the Qualifier™ Type 7830 software. Furthermore, data can be transferred in formats suitable for processing in a spreadsheet.

**Fig. 7**  
Example of print-out from Type 2260-D to Portable Printer Type 2322. Result spectra and weighted results are shown for an ISO measurement



**Fig. 8**  
2260 screen with two bands measured serially (2-channels)



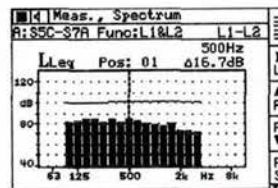
**Serial Measurement**

If the background noise in some frequency bands is too high, those bands can be measured serially, i.e., one by one in automatic sequence. The total output of the internal noise generator remains the same, so the level in each band will increase (by up to 10 dB) and thus improve the signal to noise ratio. This signal works for functions L1, L2 and T2 (it is not relevant for B2) for both one and two channels.

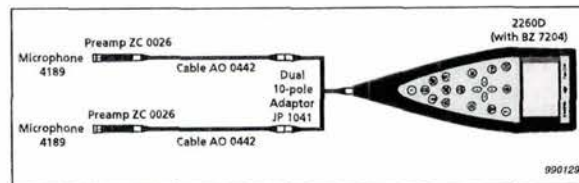
**2-channel Measurement**

The levels L1 and L2 on either side of the partition can be measured simultaneously. This is useful when making facade insulation measurements with traffic noise as a source, since this noise varies over time. 2-channel measurement can also be used to speed up measurements, or to simplify the measurement procedure.

**Fig. 9**  
2260 screen with 2-channel spectrum



**Fig. 10**  
Setup for 2-channel measurement. Type 2260 microphone and preamplifier is used for one channel, and one additional microphone and preamplifier for the other channel



**Fig. 11**  
Measuring sound pressure outside and inside the façade simultaneously - 2-channel measurement

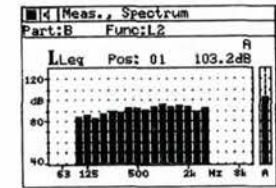


**Special Features**

A number of features are included in response to special needs in certain countries, and they can be useful for general application.

- Broadband A-weighted value for L1, L2 and B2. The instantaneous dB (A) value is shown on the 2260 screen for one channel (but not stored)
- Correction spectrum can be entered by the user. This applies to both channels (if used)
- Manual entry of reverberation time in any frequency band. You can return to the measured value at any time

**Fig. 12**  
2260 screen with L2 measurement and A weighting



**Investigator 2260-G**

**Fig. 13**  
Type 2260-G will measure reverberation time using just a starting pistol or other impulse sound source

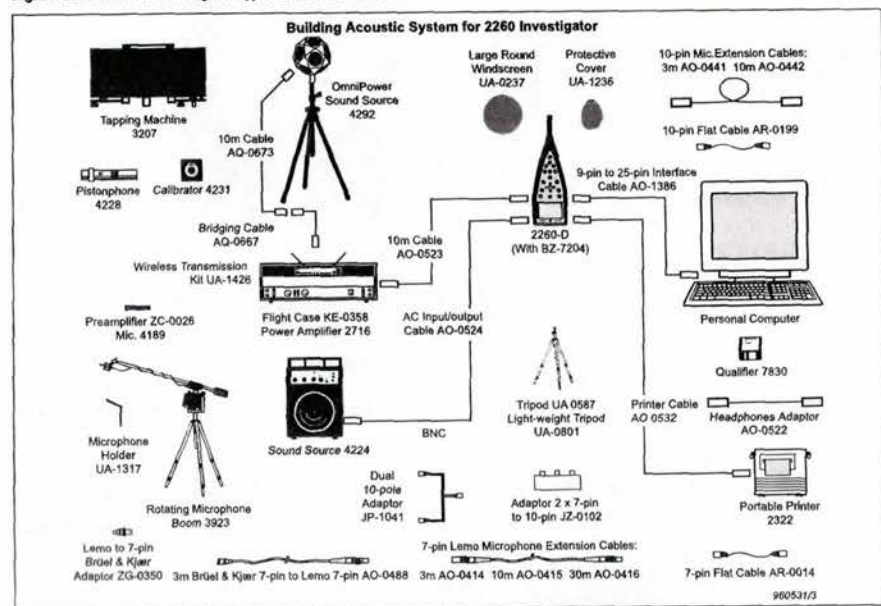


**Ideal for Room Acoustics**

Type 2260-G (including software BZ-7207) is ideal for applications that only require measurement of reverberation time, such as acceptance test of rooms, noise reduction in workplaces or determination of room corrections. 2260-G works like 2260-D but with the reverberation time task only. For these applications, you need to carry no more than 2260-G and a starting pistol. However, you can, of course, also use the built-in generator and a sound source. The calculation of broadband average reverberation time is of particular interest. After measurement, you select the bands you want included

in the average, and the average is shown on screen (but not stored). The decay curves may be exported to a spreadsheet for detailed analysis. For reviewing, editing and reporting, Qualifier Light Type 7831 is recommended, and when ordered with 2260-G or BZ-7207, forms an economical and total solution.

Fig. 14 Accessories for Investigator Types 2260-D and 2260-G



### Qualifier Type 7830

Qualifier Type 7830 PC-software provides the perfect solution for post-processing and documentation of measurement results.

#### Data Transfer

You can either transfer data from Type 2260-D to the PC on-the-spot or back in the office.

Transfer from Type 2260-D is either direct, via its RS-232 serial interface, or indirect, via PC-cards. A Serial Interface Cable AO-1442 is available for data output to a PC via the serial interface. Data are transferred maintaining the job and partition groupings that were made with Type 2260-D.

#### Qualifier Calculations

Qualifier Type 7830 works with the same bookkeeping system as Type 2260. This means that when data has been transferred to the PC you see the same results as in the 2260, including selected standard, excluded positions and other setup parameters.

Qualifier Type 7830 fulfils the same standards as listed for BZ-7204. See Tables 1 and 2. With Qualifier Type 7830, it is possible to display the reverberation measurements as 3D-multispectra. This provides a complete overview of the frequency-dependent reverberation curves.

Using Qualifier's spreadsheet-like data sheets, it is also possible to manually adjust data used in calculations, for example, to change levels or reverberation times. The result can be observed immediately.

Reverberation times can be modified by drawing a new slope line with the mouse across a displayed decay curve.

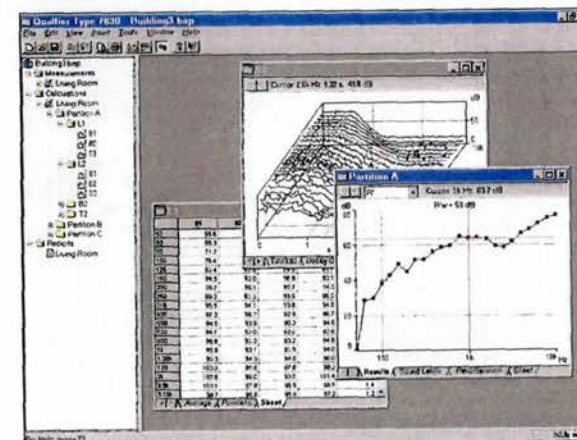
For diagnostic purposes, the reduction curve can be modified and the single value will adjust accordingly. And because manual input of data is possible, modifications for walls and rooms can be simulated.

#### Flexible Reverberation Averaging

Reverberation-time measurements may be averaged in two ways:

- Averaging of reverberation times (T20 and T30) or
- Averaging of decay curves (multispectra), also called ensemble averaging. This mode has the advantage of producing an average decay curve (multispectrum) for each frequency band

Fig. 15 Typical screen view of Qualifier Type 7830. On the left is a Project Tree, and on the right, an airborne sound reduction curve with index, a 3D reverberation time plot and a table



#### Documentation

Extensive documentation facilities are available. These allow items such as graphs and text to be entered into a report and sent to the printer. Graphs can also be exported via the clipboard.

### Qualifier Light Type 7831

Qualifier Light is like Qualifier but handles just the reverberation task. It provides an economical and convenient way of viewing, editing and reporting data from 2260-G measurements, as well as Reverberation Task data from the 2260-D.

## Building Acoustic Standards

Table 1 Building acoustic standards

		Sweden	Germany	Austria	UK	England Wales	Switz	Italy	France	Spain	Holland	USA
Measurement	ISO	SS	DIN	ONORM	BS	BREW	Sia	UNI	NF-S31	NBE	NEN	ASTM
Typical Parameters	R' L'n	R' L'n	R L'n	DnT L'nT	DnT L'nT	DnT	DnT L'nT	Dn Ln	DnAT LnAT	DnAT LnAT	Rv Ico	FTL Ln
Airborne	Lab	140-3	EN20140-3	EN20140-3	S5101	EN20140-3		8270-1	051	74-040-84/3		
	Field	140-4	EN20140-4	S2210-1	S5100-1	2750-4	BREW	181	8270-4	054, -057	74-040-84/4	5077
	Façade	140-5	EN20140-5	S2210-5	S5100-3	2750-5		181	8270-5	055, -057	74-040-84/5	5077
Impact	Lab	140-6	EN20140-6	S2210-1	S5101	2750-6			8270-6	-052	74-040-84/6	
	Field	140-7	EN20140-7	S2210-1	S5100-2	2750-7		181	8270-4	056, -057	74-040-84/7	5077
RT		3382 354		S2212								5077
Rating	Alr	717-1	SS-ISO717-1	S2210-4	S5100-1	S821-1,-3	BSEN 717-1	181	8270-7	-057	NBECA-88	5077
	Impact	717-2	SS-ISO717-2	S2210-4	S5100-2	S821-2		181	8270-7	-057	NBECA-88	5077

## Calculated Parameters

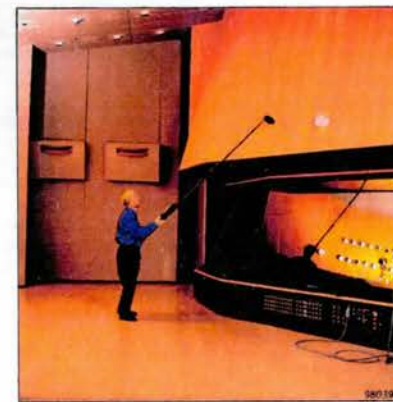
Table 2 Calculated parameters

Standard	ISO	SS	DIN ONORM BS UNI	BREW	Sia	NF	NBE	NEN	ASTM	None	
Airborne Calculated parameters	D Dw Dn Dnw DnT DnTw R' R'w R' R'w  DnTw +C +Ctr +C <sub>50-3150</sub> +C <sub>50-5000</sub> +C <sub>100-5000</sub> +Ctr <sub>50-3150</sub> +Ctr <sub>100-5000</sub> +Ctr <sub>50-5000</sub>  R'w or R'w +C +Ctr +C <sub>50-3150</sub> +C <sub>50-5000</sub> +C <sub>100-5000</sub> +Ctr <sub>50-3150</sub> +Ctr <sub>100-5000</sub> +Ctr <sub>50-5000</sub>	ISO plus R'w8 Rw8  Dw5 DnTw5	See ISO	DnT DnTw +C +Ctr	ISO plus To variable	D DnT DnATrouse DnATrouse R R'w8 R'w8	D DnT DnATrouse DnATrouse DnT DnTw +C +Ctr	DA DnAT Dw +C +Ctr Dnw +C +Ctr DnT DnTw +C +Ctr  R'w or R'w +C +Ctr +C <sub>50-3150</sub> +C <sub>50-5000</sub> +C <sub>100-5000</sub> +Ctr <sub>50-3150</sub> +C <sub>100-5000</sub> +Ctr <sub>100-5000</sub> +Ctr <sub>50-5000</sub>  RA R'A	DnT Ilu IluK	NR NIC NNR NNIC FTL FSTC	D Dn DnT R' R
Facade Calculated parameters	Dia,2m Dia,2m,w Dia,2m,nT Dia,2m,nT,w Dia,2m,nT,w +C +Ctr Dia,2m,n Dia,2m,n,w Dia,2m Dia,2m,w Dia,2m,nT Dia,2m,nT,w +C +Ctr Dia,2m,n Dia,2m,n,w R' 45° R' 45° R' 45°w or R' 45°w +C +Ctr +C <sub>50-3150</sub> +C <sub>50-5000</sub> +C <sub>100-5000</sub> +Ctr <sub>50-3150</sub> +Ctr <sub>100-5000</sub> +Ctr <sub>50-5000</sub>	See ISO	See ISO		See ISO	DnT45° DnATrouse 45° DnTr DnATrouse	ISO plus: Dia,2m,n,w +C +Ctr Dia,2m,A Dia,2m,AT Dia,2m,A Dia,2m,AT R' +A45°	GI G <sub>A,K</sub>	OILR OITL OITC	R' 45° R' 45° Dia,2m,nT Dia,2m,n Dia,2m,nT Dia,2m,n	
Impact Calculated parameters	L'nT L'nTw L'n L'nw Ln Lnw  L'nw, Lnw or L'nTw + Cl Cl <sub>50-2500</sub>	ISO plus L'nw6 Lnw6	See ISO		ISO plusTo variable	LnT Ln LnAT LnA	ISO plus LnAT LnA	LnT Ico	Ln IIC	L'nT L'n Ln	

## Sound Intensity for Building Acoustics (using 2260-E)

Building acoustics applications such as reduction indices and leakage detection benefit enormously from the intensity technique. 2260-E Investigator with Intensity Probe Kit Type 3595 form a hand-held solution for this application.

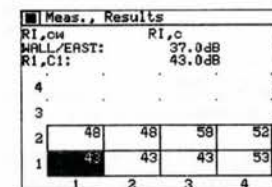
Fig. 16 Mapping the sound reduction to find leakages between studio and control room



As an alternative to a pressure-based measurement of the apparent sound insulation index  $R'$  for a given partition, this measurement system allows the corrected intensity sound reduction index,  $R'_{I,c}$  to be measured. This enables extra information regarding the contribution of various flanking and leakage transmissions to be gathered. In a traditional pressure-based measurement you get an apparent sound insulation index  $R'$  which takes every type of transmission into account. However, traditional measurements cannot identify individual transmission paths. But with this application you can choose specific details of any particular segment of any given partition or surface. If a compound partition is to be studied,

for example a wall containing a window, the respective corrected intensity sound reduction index,  $R'_{I,c}$  for both the wall material and for the window can be found.

Fig. 17 The  $R'_{I,cw}$  in surface display



The single-number weighted and corrected intensity sound reduction index,  $R'_{I,cw}$  is automatically calculated for each segment and the whole surface.

To create a sound field on one side of the wall (in the source room) use the internal white noise generator together with Power Amplifier Type 2716 and Omni-Power™ Sound Source Type 4296.

### Leakages

If measurements reveal a leakage problem or "hidden" flanking transmission, the hand-held sound intensity system can conveniently be used for noise source location with respect to either a single band or the whole spectrum.

### More Information

For more information about the Hand-held Intensity System, including sound power applications, please refer to Product Data BP 1755.

## More About the Investigator Type 2260 Platform

The 2260 Investigator is a unique concept within the field of hand-held noise measurements. A range of software can be installed into an analyzer platform and dedicated PC software is available for post-processing the data.

### Examples of Other Applications

Basic Sound Analysis Software BZ-7210 is pre-installed on all 2260 types making them Type 1 Sound Level Meters with real-time 1/3-octave frequency analysis and broadband statistical distributions.

Enhanced Sound Analysis 20kHz Software BZ-7206, with octave and 1/3-octave band filters, converts Type 2260 into a precision sound analyzer. Besides a vast array of concurrently measured parameters, including statistics, direct interfacing with a PC enables remote control as well as data downloading using optional Brüel & Kjær PC software or Windows®/MS-DOS® programs.

Noise Profile Software BZ-7203 effectively converts Type 2260 into an electronic level recorder which measures and logs noise levels over a 110dB dynamic range. It also has extensive capabilities for on-the-spot analysis including measurement annotation. Evaluator™ Type 7820 PC software is available for editing and combining measurement data into a Rating Level.

If you install BZ-7205 Sound Intensity software in your 2260 Investigator and mount the sound intensity probe, then you have a complete hand-held sound intensity measuring system. Automatic measurement guidance and aural feedback during measurements enable you to concentrate on making smooth scans of the surface. The system produces on-the-spot analyses of sound intensity and sound power for small as well as large objects. The sound intensity system can also be used to measure sound insulation and calculates the sound reduction index on the spot. It is ideal for measuring single building elements or for locating faults.

### Acoustically Streamlined

The acoustically "streamlined" body of Type 2260 minimises the effect that the analyzer has on the sound field to within 0.4dB throughout its working frequency range; well within IEC Type 1 tolerances. This, coupled with excellent directional characteristics, ensures that the validity of your measurements is unaffected by the presence of the Investigator in the sound field.

### Microphone and Pre-amplifier


Investigator is supplied with a robust Falcon Range® microphone and preamplifier which conform with IEC and ANSI Type 1 standards.

The preamplifier is detachable and able to drive a 100m long cable; a valuable asset when remote location of the microphone is necessary.

### Calibration

Internal and external calibration facilities are allowed. Both are semi-automatic. The external method makes use of an external reference sound source, for example from the Brüel & Kjær Sound Calibrator Type 4231. Furthermore, Type 2260-D "remembers" its initial calibration (and the serial number of the microphone provided). An accredited initial calibration (EK-0462) is made only at the factory. If you need one, or need to replace an existing one, contact your Brüel & Kjær representative.

### Compliance with Standards

	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand.
<b>Safety</b>	EN/IEC 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 3111-1: Standard for Safety - Electrical measuring and test equipment.
<b>EMC Emission</b>	EN/IEC 61000-6-3: Generic emission standard for residential, commercial and light industrial environments. EN/IEC 61000-6-4: Generic emission standard for industrial environments. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device.
<b>EMC Immunity</b>	EN/IEC 61000-6-1: Generic standards - Immunity for residential, commercial and light industrial environments. EN/IEC 61000-6-2: Generic standards - Immunity for industrial environments. <b>Note 1:</b> The above is guaranteed using accessories listed in this Product Data sheet only. <b>Note 2:</b> The above is guaranteed only when the AC output is not in use.

### Specifications - Investigator Type 2260-D

Specifications are given for Type 2260 fitted with Prepolarized Free-field 1/2" Microphone Type 4189 and Input Stage ZC-0026

#### SOUND LEVEL METER STANDARDS

Conforms with the relevant parts of the following:

IEC 651 (1979) Type 1 plus Amendment 1

IEC 1260 (1995) Octave and 1/3-octave Bands Class 0

ANSI S1.4 (1983) Type 1

ANSI S1.11-1986 Octave and 1/3-octave Bands, Order 3, Type 0-C, Optional Range

#### MEASUREMENT AND CALCULATION STANDARDS

Measurement and calculations can be made according to the following standards: ISO, DIN, BS, NBE, SS, Sia, ONORM, NF, UNI, ASTM, BREW and NEN. See Tables 1 and 2

#### SUPPLIED MICROPHONE

Prepolarized Free-field 1/2" Microphone Type 4189

Type: Prepolarized condenser

Nominal sensitivity: -26 dB re 1 V/Pa

Capacitance: 14 pF (at 250 Hz)

#### SUPPLIED INPUT STAGE

ZC 0026

Input Impedance: 10 GΩ || < 1 pF

Extension Cables: Up to 100 m in length between the input stage and Type 2260 can be driven by the input stage without affecting measurements

#### MEASURING RANGE

Octave and 1/3-octave: 90 dB A-weighted: 80 dB

Adjustable readings from 70 dB to 130 dB in 10 dB steps (A-weighted: 80 dB range)

Max. peak level 3 dB above full scale reading

Passive Attenuation: Microphone Attenuator ZF-0023 (included) effectively increases all full-scale readings by 20 dB

#### UNDERRANGE INDICATION

Octave and 1/3-octave: 90 dB below upper limit for each range setting, corresponding to less than 0.5 dB error

#### CHANNELS

L1 and L2 (Airborne Task) can be measured using 2 channels, which can be connected using any combination of preamplifier inputs and AC inputs. The two channels have independent gain and calibration settings. A correction spectrum can be entered manually for each channel

#### FREQUENCY WEIGHTING

Lin frequency weighting

A-weighting Instantaneous Fast (displayed, not stored)

#### OCTAVE AND 1/3-OCTAVE BAND FILTERS

Conform to IEC 1260 (1995), and ANSI S1.11-1986

#### Octave Band Centre Frequencies

Nominal: 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz

#### 1/3-octave Band Centre Frequencies

Nominal: 50 Hz, 63 Hz, 80 Hz, 100 Hz, 125 Hz, 160 Hz, 200 Hz, 250 Hz, 315 Hz, 400 Hz, 500 Hz, 630 Hz, 800 Hz, 1 kHz, 1.25 kHz, 1.6 kHz, 2 kHz, 2.5 kHz, 3.15 kHz, 4 kHz, 5 kHz, 6.3 kHz, 8 kHz, 10 kHz

Real-time Frequency Range: 50 Hz to 10 kHz centre frequencies

#### INHERENT NOISE LEVEL

(Inherent noise is the combination of the electrical noise and the thermal noise from the microphone at 20°C.) Typical values using a microphone Type 4189 with a nominal sensitivity:

1/3-octaves: 2 dB at 1 kHz, 8 dB at 10 kHz

1/1-octaves: 6 dB at 1 kHz, 12 dB at 8 kHz

#### DETECTORS

The analyzer contains several detectors working in parallel on every measurement.

Octave Band Filters (8) or 1/3-octave Band Filters (24): Pre-weighted by Lin., each with a detector channel containing one linear averaging detector

Overload Detector: Monitors the overload condition

A-weighted: Broadband detector channel with Fast exponential time weighting. Single-channel only

#### INTERNAL GENERATOR

Built-in pseudo-random noise generator

Spectrum: Selectable between Pink and White

Crest Factor:

Pink noise: 4.4 (13 dB)

White noise: 3.6 (11 dB)

Bandwidth: Follows measurement bandwidth

Lower limit: 50 Hz (1/3-oct.) or 63 Hz (oct.)

Upper limit: 10 kHz (1/3-oct.) or 8 kHz (oct.)

Output Level: Independent of bandwidth

Max.: 1 V<sub>rms</sub> (0 dB)

May be set in 1 dB steps 0 - 60 dB

When bandwidth is changed, the level for all bands is automatically adjusted to comply with the set output level

Turn-on time and Turn-off time: Equivalent to RT = 70 ms

Repetition Period: 175 s

Output Connector: Auxiliary 1 output

Control: See Measurement Control

#### EXTERNAL GENERATOR

Selectable as alternative to Internal Generator

For controlling external noise generator

Levels: 0 V (Generator off), 4.5 V (Generator on)

Rise-time and Fall-time: 10 μs

Control: See Measurement Control.

## MEASUREMENTS

- Instantaneous:** For display, no storage  
"Live" spectrum— $L_{eq}$  with a short averaging time  
**Range:** Follows setting in Levels and Reverberation Time  
**Generator:** Turned on and off manually  
**Levels:** For Display and Storage  
 $L_{eq}$ : (L1, L2, B2) in octave or 1/3-octave bands  
L1 and L2 simultaneously or as single channels  
**Averaging time:** 1s to 59min, 59s  
**Range:** Manual range or Autorange  
**Generator:** Controlled automatically  
**Averaging:** Up to 25 measurements may be averaged  
**Status indications:** Overload, underrange, start time  
**Reverberation Time:** T20 and T30 in octave or 1/3-octave bands  
Decays are measured and stored, using averaging times between 8 and 96 ms, depending on bandwidth and decay time
- Manual entry: After measurement, the value in each band, for each position, may be changed by user entry
  - Broadband average: The arithmetic average of the Reverberation Time for selected bands is calculated and displayed (not stored)
  - Impulse excitation: When level (say from starter pistol) exceeds user selected trigger level, the decay is recorded and backwards integration performed (Schroeder method)
  - The decay curves can be exported to a spreadsheet for detailed analysis
  - Generator: Controlled automatically
  - Repetition: Decays can be repeated automatically up to 99 times (ensemble averaging)
  - Averaging: up to 25 T20 and T30 measurements can be averaged (arithmetic averaging)
  - T20 and T30 calculation: From slope in evaluation range
  - Slope estimation: Least squares approximation
  - Status indications: Overload, underrange, start time, T20—T30%, Correlation Coefficient, extensive list of Status codes
  - RT range: Max. 30.00 s, min. 0.1—0.7 s, depending on bandwidth

## CALIBRATION

**External (acoustic):** Using the Multifunction Acoustic Calibrator Type 4226, Pistonphone Type 4228 or Sound Calibrator Type 4231  
**Internal (electrical):** Uses internally generated electrical signal combined with key-d-in value of microphone sensitivity  
Initial calibration stored for comparison with later calibrations  
Initial factory calibration traceable in conjunction with ISO 9001 certification

## MEASUREMENT CONTROL

Manual or semi-automatic. Measurements are started manually and can be automatically stored on completion of measurement. The noise generator is turned on and off automatically  
With Inst. spectrum on display, the generator can be turned on and off manually for checking  
Selected frequency bands can be measured serially, i.e., one by one in automatic sequence. This feature works for the functions L1, L2 and T2 and for single as well as 2 channels

## MEASUREMENT DISPLAYS

**L1:** Shows the spectrum of the level measured in the source room  
**L2:** Shows the spectrum of the level measured in the receiving room. A dimmed curve shows background noise  
**L1 and L2:** 2-channel measurements, L1 and L2 are displayed simultaneously  
**B2:** Shows the spectrum of the background level measured in the receiving room. A dimmed curve shows the L2 level  
**T2:** Shows the spectrum of reverberation times (T20 or T30) measured in the receiving room. Also, decay curve can be shown for each centre frequency  
**Spectrum:** Octave or 1/3-octave band spectrum. Y-axis can be zoomed  
**dB(A):** Instantaneous level is shown as a column next to the spectrum, with cursor read-out. Single-channel only  
The graphical displays have cursor read-out facilities

## DISPLAY RESOLUTION

**Levels:** 0.1 dB  
**Reverberation Time:** 0.01 s

## RESULT DISPLAY

Shows the sound reduction index (spectrum and weighted) according to the selected standard, along with the reference curve (if any)

## STORAGE SYSTEM

Internal disk for storing application software, user-defined setups and measurement data. Setups and data can be recalled for further analysis

**Capacity (32MB disk):** The supplied application software requires approximately 2 MB

**Measurement data space requirements:** 65 kB for typical Job (one partition)

**Application Card:** For installation of application software

**External Memory Card:** For Store/Recall of measurement data and transfer of data to and from a PC (SRAM or ATA flash cards)

**MS-DOS<sup>®</sup>:** Compatible file system (from Ver. 3.3)

## SERIAL PRINTER/OUTPUT

Setups and measurement data can be printed on an IBM<sup>®</sup> Proprinter<sup>®</sup> (or compatible) or a Portable Printer Type 2322. The formats can be screen dumps or tables  
Measurement data can be output in spreadsheet format for post-processing on a PC

## REMOTE/LOCAL

Transfer of measurement data in binary form to a PC for use with Brüel & Kjær Type 7830 application software  
**Transfer time to 7830:** 30 s for typical Job  
**Baud Rates:** 1200, 2400, 4800, 9600, 19200, 38400 and 115200

## HELP

Concise context-sensitive help for keys and menus

## LANGUAGES

All software available in English, German, French, Italian, Spanish and Czech

## DISPLAY

**Update Rate:** Instantaneous — typically 5 times per second

## AUXILIARY OUTPUTS

**Aux. 1:** noise generator output  
**Aux. 2:** 'Input' signal monitor output  
can be set to either monitor 'Input' signal with variable attenuation from 0 to -80 dB in 1 dB steps, or can be switched Off to reduce power consumption

## AC INPUTS/OUTPUTS

**Signal Output:** Buffered, unweighted microphone signal  
**Signal Input:** From an external source such as a tape recorder  
See also specifications in platform manual

## SETTLING TIME

**From Power On:** Approx. 25 s

## EFFECT OF VIBRATION

Less than 72 dB for a 50 Hz vibration at a level of 1 m/s<sup>2</sup>

## EFFECT OF TEMPERATURE

**Operation:** <0.5 dB from -10°C to +50°C (+14°F to +122°F)  
**Storage (without batteries):** -20°C to +70°C (4°F to +158°F)

## EFFECT OF MAGNETIC FIELDS

80 A/m (1 Ørsted) at 50 Hz causing a reading of:  
**63 Hz Octave-band filter:** <30 dB

## EFFECT OF HUMIDITY

**Operation:** <0.5 dB for 30% <RH <90% (at 40°C and 1 kHz)  
**Storage:** Cool, dry environment recommended to avoid formation of mould etc.

## BATTERIES

**Type:** 6 × LR14/C-size 1.5 V alkaline, QB 0009

**Lifetime (at 20°C):** 8 hours of typical use (decreases significantly at low temperatures)

## EXTERNAL DC POWER SUPPLY

**Voltage:** Regulated or smoothed 10 to 14 V, maximum ripple 100 mV  
**Power:** 3.5 W, current: 300 mA, Inrush current: 1000 mA  
**Socket:** Ø5.5 mm with Ø2 mm pin (positive)

## WEIGHT

1.2 kg including batteries, Input Stage ZC 0026 and Prepolarized Free-field 1/2" Microphone Type 4189

## DIMENSIONS

375 × 120 × 52 mm including Input Stage ZC 0026 and Prepolarized Free-field 1/2" Microphone Type 4189

## Specifications – Investigator Type 2260-G

Please refer to the sections in 2260-D Specifications relevant for Reverberation Time measurements.

## Specifications – Qualifier Type 7830

### STANDARDS

See Tables 1 and 2

### LANGUAGES

English, French and German

### PLATFORM

32-bit software for Windows<sup>®</sup> 2000/XP

### VIEWS

- Result level views:  
A collection of views showing the resulting single values, reduction curve and underlying average curves (L1, L2, B2 and T20/T30)
- Average level views:  
Each of the parameters L1, L2 and B2 has a corresponding view showing all of the measurement curves included in the average calculation and a view of the resulting average curve  
In T20/T30 average mode it is possible to see all of the T20/T30s included in the average calculation. In ensemble average mode it is possible to see the averaged 3D and averaged single frequency decay curves. Both modes gives the user the ability to see the resulting T20/T30 spectrum
- Position level views:  
Each of the level measurements (L1, L2 and B2) can be viewed as a spectrum. In addition, the T2 reverberation measurement can be viewed as 3D-multispectra and as single frequency decay curves. Furthermore it is possible to see the calculated T20/T30 spectrum
- Data sheets:  
All of the measurement and the most relevant intermediate and final results can be viewed as values in a table (not decays)

### CURSOR READ-OUT:

All curves have cursor read-out

## Specifications – Qualifier Light Type 7831

Please refer to the section in Qualifier Type 7830 specifications relevant to Reverberation Time

## Ordering Information

Type 2260-D Investigator (with Building Acoustic Software BZ-7204)  
Type 7830 Qualifier

Type 2260-G Investigator (with Room Acoustics Software BZ-7207)  
Type 7831 Qualifier Light

Accessories included with Type 7830/7831:  
Software Pack (CD-ROM)  
Security Key

Accessories included with Type 2260-D and 2260-G:  
Type 4189 Prepolarized Free-field ½" Microphone  
ZC-0026 Input Stage  
ZF-0023 20 dB Capacitive Attenuator  
UA-1236 Protective Cover  
DH-0696 Wrist Strap  
KE-0342 Shoulder Bag (with room for 2260-D and 4231)  
6 x QB-0009 1.5 V LR 14/C size alkaline cells  
BZ-5298 Software Pack (CD-ROM) for installation of application software

Literature:  
BP 1689 Sound Sources for Building Acoustics Product Data

### Optional Accessories

**Software**  
BZ-7204-100 Upgrade to latest version of BZ-7204  
BZ-7204-00 Upgrade from BZ-7207 to BZ-7204

7830-X-100 Upgrade from Qualifier Light to Qualifier

**Calibration**  
Type 4226 Multifunction Acoustic Calibrator  
Type 4228 Pistonphone  
Type 4231 Sound Calibrator (fits in KE-0342)  
2260-CAI Accredited Initial Calibration of Type 2260

**Interfacing**  
Type 2322 Portable Printer  
AO-1442 9-pin to 25-pin Interface Cable for use with PC or serial printer  
UL-1008 32 Mbyte Memory Card

**Mains Power Supplies**  
ZG-0386 EU Version  
ZG-0387 UK Version  
ZG-0388 US Version

**Measuring**  
UA-0237 Large Round Windscreen  
UA-0459 Small Round Windscreen  
UA-0587 Tripod  
UA-1317 Microphone Holder  
AO-0440 AC Input/output Cable  
AO-0441 3 m Microphone Ext. Cable  
AO-0442 10 m Microphone Ext. Cable  
JP-1041 Dual 10-pole Adaptor  
ZC-0026 Preamplifier for 2260  
Type 4189 Prepolarized Free-field ½" Microphone  
AR-0199 10-pin Flat Cable  
AO-0522 Headphones Adaptor  
UA-0801 Microphone Tripod  
Type 3207 Tapping Machine  
Type 4292 OmniPower Sound Source with Tripod  
Type 2716 Power Amplifier  
KE-0358 Flight Case  
AO-0523 10 m Cable from 2260 to 2716  
AQ-0667 Bridging Cable for 2716 output  
AQ-0673 10 m Cable from 2716 to 4296

Note: For sound sources, please see separate Product Data BP 1689

### TRADEMARKS

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Local representatives and service organisations worldwide

Brüel & Kjær 

## PRODUCT DATA

### Hand-held Analyzer Types 2250 and 2270

for Types 2250-S, 2250-S-C, 2270-S and 2270-S-C

Types 2250 and 2270 are innovative, hand-held analyzers from Brüel & Kjær. The analyzers' easy, safe and clever design philosophy is based on extensive research. Type 2250 has won several awards for its excellent ergonomics and design.

Both analyzers can host a number of applications including frequency analysis, logging, FFT, building acoustics and signal recording. Additionally, Type 2270 can simultaneously measure with two microphones, two accelerometers or one of each. All application modules can be ordered as part of a fully preconfigured instrument or separately at any time, as the need arises.

The combination of application modules and innovative hardware makes these analyzers dedicated solutions for performing high-precision measurement tasks in environmental, occupational and industrial application areas. Together with Measurement Partner Field App, MP Cloud support and Measurement Partner Suite for post-processing, they provide a total solution for your measurement needs.

#### Uses and Features

##### Uses

- Class 1 sound measurements to latest international standards
- Environmental noise assessment and tone assessment (1/3-octave and FFT)
- Loudness and noise rating measurements
- Occupational noise evaluation
- Reverberation time measurements (see BP 2190)
- Building acoustics (see BP 2190)
- Product quality control (see BP 2183)
- Noise source identification using sound intensity (see BP 2341)\*
- Audiometer calibration
- Real-time analysis in 1/1- and 1/3-octave bands
- Analysis of logging profiles for broadband parameters and spectra
- Vibration criteria measurements
- Low-frequency building vibration according to ISO 8041:05 and DIN 45669 – 1:2010 – 09
- Whole-body and hand-arm human vibration measurements (RMS, MTVV and Crest Factor)
- Infrasound (G-weighting) measurements according to ISO 7196:1995 and ANSI S1.42 – 2001 (R2011)

\* Type 2270 only.



##### Features

- Hardware:
  - 2-channel measurement capability with any combination of microphones and accelerometers
  - Large, high-resolution, touch-sensitive colour screen
  - Communication via USB, LAN and options for Wi-Fi or 4G communication
  - Integral digital camera for documentation and reference
  - Automatic detection of and correction for windscreen
  - Robust and environmentally protected (IP44)
- Software:
  - Dynamic range in excess of 123 dB(A)
  - 0.5 Hz – 20 kHz broadband linear range
  - Personalized measurement, display and job setup
  - 'Smiley' quality indicators with hints and warnings
  - Timers for automatic start of measurement
  - Measurement Partner Cloud (MP Cloud)
  - Measurement Partner Field App
  - Measurement Partner Suite for comprehensive post-processing
  - GPS coordinates stored with measurement data
  - Simultaneous noise and weather data acquisition
  - 24- or 16-bit recording during all or parts of measurement

## Hardware and Applications

### Introduction

Types 2250 and 2270 are flexible hand-held analyzers that cover all your sound and vibration measurement and analysis needs – from the traditional uses in assessing environmental and workplace noise to industrial quality control and development.

The high-resolution touchscreen allows you to easily navigate through the setup menu tailoring one of the many predefined templates to precisely your measurement requirements. The large dynamic range copes with both the loudest noises and those just above the noise floor and the frequency range, extended with the low-frequency option, spans from 20 kHz down to infrasound for measurement of noise sources suspected of emitting very low frequency noise.

When on site, the weather station kit measures weather parameters that are stored on the analyzer together with the noise data. Measurement Partner Field App provides measurement annotation and control, keeping you out of the sound field and improving the quality of your measurement. After completion, upload your measurement data to MP Cloud and it is ready for you or a colleague to post-process using Measurement Partner Suite, which has tools to help you extract exactly what you need from your data.

This product data describes different combinations of software modules (applications) available for Type 2250 and Type 2270. All analyzers are delivered with the Sound Level Meter Software BZ-7222 enabled. These modern Class 1 Sound Level Meters (SLMs) fulfil the requirements up to and including the latest standard, IEC 61672-1 (see the specifications section for compliance information), and are delivered with a number of predefined measurement templates tailored to suit specific requirements.

### The Hand-held Analyzer Hardware

Great care has been taken to ensure that the hardware is ergonomically optimal in field use. Both Type 2250 and Type 2270 use the same award-winning design. The key features are shown in Fig. 1.

### Long-term and Continuous Noise Monitoring

For long-term and continuous noise monitoring, Brüel & Kjær offers a wide range of Noise Monitoring Terminal (NMT) and Sentinel solutions that will meet and evolve with your needs. For more information, please consult product data BP 2379 for NMT solutions and product data BP 2389 for Noise Sentinel solutions.

### Alerting the Operator

Email or SMS/text messages can be sent to a PC or mobile device to inform operators instantly of noise events that require a response, battery power levels that require attention, memory storage status, calibration status and many other user-programmed trigger conditions. This is a very low-cost solution for receiving important alerts.

### Standard Applications

The following applications are included with every new Type 2250 and Type 2270 analyzer:

- **Sound Level Meter Software BZ-7222** – standard sound level meter software according to IEC 61672-1/ANSI
- **Frequency Analysis Software BZ-7223** – analyse, in real-time, the 1/1- and 1/3-octave filter bands with a dynamic range in excess of 135 dB, from the noise floor to 140 dB, the maximum measurable level
- **2-channel Option BZ-7229 (Type 2270 only)** – realize the full potential of your analyzer with 2-channel functionality for SLM, Frequency Analysis, Logging, Enhanced Logging, and Building Acoustics software
- **Tone Assessment Option BZ-7231** – when used in conjunction with the FFT Analysis Software, this software provides an objective in-field assessment of tonal noise components
- **Noise Monitoring Software BZ-7232** – for use with Sentinel and Sentinel on Demand

Fig. 1 Key features of Hand-held Analyzer Types 2250 and 2270



### Optional Applications

A variety of applications that can be used in any combination can be purchased when you need them and are delivered as easily installed licenses. The applications described in this product data are:

- **Logging Software BZ-7224** – freely select parameters to log at periods from 1 s to 24 h. Running together with SLM Software, all broadband parameters can be logged. If Frequency Analysis Software is also

enabled, spectra can be logged at the same rates. Logging (or noise profiling) is used to develop time histories for use in environmental noise as well as workplace noise assessment

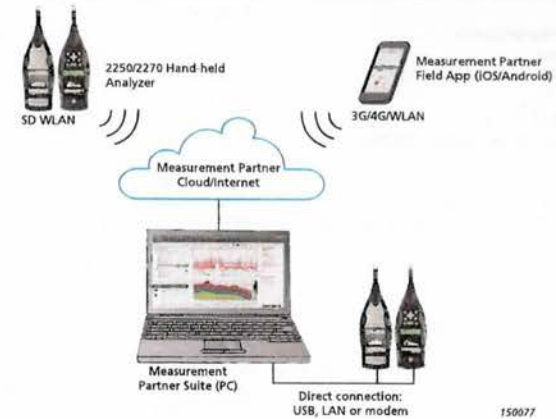
- **Enhanced Logging Software BZ-7225** – continuously monitor and log periodic reports in addition to the features of Logging Software. Parameters such as  $L_{dn}$  and  $L_{den}$  are calculated
- **Signal Recording Option BZ-7226** – attach actual samples of the measured signal to your measurements using the actual measurement transducer
- **Enhanced Vibration and Low Frequency Option BZ-7234** – measure infrasound (G-weighting) and building vibration ( $w_m$  weighting) with 1/3-octave spectra to very low frequencies and add enhanced vibration capabilities to your instrument including time domain integration and band-pass filtering

Information regarding the following applications can be found in their respective product data:

- **Reverberation Time Software BZ-7227** – start a basic measurement by clapping your hands. The 'traffic light' shows measurement status at a glance, and the resulting reverberation time (RT) spectrum is shown as well as the average RT for the room. For assessing the acoustic quality of auditoria, halls, public spaces and workplaces (product data BP 2190)
- **Building Acoustics Software BZ-7228** – assess sound insulation in buildings and of building elements. Airborne as well as impact sound insulation can be measured, and final results shown on the spot to international (ISO) and 13 national standards. The required sound sources and PC reporting software are available, as well as complete building acoustics systems (product data BP 2190)
- **FFT Analysis Software BZ-7230** – analyse using the fast Fourier transform (FFT) algorithm, the tool of choice for measurement and diagnostics of machinery noise and vibration. The 'profile' of a machine is its fingerprint, revealing sources of noise and vibration and their paths to the measurement position. Useful in product development, troubleshooting, quality control and environmental noise measurements (product data BP 2183). With Tone Assessment Option BZ-7231, FFT Analysis offers objective indication of tonal noise audibility and annoyance
- **Sound Intensity Software BZ-7233 (Type 2270 only)** – make sound intensity measurements from beginning to end. A single user can make complete intensity measurements for total sound power and noise source location. You can use the built-in camera to take a photo to aid in probe placement during measurement and for use as a background for a map of the results (product data BP 2341)

### Connectivity

Fig. 2 Secure access to measurement data from anywhere



### Remote Internet Communication

Access your data from anywhere by using various technologies. Types 2250 and 2270 allow direct operation through WiFi, modem communication (for example, 3G) or LAN (Ethernet).

### Measurement Partner Cloud (MP Cloud)

Take advantage of cloud capability with Types 2250 and 2270. The analyzers can communicate with MP Cloud via WiFi, mobile connection or LAN (Ethernet). Upload your measurement data directly to MP Cloud for merging in Measurement Partner Suite with annotations collected with Measurement Partner Field App.

Store your data safely and securely in MP Cloud and share Cloud archives with anyone on the planet.

### Post-processing Software

Fig. 3  
Measurement Partner Suite BZ-5503



Measurement Partner Suite BZ-5503, in its basic configuration, comes with your hand-held analyzer (see product data BP 2430). It is Brüel & Kjær's state-of-the-art data viewing and post-processing toolbox for environmental noise and vibration.

The free, basic configuration provides data archive, preview and export capabilities, software maintenance and online display. Archives can be stored locally, on network drives or, alternatively, in MP Cloud for easy sharing with anyone on the planet.

Measurement Partner Suite also merges Field App annotations with the corresponding instrument project.

Additional valuable data analysis and post-processing tools are available on a time-limited subscription basis. You only pay for what you need, when you need it, with no penalty should your subscription lapse.

### Annotating your Measurement Data

Measurement Partner Field App is the recommended solution for on-site annotation of your measurement data.

#### Measurement Partner Field App

Measurement Partner Field App transforms the way you work with your hand-held analyzer. It is an advanced companion app for the sound and vibration professional offering:

- Remote analyzer control
- Remote display
- Remote annotation of measurement data
- Cloud support

Whenever you stand next to your analyzer to operate it, you disturb the sound field. Therefore, we have released a field app that lets you stay away from your analyzer. Once your analyzer is powered on, you can wirelessly connect to it using Wireless USB-A Adapter UL-1050 for G4, Ethernet CF Card UL-1019 for G3.

Fig. 4  
View and edit annotations collected with the field app



Once connection is made to the analyzer, you are ready to start, stop and pause your measurement from a safe distance. During noise measurements, the instantaneous LAF profile is displayed on the field app. During vibration measurements, the Fast inst. profile is shown.

This allows you to keep an eye on the status of your measurement without being close to the analyzer. This is particularly important when low noise levels are being measured such as for indoor measurements.

MP Field App supports notes, voice commentary, image, video and GPS annotations. All annotations can be uploaded to MP Cloud for merging with the project in Measurement Partner Suite.

It is also possible to annotate your measurements directly on the analyzer using notes, voice commentaries and images (Type 2270 only). These are transferred to Measurement Partner Suite along with your measurement data.

### Uploading Measurement Data to Measurement Partner Cloud

Types 2250 and 2270 can send measurement data to Measurement Partner Cloud (MP Cloud) where projects are immediately available for post-processing, sharing or storage subject to account capacity. Only authorized users have access to the data when it is the MP Cloud.

You can create a Cloud account by visiting the MP Cloud web service at [cloud.bksv.com](http://cloud.bksv.com). You open an account, register your analyzer serial numbers and perform a one-time pairing of analyzer and account, ensuring data security. You can also administer access to the account from the web service and order subscriptions to increase account capacity.

You can connect the hand-held analyzer to the internet through modem, LAN or Wi-Fi connected to router. In the field, the analyzer can connect through Wi-Fi to hotspot on a smart device (Wi-Fi using CF-card UL-1019 for G1-G3 and Wireless USB-A Adapter UL-1050 for G4, respectively).

After measurement is completed and the project is saved, you log the analyzer into the cloud, and projects are uploaded to the cloud from the analyzer. To do this, you simply need to move your data to the Cloud folder, which is automatically created when you log on to your account. The data will now be ready for post-analysis in Measurement Partner Suite by anyone who has access to the relevant Cloud archive.

### 2-channel Measurement Option – BZ-7229

2-channel Option BZ-7229 adds an extra measurement channel to Hand-held Analyzer Type 2270 and is a standard application included on all new Type 2270 analyzers. The two channels accept inputs from the same type of transducer (for example, two microphones) or different transducers (for example, one microphone and one accelerometer.)

2-channel functionality is available for the following modules: Sound Level Meter Software BZ-7222, Frequency Analysis Software BZ-7223, Logging BZ-7224, Enhanced Logging BZ-7225 and Building Acoustics Software BZ-7228. BZ-7229 is compatible with Signal Recording Option BZ-7226 and Low Frequency Option BZ-7234.

## Sound Level Meter Software – BZ-7222

Fig. 5

Sound Level Meter Software displays with a sound measurement (left) and a vibration measurement (right) with an accelerometer, including the icons for added annotations, visible in the upper right corner



Fig. 6

Sound level meter software display showing 2-channel measurement. Channel 1 is noise, channel 2 is vibration in engineering units



### 2-channel Measurements with BZ-7222

Type 2270 users can measure two channels of broadband values with any combination of transducers: two microphones, two accelerometers or one microphone and one accelerometer.

All Hand-held Analyzer Types 2250 and 2270 come with the Sound Level Meter Software enabled. This makes your analyzer a versatile broadband SLM. If you connect an accelerometer to the rear socket, it also functions as a Vibration Meter that can display parameters as engineering units or logarithmically in dB. The software complies with the latest international standard (IEC 61672-1) as well as national standards. For a complete list of measured parameters, see "Specifications".

## Frequency Analysis Software – BZ-7223

Fig. 7

Frequency Analysis Software BZ-7223 displays: (Left) 1/3-octave showing dual spectra and generator icon, cursor readouts, loudness and noise rating (NR) results (Right) The decisive band and the corresponding NR curve is shown



This application enables real-time measurements in 1/1- and 1/3-octave bands, adding frequency information to your data, making it easy to collect spectra, whatever the task.

Each 1/1- or 1/3-octave band has a dynamic range in excess of 135 dB, from the noise floor to 140 dB, the maximum measurable level.

The available ranges are centre frequencies 8 Hz to 16 kHz (1/1-octave) and centre frequencies 6.3 Hz to 20 kHz (1/3-octave). The low-frequency option extends the ranges to 1 and 0.8 Hz, respectively.

Spectra can be A-, B-, C-, G- or Z-weighted. Five spectra and full spectral statistics are measured and stored. In addition, seven different  $L_N$  spectra and instantaneous values are available for display. Two spectra (for example, a minimum and maximum spectrum) can be superimposed on the display. All the broadband quantities measured by Sound Level Meter Software BZ-7222 are computed in parallel with the analysis. Spectral analyses can be documented using notes and voice annotations.

Fig. 8  
2-channel Frequency Analyzer display



### 2-channel Measurements with BZ-7223

Type 2270 users can measure two spectra simultaneously with any combination of transducers. If the transducers are one microphone and one accelerometer, two independently scalable y-axes are available.

Simple difference calculations are available between channels when transducer type and weightings are compatible.

## Enhanced Logging Software – BZ-7225

Fig. 9  
Single-channel logging display showing a LAeq profile with marker functionality on the analyzer



With logging software enabled, your analyzer becomes a versatile instrument for obtaining time histories (logging profiles). Logging software allows you to select any of the available broadband parameters and log them at intervals from 1 s to 24 h. Additionally  $L_{Aeq}$  and/or  $L_{AF}$  can be simultaneously logged at 100 ms intervals.

With Frequency Analysis Software BZ-7223, the logging software also lets you log spectra the same as your broadband values at intervals from 1 s to 24 h.

Enhanced Logging Software BZ-7225 incorporates a number of features designed to make difficult field work as manageable as possible:

- Five user-definable markers can be set while you measure. Use these to annotate specific noise or vibration sources
- Markers can be set in the field using the stylus and the touch screen. Simply 'tap and drag' on the part of the profile you want to mark and select a marker from the drop-down list
- Markers can even be set after the noise event has passed. The display covers the latest 100 samples (100 s of profile when logging at 1 s intervals, otherwise more), so in most cases, you can wait for the event (or disturbance) to end before placing your marker. Alternatively, scroll back in the profile, freeze the display, and set your marker
- Voice annotations, using the commentary microphone, are attached to the exact point on the profile where the annotation is made

All markers and annotations are saved with the measurement and are imported into Measurement Partner Suite BZ-5503 where they are directly accessible in the profile.

Logging data are stored directly on SD cards and can be directly read from the SD card by Measurement Partner Suite. Large amounts of data can be quickly transferred directly from the analyzer using the USB cable or using a standard card reader. SDHC memory cards complying with the new SD 2.0 standard, offer up to 32 GB of removable data storage. This enables very long signal recordings and measurement profiles to be made.

For example, a project where all broadband parameters, one 100 ms parameter, all 1/3-octave spectra and full statistics are measured with a logging period of 1 s for a total duration 24 h will use 88 Mb.

The enhanced logging templates equip your analyzer for extended logging periods, allowing you to measure continuously, saving data to SD memory cards or USB devices.

Additional functionality includes:

- Measure continuously, saving data to SD memory cards or USB devices
- Reboot automatically and resume operation in case of power failure
- Save data in manageable portions (every 24 hr), selectable for download
- Make periodic reports; that is, calculate measurement parameters at preset intervals (report periods)
- Measure  $L_{dn}$ ,  $L_{den}$ ,  $L_{day}$ ,  $L_{evening}$  and  $L_{night}$

A periodic report is similar to the Measurement Total of the Logging software, except it is made periodically. For example, you may need to know  $L_{Aeq}$  values at 1 h intervals during an extended logging period. The Enhanced Logging software will do this for you.

Combining periodic reports with level triggered event markers and Signal Recording Option BZ-7226 provides an overview as well as a focus on essential details.

A typical setup for 24 hours of extended logging might be:

- Continuous measurement
- Hourly periodic reports
- Level triggered marker for events above  $L_{AF} = 60$  dB(A)
- Signal Recording of events (please refer to the Signal Recording Option BZ-7226)
- Logging of other parameters as required

After the measurement, you can check  $L_{dn}$  or  $L_{den}$ , the Total and the periodic reports, and then browse the events and sound recordings to verify the quality of your measurements. For semi-continuous logging, Measurement Partner Suite license BZ-5503-A enables you to remotely schedule the automatic download of projects from your analyzer to Measurement Partner.

### 2-channel Measurement Logging

Type 2270 users can log measurement data using both input channels with any combination of transducers: two microphones, two accelerometers or one of each.

You can toggle between the two measurement channels on the analyzer display and can see both measurement channels on the same graph when the measurement data are transferred to Measurement Partner Suite BZ-5503 for post-processing.



Fig. 10  
2-channel Logging display

### Signal Recording Option – BZ-7226

Signal Recording Option BZ-7226 works with all applications and enables you to make recordings of the actual measured signal with the microphone used for acoustic measurements (that is, not the commentary microphone) or accelerometer used for vibration measurements. Signal recordings are automatically transferred with the data to Measurement Partner Suite and can be helpful in identifying noise sources during post-processing.

Another important use of signal recording is to record signals for later processing. This could be in industrial applications – analysing an engine run-up or a machinery process cycle – or in environmental applications – recording noise for later post-processing in Measurement Partner Suite. With Measurement Partner Suite's BZ-5503-C license, you can perform an FFT-based pure tone assessment on .wav files.

In addition to manual and automatic signal recording, Logging Software BZ-7224 and Enhanced Logging Software BZ-7225 can trigger signal recording based on level exceedance, meaning that recordings can be automatically initiated when no operator is present.

The Signal Recording Option offers a choice of 24- or 16-bit recording with post processing supported in Measurement Partner. You can use 24-bit recording to capture the full 120 dB dynamic range of Type 2250/2270, which is convenient for later signal analysis. You can use 16-bit recording to consume less memory; however, this requires selecting the level range for recording (or using the automatic gain control).

### Tone Assessment Option – BZ-7231

Fig. 11  
Performing an outdoor tone assessment measurement



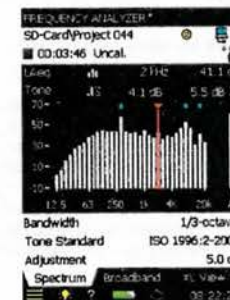
Noise can be described as tonal if it contains a noticeable or discrete, continuous note. This can include noises such as hums, hisses, screeches, drones, etc. Any such subjective description is open to discussion and contradiction when reported.

ISO 1996-2 (2007) Annex C, *Objective method for assessing the audibility of tones in noise-reference method*, provides measurement procedures to be used to verify the audibility of tones and to quantify them. Measurement results can therefore be compounded and help explain subjective reactions.

### Automatically Configured for ISO 1996 Assessments

Tone Assessment Option BZ-7231 offers a quick and easy 'in-the-field' objective assessment of tonal noise components, in compliance with ISO 1996 assessments and is a standard application on all new analyzers. The facility to carry out the ISO standard tone assessment offers objective feedback about whether you have 'found the problem' or need to take further measurements. In addition, the analyzer offers an easy way of setting up the analysis to follow the ISO 1996-2 standard. When this option is selected, simply press Start and the analyzer automatically selects the appropriate measurement configuration and the measurement and analysis are in progress.

Fig. 12  
Tone Assessment Option BZ-7231 showing 1/3-octave bands with audible tones higher than a set limit (tones are identified by the blue dots)



### Used with BZ-7223: 1/3-octave Bands

Tone Assessment identifies any 1/3-octave bands with audible tones above a set level limit. The assessment is based on the band's prominence versus adjacent bands. The adjustment is the penalty to add to  $L_{Aeq}$ . The level of each 1/3-octave band is compared to the levels of its neighbours, and all tones as well as the overall penalty (adjustment) are indicated. The search parameters are user adjustable to suit national requirements.

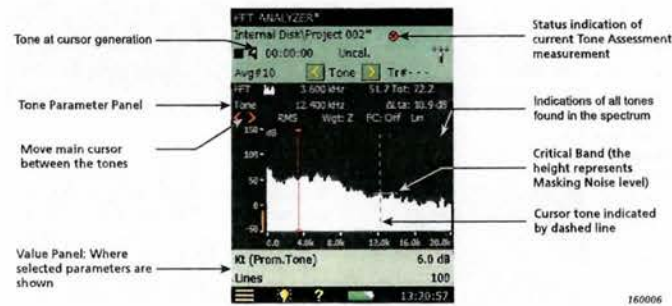
### Used with BZ-7230: FFT

After a measurement, the calculation of tonal parameters for all the possible tonal candidates in the analysis takes only a few seconds, after which the following comprehensive list of results can be displayed on the spot:

- $K_t$  – the value added to the  $L_{Aeq}$  to give the tone-corrected rating level
- $\Delta L_{ta}$  – the audibility of all tones found in the same critical band as the selected tone
- $L_{pn}$  – the Total level of the masking noise in the band containing the selected tone
- $L_{pti}$  – the Level of the selected tone
- $L_{pt}$  – the total Level of all tones in the critical band containing the prominent tone
- Critical Band – the start and end of the critical band containing the selected tone

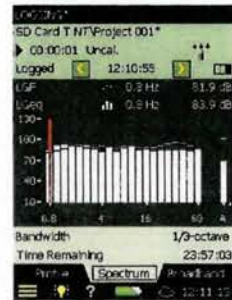
The  $L_{Aeq}$  and other broadband parameters are measured simultaneously by the analyzer and the tone corrected rating level can be calculated on the spot.

**Fig. 13**  
Typical FFT spectrum display for the Tone Assessment Option, showing the various fields and parameters



### Enhanced Vibration and Low Frequency Option – BZ-7234

**Fig. 14**  
Low Frequency Option showing G-weighted parameters  $L_{Gf}$  and  $L_{Geq}$



Enhanced Vibration and Low Frequency Option BZ-7234 enables vibration and low-frequency sound functionality in Sound Level Meter Software BZ-7222, Frequency Analysis Software BZ-7223, Logging Software BZ-7224 and Enhanced Logging Software BZ-7225.

With the low-frequency sound option enabled and the appropriate transducer selection, infrasound (including G-weighting) measurements can be performed according to the most important international standards. For infrasound measurements, use low-frequency Microphone Type 4193 or Infrasound Microphone Type 4964 optionally with the Low-frequency Adapter UC-0211.

BZ-7234 also adds additional single- and dual-axis (with Type 2270) vibration capabilities. Time-domain integration and bandpass filtering allow measurement of:

- Peak particle velocity (PPV). Useful for monitoring buildings near blasting, construction and mining. For PPV measurements use accelerometers from Brüel & Kjær's Type 4533/4534 family (see product data BP 2464)
- Vibration criteria (requires Frequency Analysis Software BZ-7223). Used when doing location surveys for vibration-sensitive instruments (for example, electron microscopes) and tools. Also useful with logging of vibration near installed vibration-sensitive instruments using optional Logging Software BZ-7224.

For building vibration, use Accelerometer Type 8344 (see product data BP 2262).

A wide range of human vibration weightings is also available:

- $W_m$  weighting for whole-body vibration measurements in buildings
- $W_b$ ,  $W_c$ ,  $W_d$ ,  $W_e$ ,  $W_k$  for whole-body vibration
- $W_h$  for hand-arm vibration
- $W_j$  for vertical head vibration

For human vibration, use accelerometers from Brüel & Kjær's Type 4533/4534 family (see product data BP 2464).

### Adding Weather Parameters to Your Measurement Data

**Fig. 15**  
Hand-held analyzer measuring outdoor noise using a weather station kit



Weather conditions affect the propagation of sound, so wind speed and direction must be taken into account when measuring noise outdoors. Consequently, most environmental noise measurement standards define limits for wind speed and direction. To identify the portions of your measurement that are within allowable limits for wind speed and direction, use Weather Station Kit MM-0316-A (two parameters) or MM-0256-A (six parameters).

**Fig. 16**  
Weather Station Kit MM-0316-A



The weather stations are based on ultrasound technology and operate well above the upper frequency limit of the microphone. Connect your weather station to your analyzer, turn it on, and you are ready to start measuring with no software setup necessary. The weather station is powered by the analyzer's battery, so there is no need for extra batteries.

#### Post-processing of Weather Data

Noise and weather parameters are captured simultaneously on the analyzer and are available for display and post-processing in Measurement Partner Suite BZ-5503 along with your noise data when you are back in the office. To quickly identify the portions of your logging profile where wind speed and direction are within the allowed limits, use Measurement Partner's report and marker wizard (requires license BZ-5503-A).

#### Outdoor Protection

For outdoor environmental noise measurements, your analyzer may need extra weather protection, offered by All-weather Case Type 3535-A and Outdoor Microphone Type 4952. For details, please refer to product data BP 2251 and product data BP 2099 respectively.

## Overview of Software Features


The table below presents a summary of the main features of each of the basic application modules available with Type 2250 and Type 2270. See "Specifications" for more details.

Feature	SLM Software BZ-7222	Frequency Analysis Software BZ-7223	Logging Software BZ-7224	Enhanced Logging Software BZ-7225
IEC/ANSI SLM standards Type/Class 1	*	*	*	*
120+ dB Dynamic Range – no need for range switching	*	*	*	*
Sound levels up to 140 dB with supplied Microphone Type 4189	*	*	*	*
Sound levels up to 152 dB using Microphone Type 4191	*	*	*	*
Frequency weightings A, B, C, Z (linear) and time weightings F, S, I	*	*	*	*
Free-field/diffuse-field correction	*	*	*	*
Automatic windscreen detection and correction	*	*	*	*
Preset time start/stop	*	*	*	*
Multi-language user interface	*	*	*	*
Context-sensitive help	*	*	*	*
Voice, metadata and text annotation of measurements	*	*	*	*
Display colour-schemes optimized for day, night, indoor and outdoor use	*	*	*	*
Personal login – protects your personal setups from other users	*	*	*	*
Broadband statistics based on $L_{Aeq}$ , $L_{AF}$ or $L_{AS}$	*	*	*	*
Maximum broadband range: 0.5 Hz – 20 kHz	*	*	*	*
Remote control using GPRS/EDGE/3G modem	*	*	*	*
Transfer of data files while measuring (USB, LAN or modem)	*	*	*	*
Recording of measured signal during measurement – 16- or 24-bit	*†	*†	*†	*†
Timers for automatic start of measurement	*	*	*	*
Occupational health parameters	*	*	*	*
Weather data and GPS input	*	*	*	*
G-weighting for infrasound parameters	*†	*†	*†	*†
$W_m$ -weighting for building vibration parameters	*†	*†	*†	*†
Back-erase – last 5 seconds of measurement data	*	*	*	*
Tone assessment	*‡	*‡	*‡	*‡
1/1-octave spectra (max. range 1 Hz to 16 kHz)	*	*†	*†	*†
1/3-octave spectra (max range 0.8 Hz to 20 kHz)	*	*†	*†	*†
Spectral statistics based on $L_{AF}$ or $L_{AS}$	*	*†	*†	*†
Loudness and Noise Rating results	*	*†	*†	*†
Charge Injection Calibration	*	*	*	*
Level triggers and recordings	*	*	*	*
Logging of all or selected broadband parameters and spectra	*	*	*	*
Logging period 1 s to 24 h	*	*	*	*
$L_{Aeq}$ , $L_{AS}$ , $L_{AF}$ logged every 100 ms	*	*	*	*
Profile display	*	*	*	*
Profile overview of entire measurement	*	*	*	*
Markers on profile display	*	*	*	*
Recording of signal during noise events	*	*	*	*
Periodic reports of all measured data	*	*	*	*
Report period 1 min to 24 h, logging time up to 31 days	*	*	*	*
Timer trigger for recordings	*	*	*	*
$L_{dn}$ , $L_{den}$ , $L_{day}$ , $L_{evening}$ , $L_{night}$	*	*	*	*
Continuous measurement	*	*	*	*

\* If Signal Recording Option is enabled  
‡ If Tone Assessment Option is enabled

† If Low Frequency Option is enabled  
\*\* If Frequency Analysis Software is enabled

## Compliance with Environmental Standards

	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China WEEE mark indicates compliance with the EU WEEE Directive
<b>Safety</b>	EN/IEC 61010–1, ANSI/UL 61010–1 and CSA C22.2 No.1010.1: Safety requirements for electrical equipment for measurement, control and laboratory use
<b>EMC Emission</b>	EN/IEC 61000–6–3: Generic emission standard for residential, commercial and light Industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards <b>Note:</b> The above is only guaranteed using accessories listed in this document
<b>EMC Immunity</b>	EN/IEC 61000–6–2: Generic standard – Immunity for industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards <b>Note:</b> The above is only guaranteed using accessories listed in this document
<b>Temperature</b>	IEC 60068–2–1 & IEC 60068–2–2: Environmental Testing. Cold and Dry Heat Operating Temperature: –10 to +50 °C (14 to 122 °F) Storage Temperature: –25 to +70 °C (–13 to 158 °F)
<b>Humidity</b>	IEC 60068–2–78: Damp Heat: 93% RH (non-condensing at +40 °C (104 °F)). Recovery time 2 – 4 hours
<b>Mechanical</b>	Non-operating: IEC 60068–2–6: Vibration: 0.3 mm, 20 m/s <sup>2</sup> , 10 – 500 Hz IEC 60068–2–27: Bump: 1000 bumps at 400 m/s <sup>2</sup> IEC 60068–2–27: Shock: 1000 m/s <sup>2</sup> , 6 directions
<b>Enclosure</b>	IEC 60529 (1989): Protection provided by enclosures: IP 44 <sup>†</sup>

<sup>†</sup> With preamplifier, extension cable or protection plug connected to the top socket and the hinged cover protecting the bottom connectors.

### ADDITIONAL STANDARDS FOR MICRO USB WIRELESS ADAPTOR UL-1050<sup>†</sup>

<b>Safety</b>	EN 60950–1:2006+A11:2009+A1:2010 +A12:2011
<b>EMC Emission</b>	EN 301 489–1 V1.9.2 EN 301 489–17 V2.2.1 EN 55022: 2010+AC:2011
<b>Spectrum &amp; Health</b>	EN 300 328 V1.7.1 EN 62311:2008
<b>Restriction of Hazardous Substances</b>	EN 50581:2012

### FCC GRANT OF EQUIPMENT AUTHORIZATION FOR MICRO USB WIRELESS ADAPTOR UL-1050<sup>†</sup>

<b>FCC Identifier</b>	KA2WA121A1
<b>FCC Rule Parts</b>	15c
<b>Frequency Range (MHz)</b>	2412.0 – 2462.0
<b>Output Watts</b>	0.269
<b>EC Declaration of Conformity</b>	1Tx1R 802.11bgn USB adaptor
<b>C-Tick Authorization</b>	AS/NZS 4268: 2008+A1:2010

<sup>†</sup> From the D-Link Corporation declaration of conformance for Wireless N 150 Micro USB Adaptor DWA-121.

## Specifications – Hand-held Analyzer Type 2250/2270 Platform

Specifications apply to Type 2250/2270 fitted with Microphone Type 4189 and Microphone Preamplifier ZC-0032

### Transducer

#### SUPPLIED TRANSDUCER

- One of the Following Microphones:
- Type 4189: Prepolarized Free-field ½" Microphone
  - Type 4190: Free-field ½" Microphone
  - Type 4966: Free-field ½" Microphone

Nominal Open-circuit Sensitivity: 50 mV/Pa (corresponding to –26 dB re 1 V/Pa) ±1.5 dB  
Capacitance: 14 pF (at 250 Hz)

#### SUPPLIED MICROPHONE PREAMPLIFIER

Part No.: ZC-0032  
Nominal Preamplifier Attenuation: 0.25 dB  
Connector: 10-pin LEMO  
Extension Cables: Up to 100 m in length between the microphone preamplifier and Type 2250/2270, without degradation of the specifications

**Accessory Detection:** Windscreen UA-1650 can be automatically detected when fitted over ZC-0032

**MICROPHONE POLARIZATION VOLTAGE**  
Selectable between 0 V and 200 V

**SELF-GENERATED NOISE LEVEL**

Typical values at 23 °C for nominal microphone open-circuit sensitivity:

Weighting	Microphone	Electrical	Total
"A"	14.6 dB	12.4 dB	16.6 dB
"B"	13.4 dB	11.5 dB	15.6 dB
"C"	13.5 dB	12.9 dB	16.2 dB
"Z" 5 Hz–20 kHz	15.3 dB	18.3 dB	20.1 dB
"Z" 3 Hz–20 kHz	15.3 dB	25.5 dB	25.9 dB

**Hardware Interface**

**PUSHBUTTONS**

11 buttons with backlight, optimized for measurement control and screen navigation

**ON-OFF BUTTON**

**Function:** Press 1 s to turn on; press 1 s to enter standby; press for more than 5 s to switch off

**STATUS INDICATORS**

**LEDs:** Red, yellow and green

**DISPLAY**

**Type:** Transflective back-lit colour touchscreen 240 × 320 dot matrix  
**Colour Schemes:** Five different – optimized for different usage scenarios (day, night, etc.)  
**Backlight:** Adjustable level and time

**USER INTERFACE**

**Measurement Control:** Using pushbuttons

**Set-up and Display of Results:** Using stylus on touchscreen or pushbuttons

**Lock:** Pushbuttons and touchscreen can be locked and unlocked

**USB INTERFACE**

USB 2.0 OTG Micro AB and USB 2.0 Standard A sockets for Wireless USB-A Adapter UL-1050, printer or weather station

**MODEM INTERFACE**

Connection to Internet through GPRS/EDGE/HSPA modem connected through the USB Standard A Socket.  
Supports DynDNS for automatic update of IP address of host name

**PRINTER INTERFACE**

PCL printers, Mobile Pro Spectrum thermal printer or Seiko DPU S245/S445 thermal printers can be connected to USB socket

**MICROPHONE FOR COMMENTARY**

Microphone, which utilizes automatic gain control (AGC), is incorporated in underside of analyzer. Used to create voice annotations for attaching to measurements

**CAMERA (TYPE 2270 ONLY)**

Camera with fixed focus and automatic exposure is incorporated in underside of analyzer.

Used to create image annotations for attaching to measurements

**Image Size:** 2048 × 1536 pixels

**Viewfinder Size:** 212 × 160 pixels

**Format:** jpg with exif information

**SECURE DIGITAL SOCKET**

2 × SD sockets

Connect SD and SDHC memory cards

**LAN INTERFACE SOCKET**

• Connector: RJ45 Auto-MDIX

• Speed: 100 Mbps

• Protocol: TCP/IP

**INPUT SOCKET**

One socket with Type 2250; two with Type 2270

**Connector:** Triaxial LEMO

**Input Impedance:** ≥ 1 MΩ

**Direct Input:** Max. input voltage: ±14.14 V<sub>peak</sub>

**CCLD Input:** Max. input voltage: ±7.07 V<sub>peak</sub>

**CCLD Current/voltage:** 4 mA/25 V

**TRIGGER SOCKET**

**Connector:** Triaxial LEMO

**Max. Input Voltage:** ± 20 V<sub>peak</sub>

**Input Impedance:** > 47 kΩ

**Precision:** ± 0.1 V

**OUTPUT SOCKET**

**Connector:** Triaxial LEMO

**Max. Peak Output Level:** ± 4.46 V

**Output Impedance:** 50 Ω

**HEADPHONE SOCKET**

**Connector:** 3.5 mm MiniJack stereo socket

**Max. Peak Output Level:** ± 1.4 V

**Output Impedance:** 32 Ω in each channel

**Storage**

**INTERNAL FLASH-RAM (NON-VOLATILE)**

512 MB for user set-ups and measurement data

**EXTERNAL MEMORY CARD**

**SD and SDHC Card:** For store/recall of measurement data

**USB MEMORY STICK**

For store/recall of measurement data

**Power**

**EXTERNAL DC POWER SUPPLY REQUIREMENTS**

Used to charge the battery pack in the analyzer

**Voltage:** 8 – 24 V DC, ripple voltage < 20 mV

**Current Requirement:** min. 1.5 A

**Power Consumption:** < 2.5 W, without battery charging, < 10 W when charging

**Cable Connector:** LEMO Type FFA.00, positive at centre pin

**EXTERNAL AC MAIN SUPPLY ADAPTOR**

**Part No.:** ZG-0426

**Supply Voltage:** 100 – 120/200 – 240 V AC; 47 – 63 Hz

**Connector:** 2-pin IEC 320

**BATTERY PACK**

Rechargeable Li-Ion battery

**Part No.:** QB-0061

**Voltage:** 3.7 V

**Capacity:** 5200 mAh nominal

**Typical Operating Time:**

**Single-channel:** > 11 h (screen backlight dimmed); > 10 h (full screen backlight)

**Dual-channel:** > 10 h (full screen backlight)

Use of external interfaces (LAN, USB, Wi-Fi) will decrease battery operating time. Connecting a weather station or a GPS receiver can decrease battery operating with up to 20%. Connecting Wireless USB-A Adapter UL-1050 can decrease battery operating time up to 35%

**Battery Cycle Life:** > 500 complete charge/discharge cycles

**Battery Aging:** Approximately 20% loss in capacity per year

**Battery Indicator:** Remaining battery capacity and expected working time may be read out in % and in time

**Battery Fuel Gauge:** The battery is equipped with a built-in fuel gauge, which continuously measures and stores the actual battery capacity in the battery unit

**Charge Time:** In analyzer, typically 10 hours from empty at ambient temperatures below 30 °C (86 °F). To protect the battery, charging will be terminated completely at ambient temperatures above 40 °C (104 °F). At 30 to 40 °C, charging time will be prolonged. With External Charger ZG-0444 (optional accessory), typically 5 hours  
**Note:** It is not recommended to charge the battery at temperatures below 0 °C (32 °F) or over 50 °C (122 °F). Doing this will reduce battery lifetime

**CLOCK**

Back-up battery powered clock. Drift < 0.45 s per 24-hour period

**Environmental**

**WARM-UP TIME**

**From Power Off:** < 2 min

**From Standby:** < 10 s for prepolarized microphones

**WEIGHT AND DIMENSIONS**

650 g (23 oz) including rechargeable battery

300 × 93 × 50 mm (11.8 × 3.7 × 1.9") including preamplifier and microphone

**Wireless Connection to Mobile Device**

Specifications apply to Wireless USB-A Adapter UL-1050

**Operating Frequency:** 2.4 GHz

**Data Rate:**

• IEEE 802.11n: up to 150 Mbps

• IEEE 802.11g: up to 54 Mbps

• IEEE 802.11b: up to 11 Mbps

**Encryption/Authentication:**

• 64/128-bit WEP

• WPA-PSK

• WPA2-PSK

**Range:** The range is similar to a standard WLAN unit, typically from 10 to 50 m (33 to 164'), depending on the environment and the number of other WLAN transmitters in the area (smartphones, Wi-Fi, etc.)

**Power Requirements:** Power Consumption: < 1 W

**Software Interface**

**USERS**

Multi-user concept with login. Users can have their own settings with jobs and projects totally independent of other users

**PREFERENCES**

Date, time and number formats can be specified per user

**LANGUAGE**

User interface in Catalan, Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

**HELP**

Concise context-sensitive help in Chinese (People's Republic of China), English, French, German, Italian, Japanese, Polish, Romanian, Serbian, Slovenian, Spanish and Ukrainian

**UPDATE OF SOFTWARE**

Update to any version using BZ-5503 through USB or update via Internet

**REMOTE ACCESS**

Connect to the analyzer using:

• Measurement Partner Suite BZ-5503

• Measurement Partner Field App (iOS or Android smartphone app)

• the 2250/2270 SDK (software development kit)

• a REST Interface through HTTP

• an Internet browser supporting JavaScript

The connection is password protected with two levels of protection:

• Guest level: for viewing only

• Administrator level: for viewing and full control of the analyzer

**CLOUD**

Connect to Measurement Partner Cloud on [cloud.bksv.com](http://cloud.bksv.com) for transferring data to an archive in the cloud for storage or easy synchronization with Measurement Partner Suite BZ-5503

**Input**

**DUAL CHANNELS (Type 2270 only)**

All measurements are made from either Ch. 1 or Ch. 2

**TRANSDUCER DATABASE**

Transducers are described in a transducer database with information on Serial Number, Nominal Sensitivity, Polarization Voltage, Free-field Type, CCLD Required, Capacitance, and additional information. The analogue hardware is set up automatically in accordance with the selected transducer

**CORRECTION FILTERS**

For Microphone Types 4189, 4190, 4191, 4192, 4193, 4193 + UC-0211, 4950, 4952, 4952+EH-2152, 4955-A, 4964, 4964 + UC-0211, 4966 and 4184-A, BZ-7222 is able to correct the frequency response to compensate for sound field and accessories:

**Sound Field:** Free-field, diffuse-field or pressure-field (Type 4192 only). For Types 4952 and 4184-A only: 0° (Top) reference direction and 90° (Side) reference direction

**Accessories:**

• Types 4189, 4190, 4964 and 4964 + UC-0211 only: None, Windscreen UA-1650 or Outdoor Microphone Kit UA-1404

• Types 4191, 4192, 4193, 4193 + UC-0211, 4966 and 4955-A only: None or Windscreen UA-1650

• Type 4950 only: None or Windscreen UA-0237

For Accelerometer Types 4397-A, 4513, 4513-001, 4513-002, 4514, 4514-001, 4514-002, 4533-B, 4533-B-001, 4533-B-002, 4534-B, 4534-B-001, 4534-B-002, 8324, 8341, 8344, 8347-C + 2647-D the lower frequency limit will be optimized to match the specifications for the accelerometer

**Calibration**

Initial calibration is stored for comparison with later calibrations

**ACOUSTIC**

Using Sound Calibrator Type 4231 or custom calibrator. The calibration process automatically detects the calibration level when Sound Calibrator Type 4231 is used

**ELECTRICAL**

Uses internally generated electrical signal combined with a typed-in value of microphone sensitivity

**CALIBRATION HISTORY**

Up to 20 of the last calibrations made are listed and can be viewed on the analyzer

**Data Management**

**METADATA**

Up to 30 metadata annotations can be set per project (text from keyboard or text from pick list, number from keyboard or auto-generated number)

**PROJECT TEMPLATE**

Defines the display and measurement set-ups. Set-ups can be locked and password protected

**PROJECT**

Measurement data stored with the project template

**JOB**

Projects are organized in jobs.

Explorer facilities for easy management of data (copy, cut, paste, delete, rename, open project, create job, set default project name)

## Measurement Control

### MANUAL

Manually controlled single measurement

### AUTOMATIC

Preset measurement time from 1 s to 24 h in 1 s steps

### MANUAL CONTROLS

Reset, Start, Pause, Back-erase, Continue and Store the measurement manually

### AUTO-START

A total of 10 timers allow set up of measurement start times up to a month in advance. Each timer can be repeated. Measurements are automatically stored when completed

### BACK-ERASE

The last 5 s of data can be erased without resetting the measurement

## Measurement Status

### ON SCREEN

Information such as overload and running/paused are displayed on screen as icons

### TRAFFIC LIGHTS

Red, yellow and green LEDs show measurement status and instantaneous overload as follows:

- Yellow LED flashing every 5 s = stopped, ready to measure
- Green LED flashing slowly = awaiting calibration signal
- Green LED on constantly = measuring
- Yellow LED flashing slowly = paused, measurement not stored
- Red LED flashing quickly = intermittent overload, calibration failed

## NOTIFICATIONS

Sends an SMS or email daily at a specified time or if an alarm condition is fulfilled

### Alarm Conditions:

- Disk Space below set value
- Trig. Input Voltage below set value
- Internal Battery enters set state
- Change in Measurement State
- Reboot of analyzer

## Annotations

### VOICE ANNOTATIONS

Voice annotations can be attached to measurements so that verbal comments can be stored together with the measurement  
**Playback:** Playback of voice annotations can be listened to using an earphone/headphones connected to the headphone socket  
**Gain Adjustment:** -60 dB to +60 dB

### TEXT ANNOTATIONS

Text annotations can be attached to measurements so that written comments can be stored with the measurement

### GPS ANNOTATIONS

A text annotation with GPS information can be attached (Latitude, Longitude, Altitude and position error). Requires connection to a GPS receiver

### IMAGE ANNOTATIONS (TYPE 2270 ONLY)

Image annotations can be attached to measurements. Images can be viewed on the screen

## Software Specifications – Sound Level Meter Software BZ-7222

## Standards

Conforms with the following national and international standards:

- IEC 61672-1 (2013) Class 1
- IEC 60651 (1979) plus Amendment 1 (1993-02) and Amendment 2 (2000-10), Type 1
- IEC 60804 (2000-10), Type 1
- DIN 45657 (1997-07)
- ANSI S1.4-1983 plus ANSI S1.4A-1985 Amendment, Type 1
- ANSI/ASA S1.4-2014, Class 1
- ANSI S1.43-1997, Type 1

**Note:** The international IEC standards are adopted as European standards by CENELEC. When this happens, the letters IEC are replaced with EN and the number is retained. Type 2250/2270 also conforms to these EN standards

## Input

### CHANNELS (Type 2270 only)

All measurements are made from either Ch. 1 or Ch. 2

## Analysis

### DETECTORS

Parallel detectors on every measurement:

- **A- or B-weighted (switchable):** Broadband detector channel with three exponential time weightings (Fast, Slow, Impulse), one linearly averaging detector and one peak detector
- **C- or Z-weighted (switchable):** As for A- or B-weighted
- **Overload Detector:** Monitors the overload outputs of all the frequency weighted channels

### MEASUREMENTS FOR SOUND INPUT

X = frequency weightings A or B

Y = frequency weightings C or Z

V = frequency weightings A, B, C or Z

U = time weightings F or S

Q = exchange rate 4, 5 or 6 dB

N = number between 0.1 and 99.9

### For Display and Storage:

Start Time	Stop Time	Overload %
Elapsed Time	L <sub>Xeq</sub>	L <sub>Veq</sub>
L <sub>XE</sub>	L <sub>YE</sub>	L <sub>Ceq-TAeq</sub>
L <sub>XSm</sub>	L <sub>XFmax</sub>	L <sub>XIm</sub>
L <sub>YSm</sub>	L <sub>YFmax</sub>	L <sub>YIm</sub>
L <sub>XSm</sub>	L <sub>XFmin</sub>	L <sub>XIm</sub>
L <sub>YSm</sub>	L <sub>YFmin</sub>	L <sub>YIm</sub>
L <sub>Xieq</sub>	L <sub>Yieq</sub>	L <sub>ATeq-TAeq</sub>
L <sub>AFTeq</sub>	L <sub>AFTeq-TAeq</sub>	Time Remaining
L <sub>ep,d</sub>	L <sub>ep,dv</sub>	E
Dose	Proj. Dose	L <sub>Vpeak</sub>
#VPeaks	#VPeaks	#VPeaks
(>NNDdB)	(>137dB)	(>135dB)
T <sub>Ypeak</sub>	L <sub>avUQ</sub>	TWA
TWAV	DoseUQ	Proj. DoseUQ
L <sub>AeqT1,mov,max</sub>	L <sub>AeqT2,mov,max</sub>	L <sub>CeqT1,mov,max</sub>
L <sub>CeqT2,mov,max</sub>	ΔL <sub>eqT1,mov,max</sub>	ΔL <sub>eqT2,mov,max</sub>
Avg. RPM		

### Weather Data (requires weather station):

Wind Dir. avg.	Wind Dir. min.	Wind Dir. max.
Wind Speed avg.	Wind Speed min.	Wind Speed max.
Amb. Temp.	Amb. Humidity	Amb. Pressure
Rainfall		

## Only for Display as Numbers or Quasi-analog Bars:

L <sub>XS</sub>	L <sub>XF</sub>	L <sub>XI</sub>
L <sub>YS</sub>	L <sub>YF</sub>	L <sub>YI</sub>
L <sub>XS(SPL)</sub>	L <sub>XF(SPL)</sub>	L <sub>XI(SPL)</sub>
L <sub>YS(SPL)</sub>	L <sub>YF(SPL)</sub>	L <sub>YI(SPL)</sub>
L <sub>XN1</sub> or L <sub>XUN1</sub>	L <sub>XN2</sub> or L <sub>XUN2</sub>	L <sub>XN3</sub> or L <sub>XUN3</sub>
L <sub>XN4</sub> or L <sub>XUN4</sub>	L <sub>XN5</sub> or L <sub>XUN5</sub>	L <sub>XN6</sub> or L <sub>XUN6</sub>
L <sub>XN7</sub> or L <sub>XUN7</sub>	L <sub>Vpeak,1s</sub>	Trig. Input Voltage
Std.Dev.	L <sub>AeqT1,mov</sub>	L <sub>AeqT2,mov</sub>
L <sub>CeqT1,mov</sub>	L <sub>CeqT2,mov</sub>	ΔL <sub>eqT1,mov</sub>
ΔL <sub>eqT2,mov</sub>	Inst. RPM	

### Instantaneous Weather Data:

Wind Dir. Wind Speed

### Instantaneous GPS Data:

Latitude Longitude

## MEASUREMENTS FOR VIBRATION INPUT

### For Display and Storage:

Start Time	Stop Time	Overload %
Elapsed Time	Time Remaining	
aLinear	aLin(1k-20kHz)	
aFast max	aF max(1k-20kHz)	
aSlow max	aS max(1k-20kHz)	
aFast min	aF min(1k-20kHz)	
aPeak	aT <sub>Peak</sub>	
Crest Factor	Avg. RPM	

## Only for Display as Numbers or Quasi-analog Bars:

aFast Inst	aF Inst(1k-20kHz)
aSlow Inst	aS Inst(1k-20kHz)
Inst RPM	Trig. Input Voltage

### Instantaneous GPS Data:

Latitude Longitude

## MEASUREMENTS FOR DIRECT INPUT

### For Display and Storage:

Start Time	Stop Time	Overload %
Elapsed Time	Time Remaining	
Linear	Fast max	Slow max
Fast min	Slow min	Peak
T <sub>Peak</sub>	Crest Factor	Avg. RPM

## Only for Display as Numbers or Quasi-analog Bars:

Fast Inst	Slow Inst
Inst RPM	Trig. Input Voltage

### Instantaneous GPS Data:

Latitude Longitude

## Software Specifications – Frequency Analysis Software BZ-7223

The specifications for BZ-7223 also include the specifications for Sound Level Meter Software BZ-7222.

## Standards

Conforms with the following National and International Standards:

- IEC 61260-1 (2014), 1/1-octave Bands and 1/3-octave Bands, Class 1

## MEASURING RANGES

When using Microphone Type 4189:

**Dynamic Range:** From typical noise floor to max. level for a 1 kHz pure tone signal, A-weighted: 16.6 to 140 dB

**Primary Indicator Range:** In accordance with IEC 60651: A-weighted: 23.5 dB to 122.3 dB

**Linearity Range:** In accordance with IEC 60804: A-weighted: 21.4 dB to 140.8 dB

**Linear Operating Range:** In accordance with IEC 61672:

• A-weighted: 1 kHz: 24.8 dB to 139.7 dB

• C-weighted: 25.5 dB to 139.7 dB

• Z-weighted: 30.6 dB to 139.7 dB

**Peak C Range:** In accordance with IEC 61672: 1 kHz: 42.3 dB to 142.7 dB

## SAMPLING FOR STATISTICS

The Statistics can be based on either L<sub>XF</sub>, L<sub>YS</sub> or L<sub>Xeq</sub>:

- Statistics L<sub>XFN1-7</sub> or L<sub>YSN1-7</sub> are based on sampling L<sub>XF</sub> or L<sub>YS</sub>, resp., every 10 ms into 0.2 dB wide classes over 130 dB
- Statistics L<sub>XN1-7</sub> are based on sampling L<sub>Xeq</sub> every second into 0.2 dB wide classes over 130 dB

Full distribution saved with measurement

The Std.Dev. (Standard Deviation) parameter is calculated from the statistics

## RPM MEASUREMENT

RPM is measured on the signal connected to Trigger input when Tacho is set to On

**Range:** 1 to 6 000 000 RPM

**Gear Ratio:** 10<sup>-3</sup> to 10<sup>35</sup>. The displayed RPM is the measured RPM divided by the RPM gear ratio

## Displays

### MEASUREMENT DISPLAYS

**SLM:** Measurement data displayed as numbers of various sizes and one quasi-analog bar

Measured sound data are displayed as dB values, vibration data as dB values or in physical units (SI units (m/s<sup>2</sup>) or US/UK units (g)), direct data as voltage in dB or V, housekeeping data as numbers in relevant format.

Instantaneous measurement L<sub>XF</sub> or Fast Inst is displayed as a quasi-analog bar

## Signal Monitoring

The input signal can be monitored using an earphone/headphones connected to the headphone socket, or it can be fed to the output socket

## OUTPUT SIGNAL

**Input Conditioned:** A-, B-, C- or Z-weighted

**Gain Adjustment:** -60 dB to 60 dB

L<sub>XF</sub> output (every ms) as a DC voltage between 0 V and 4 V

DC output for calibration purposes: 0 dB - 0 V and 200 dB - 4 V

## HEADPHONE SIGNAL

Input signal can be monitored using this socket with headphones/earphones

**Gain Adjustment:** -60 dB to 60 dB

## Input

### CHANNELS (TYPE 2270 ONLY)

All measurements are made from either Ch. 1 or Ch. 2

## Frequency Analysis

### CENTRE FREQUENCIES

1/1-oct. Band Centre Frequencies: 8 Hz to 16 kHz

1/3-oct. Band Centre Frequencies: 6.3 Hz to 20 kHz

### MEASUREMENTS FOR SOUND INPUT

X = frequency weightings A, B, C or Z, Y = time weightings F or S

Data for Storage

Full Spectral Statistics

Spectra for Display and Storage:

$L_{Xeq}$   $L_{XSmax}$   $L_{XFmax}$   
 $L_{XSmin}$   $L_{XFmin}$

Spectra for Display Only:

$L_{XS}$   $L_{XF}$   $L_{XYN1}$   
 $L_{XYN2}$   $L_{XYN3}$   $L_{XYN4}$   
 $L_{XYN5}$   $L_{XYN6}$   $L_{XYN7}$

Single Values:

SIL PSIL SIL3  
 $L_{Xeq}(f1-f2)^*$   
NR NR Decisive Band  
RC RC Classification  
NCB NCB Classification  
NC NC Decisive Band  
Loudness Loudness Level

\* where f1 and f2 are frequency bands in the spectrum

### MEASUREMENTS FOR VIBRATION AND DIRECT INPUT

Spectra for Display and Storage:

Linear Fast max Slow max  
Fast min Slow min

Spectra for Display Only:

Fast Inst Slow Inst

Single Values:

Linear  $(f1 - f2)^*$   
\* where f1 and f2 are frequency bands in the spectrum

### MEASURING RANGES

When using Microphone Type 4189:

**Dynamic Range:** From typical noise floor to max. level for a pure tone signal at 1 kHz 1/3-octave: 1.1 to 140 dB

**Linear Operating Range:** In accordance with IEC 61260, 1/3-octave:  $\leq 20.5$  to 140 dB

## Software Specifications – Logging Software BZ-7224

The specifications for BZ-7224 include the specifications for Sound Level Meter Software BZ-7222. BZ-7224 adds:

### Logging

#### MEASUREMENTS

**Logging:** Measurement data logged at preset periods into files on:

- SD Card
  - USB Memory Stick
- Logging Period:** From 1 s to 24 hr with 1 s resolution

**Broadband Statistics Stored at each Logging Interval:** Full distribution,

### SAMPLING FOR OCTAVE OR 1/3-OCTAVE STATISTICS

X = frequency weightings A or B

The Statistics can be based on either  $L_{XF}$  or  $L_{XS}$ : Statistics  $L_{XFN1} - 7$  or  $L_{XSN1} - 7$  are based on sampling  $L_{XF}$  or  $L_{XS}$ , respectively, every 100 ms into 1 dB wide classes over 150 dB.

Full distribution can be saved with measurement

## Displays

### MEASUREMENT DISPLAYS

**Spectrum:** One or two spectra superimposed + A/B and C/Z broadband bars

**Table:** One or two spectra in tabular form

**Y-axis:** Range: 5, 10, 20, 40, 60, 80, 100, 120, 140, 160 or 200 dB. Auto zoom or auto scale available. Sound data are displayed as dB values, vibration data as dB values or in physical units (SI units (m/s<sup>2</sup>) or US/UK units (g)), direct data as voltage in dB or V

**Cursor:** Readout of selected band

## Generator

### INTERNAL GENERATOR

Built-in pseudo-random noise generator

**Spectrum:** Selectable between Pink and White

**Crest Factor:**

- Pink Noise: 4.4 (13 dB)
- White Noise: 3.6 (11 dB)

**Bandwidth:** Selectable:

- Lower Limit: 50 Hz (1/3-oct.) or 63 Hz (oct.)
- Upper Limit: 10 kHz (1/3-oct.) or 8 kHz (oct.)

**Output Level:** Independent of bandwidth

- Max.: 1 V<sub>rms</sub> (0 dB)
- Gain Adjustment: -60 to 0 dB

When bandwidth is changed, the level for all bands is automatically adjusted to comply with the set output level

**Correction Filters:** For Sound Sources Type 4292, Type 4295 and Type 4296: Flat or Optimum

**Repetition Period:** 175 s

**Output Connector:** Output socket

### EXTERNAL GENERATOR

Selectable as alternative to internal generator (for microphone input only)

To control external noise generator, set:

- Levels: 0 V (generator off), 4.5 V (generator on)
- Rise-time and Fall-time: 10  $\mu$ s

The noise generator is turned on and off automatically during the measurement

**Escape Time:** 0 to 60 s

**Build-up Time:** 1 to 10 s

The generator can be turned on and off manually for checking equipment and sound levels

**Fast Logging:**  $L_{AF}$ ,  $L_{AS}$  and  $L_{Aeq}$  (sound input) or Fast Inst, Slow Inst and Linear (vibration and Direct input) can be logged every 100 ms, irrespective of logging period. For sound input you can also log LAF every 10 ms. One spectrum ( $L_{eq}$ , LF or LS) can be logged every 100 ms. The 10 ms LAF and the 100 ms spectrum can only be stored and not displayed on the analyzer; it can be displayed on Measurement Partner Suite BZ-5503

**Broadband Data Stored at each Logging Interval:** All, or up to 10 selectable broadband sound data incl. Trig. Input Voltage, Avg. RPM, Weather data, and  $L_{Aeq,T,mov}$  (for vibration and direct input: up to 5 parameters)

or none (sound input only)

**Spectrum Data Stored at each Logging Interval:** All, or up to three selectable spectra (license for BZ-7223 required)

**Spectral Statistics Stored at each Logging Interval:** Full distribution, or none (sound input only, license for BZ-7223 required)

**Logging Time:** From 1 s to 31 days with 1 s resolution

**Measurement Total:** For the logging time, in parallel with logging: All broadband data, statistics and spectra (license for BZ-7223 required)

### MARKERS

One data exclusion marker and four user-definable markers for on-line marking of sound categories heard during the measurement

Events can be set manually

### TRIGGERS

Markers can be set and signal recordings can be started (license for BZ-7226 required) when a broadband level is above or below a specified level

### ANNOTATIONS

On-line annotations with spoken comments, written notes or images (Type 2270 only)

## Calibration

### CHARGE INJECTION CALIBRATION (CIC)

Injects an internally generated electrical signal in parallel with the microphone diaphragm. A manual CIC can be performed whenever there is no measurement in progress

An automatic CIC can be performed at the start and end of a logging measurement

### Measurement Displays

**Profile:** Graphical display of selectable measurement data versus time. Fast display of next or previous marker, profile overview of entire measurement

**Y-axis:** Range: 5, 10, 20, 40, 60, 80, 100, 120, 140, 160 or 200 dB. Auto zoom or auto scale available. Sound data are displayed as dB values, vibration data as dB values or in physical units (SI units (m/s<sup>2</sup>) or US/UK units (g)), direct data as voltage in dB or V.

**X-axis:** Scroll facilities

**Cursor:** Readout of measurement data at selected time

### Notifications

**Alarm Conditions** (in addition to those specified for BZ-7222):

- CIC failed
- Trigger Level exceeded

## Software Specifications – Enhanced Logging Software BZ-7225

The specifications for BZ-7225 include the specifications for Logging Software BZ-7224. BZ-7225 adds:

### Logging

#### For Display and Storage

$L_{dir}$ ,  $L_{den}$ ,  $L_{day}$ ,  $L_{evening}$  and  $L_{night}$   
Selectable Day, Evening and Night periods and penalties (sound input only)

**Periodic Reports:** Measurement data logged at a preset report period into files on:

- SD Card
- USB Memory Stick

**Report Period:** From 1 min to 24 h with 1 min resolution

**Broadband Data and Statistics Stored at each Reporting Interval:** All including Weather data

**Spectrum Data Stored at each Reporting Interval:** All (license for BZ-7223 required)

**Spectral Statistics Stored at each Reporting Interval:** Full distribution, or none (sound input only, license for BZ-7223 required)

**Logging Time:** From 1 s to 31 days with 1 s resolution or Continuous

Data are saved in separate projects for every 24 hr of logging – at a user-defined time of day

Automatic reboot and resume of operation in case of power failure

### TRIGGERS

Signal Recording Timer

For periodically starting a signal recording (license for BZ-7226 required)

#### Level Triggers

Markers can be set and signal recordings can be started (license for BZ-7226 required) when a broadband or frequency band level is above or below a specified level. Hold off time between triggers can be set. You can specify up to four independent Level Triggers to be active at four different times during the day

## Calibration

### CHARGE INJECTION CALIBRATION (CIC)

Injects an internally generated electrical signal in parallel with the microphone diaphragm. A manual CIC can be performed whenever there is no measurement in progress

An automatic CIC can be performed at the start and end of a logging measurement. The CIC can be set to occur up to 4 times in each 24 hour period

**CIC Duration:** 10 s

### Notifications

**Alarm Conditions** (in addition to those specified for BZ-7224):  $L_{Aeq}$  for the latest Report Period exceeds a set threshold

## Software Specifications – Signal Recording Option BZ-7226

Signal Recording Option BZ-7226 is enabled with a separate license. It works with all analyzer software: Sound Level Meter, Frequency Analysis, and Logging Software, Enhanced Logging Software and Reverberation Time Software.

For data storage, signal recording requires:

- SD Card
- USB Memory Stick

### RECORDED SIGNAL

A-, B-, C- or Z-weighted signal from the measurement transducer

### AUTOMATIC GAIN CONTROL

The average level of the signal is kept within a 40 dB range, or the gain can be fixed

### SAMPLING RATE AND PRE-RECORDING

The signal is buffered for the pre-recording of the signal. This allows the beginning of events to be recorded even if they are only detected later.

Sampling Rate (kHz)	8	16	24	48
Maximum Pre-recording (s)	470	230	150	70
16-bit				

Maximum Pre-recording (s) 24-bit	310	150	96	43
Memory (KB/s) 16-bit	16	32	48	96
Memory (KB/s) 24-bit	24	48	72	144

#### PLAYBACK

Playback of signal recordings can be listened to using the earphone/headphones connected to the headphone socket

#### RECORDING FORMAT

The recording format is either 24- or 16-bit wave files (extension .wav) attached to the data in the project, easily played back afterwards on a PC using BZ-5503, Type 7820 or 7825. Calibration information and possible tachometer trigger information are stored in the .wav file, allowing BZ-5503 and PULSE to analyse the recordings

#### Functions with BZ-7222 and BZ-7223

**Manual Control of Recording:** Recording can be manually started and stopped during a measurement using a pushbutton or an external signal

### Software Specifications – Reverberation Time Software BZ-7227

#### Standards

Conforms with the relevant parts of the following:

- IEC 61672-1 (2013) Class 1
- IEC 60651 (1979) plus Amendment 1 (1993–02) and Amendment 2 (2000–10), Type 1
- IEC 61260-1 (2014), 1/1-octave Bands and 1/3-octave Bands, Class 1
- ANSI S1.4–1983 plus ANSI S1.4A–1985 Amendment, Type 1
- ANSI/ASA S1.4–2014, Class 1
- IEC 61260 (1995–07) plus Amendment 1 (2001–09), 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI S1.11–1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0-C
- ANSI S1.11–2004, 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI/ASA S1.11–2014 Part 1, 1/1-octave Bands and 1/3-octave Bands, Class 1
- ISO 140
- ISO 3382
- ISO 354

#### CORRECTION FILTERS

For Microphone Types 4189, 4190, 4191, 4192, 4193, 4950, 4952, 4952+EH-2152, 4955-A, 4964, 4966 and 4184-A, BZ-7227 is able to correct the frequency response to compensate for sound field and accessories

#### Broadband Measurements

##### DETECTORS

A- and C-weighted broadband detectors with F exponential time weighting

**Overload Detector:** Monitors the overload outputs of all the frequency weighted channels

##### MEASUREMENTS

$L_{AR}$  and  $L_{CR}$  for display as numbers or quasi-analogue bars

##### MEASURING RANGES

When using Microphone Type 4189:

**Dynamic Range:** From typical noise floor to max. level for a 1 kHz pure tone signal, A-weighted: 16.6 to 140 dB

**Primary Indicator Range:** In accordance with IEC 60651, A-weighted: 23.5 dB to 122.3 dB

**Linear Operating Range:** In accordance with IEC 61672:

- A-weighted: 23.5 dB to 122.3 dB
- C-weighted: 25.5 dB to 139.7 dB

**Automatic Control of Recording:** Start of recording when measurement is started. Minimum and Maximum recording time can be preset

#### Functions with BZ-7224 and BZ-7225

**Manual Control of Recording (using Manual Event or Back-erase pushbutton, or an external signal):** Recording during all of the event, or for preset minimum and maximum duration. A Sound marker is set while recording. Selectable pre- and post-recording time

**Manual Control of Recording (using touch screen):** Recording for the selected time period (subject to the limitations of the pre-recording buffer). A Sound marker is set for the selected time period

**Automatic Control of Recording:** An event can be triggered when a broadband level is above or below a specified level. Recording during all of the event or for preset minimum and maximum duration.

Selectable pre- and post-recording time

#### Functions with BZ-7227

**Automatic Control of Recording:** Start of recording when measurement is started. 16-bit recording format only

- Z-weighted: 30.6 dB to 139.7 dB

#### Frequency Analysis

##### CENTRE FREQUENCIES

**1/1-oct. Band Centre Frequencies:** 63 Hz to 8 kHz

**1/3-oct. Band Centre Frequencies:** 50 Hz to 10 kHz

##### MEASUREMENTS

$L_{ZF}$  spectrum for display only

$L_{Zeq}$  spectra sampled at 5 ms intervals

##### MEASURING RANGES

When using Microphone Type 4189:

**Dynamic Range:** From typical noise floor to max. level for a pure tone signal at 1 kHz 1/3-octave: 1.1 to 140 dB

**Linear Operating Range:** In accordance with IEC 61260, 1/3-octave:  $\leq 20.5$  dB to 140 dB

#### Internal Generator

Built-in pseudo-random noise generator

**Spectrum:** Selectable Pink or White

**Crest Factor:**

- Pink noise: 4.4 (13 dB)
- White noise: 3.6 (11 dB)

**Bandwidth:** Follows measurement frequency range

• Lower Limit: 50 Hz (1/3-oct.) or 63 Hz (oct.)

• Upper Limit: 10 kHz (1/3-oct.) or 8 kHz (oct.)

**Output Level:** Independent of bandwidth

- Max.:  $1 V_{rms}$  (0 dB)
- Gain Adjustment: -60 to 0 dB

When bandwidth is changed, the level for all bands is automatically adjusted to comply with the set output level

**Correction Filters for Sound Sources Type 4292, Type 4295 and Type 4296:** Flat or Optimum

**Turn-on Time and Turn-off Time:** Equivalent to RT = 70 ms

**Repetition Period:** 175 s

**Output Connector:** Output Socket

**Control:** See Measurement Control

#### External Generator

Selectable as alternative to internal generator

For controlling external noise generator

**Levels:** 0 V (Generator off), 4.5 V (Generator on)

**Rise-time and Fall-time:** 10  $\mu$ s

**Control:** See Measurement Control

#### Reverberation Time

EDT, T20 and T30 in octave or 1/3-octave bands

**Decays:** Measured and stored using averaging time of 5 ms

**Evaluation Range:** 0 to -10 dB for EDT, -5 to -25 dB for T20 and -5 to -35 dB for T30

**Measurement Time:** Automatic selection of measurement time for the decays based on the actual reverberation time of the room

**Maximum Measurement Time:** from 2 to 30 s

**Averaging:** EDT, T20 and T30 measurements can be averaged (arithmetic averaging or ensemble averaging)

**EDT, T20 and T30 Calculation:** From slope in evaluation range

**Slope Estimation:** Least squares approximation

**Quality Indicators:** Quality Indicators with status information like

Overload, Curvature in %, etc.; extensive list of status information.

Quality indicators are available on reverberation time spectra for each

frequency band, and as overall quality indicators for each

measurement position and for the total project (room)

**Reverberation Time Range:** Max. 50 s, min. 0.1 – 0.7 s, depending on

bandwidth and centre frequency

**Wide Band Reverberation Time:** The arithmetic average of the

Reverberation Time within a selectable frequency range is calculated

#### Measurement Display and Control

##### OVERVIEW MAP

Map of Source and Receiver positions with reverberation time readout

for a selectable frequency band on each measurement position

together with quality indicator

**Organization of Source and Receiver Positions:** measure at all receiver positions for each source or measure in a number of positions (1 to 10)

for each source

Source and Receiver positions can be added, moved or deleted

##### OVERVIEW TABLE

Table of measurement positions with reverberation time readout for

selectable frequency band on each position together with quality

indicator

Positions can be included/excluded from Room average

##### SOUND LEVEL SPECTRUM

LZF spectrum plus A and C broadband bars

**Y-axis:** Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto zoom

or auto scale available

**Cursor:** Readout of selected band

Quality indicator for each frequency band

##### REVERBERATION TIME SPECTRUM

One or two spectra can be displayed

**Y-axis:** Range: 0.5, 1, 2, 5, 10 or 20 s. Auto zoom available

**Cursor:** Readout of selected band

Quality Indicator for each frequency band

##### REVERBERATION TIME SPECTRUM TABLE

One or two spectra can be displayed in tabular form

##### DECAY

Decay curve for a position or the room average available for each

frequency band

Display of evaluation range and regression line

Readout of Curvature in %

**Y-axis:** Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto zoom

or auto scale available

##### MEASUREMENT CONTROL

**Measurement Sequence:** Supports measuring:

- at all receiver positions before using another source
- at a receiver position for all sources before measuring at a new position

- at subsequent receiver positions without source information, or
- at manually selected source and receiver positions

During measurement, the instantaneous sound level spectrum is

displayed. After measurement, the reverberation time is displayed

**Interrupted Noise Excitation:** Measurements are started manually and

can be automatically stored on completion of measurement

The noise generator is turned on and off automatically

**Escape Time:** 0 to 60 s

**Build-up Time:** 1 to 10 s

**Number of Decays per Measurement:** 1 to 100, ensemble averaged

into one decay

The generator can be turned on and off manually for checking

equipment and sound levels

**Serial Measurements:** Selected frequency bands can be measured

serially, that is, one by one in an automatic sequence. This can be done

automatically in combination with the parallel measurement

**Impulse Excitation:** Manual start of first measurement. When level

(say from starter pistol) exceeds the user-selected trigger level, the

decay is recorded and backwards integration performed (Schroeder

method). The trigger can then be armed automatically for measuring at

the next position

**Signal Recording:** (requires license for Signal Recording Option

BZ-7226) Recording of the Z-weighted measured signal can be done at

each position. For data storage, Signal Recording requires:

- SD Card
- USB Memory Stick

#### Measurement Status

##### ON SCREEN

Information such as *overload*, *awaiting trigger* and *running/paused* are

displayed on screen as icons

##### TRAFFIC LIGHT

Red, yellow and green LEDs show measurement status and

instantaneous overload as follows:

- Yellow LED flashing every 5 s = stopped, ready to measure
- Green LED flashing slowly = awaiting trigger or calibration signal
- Green LED on constantly = measuring
- Yellow LED flashing slowly = paused, measurement not stored
- Red LED flashing quickly = intermittent overload, calibration failed

#### Calibration

Initial calibration is stored for comparison with later calibrations

##### ACOUSTIC

Using Sound Calibrator Type 4231 or custom calibrator. The calibration

process automatically detects the calibration level when Sound

Calibrator Type 4231 is used

##### ELECTRICAL

Uses internally generated electrical signal combined with a typed-in

value of microphone sensitivity

##### CALIBRATION HISTORY

Up to 20 of the last calibrations made are listed and can be viewed on

the analyzer

#### Signal Monitoring

Input signal A-, C- or Z-weighted can be monitored using an

earphone/headphones connected to the headphone socket

**Headphone Signal:** Input signal can be monitored using this socket

with headphones/earphones

**Gain Adjustment:** -60 dB to 60 dB

#### Annotations

##### VOICE ANNOTATIONS

Voice annotations can be attached to the Reverberation Time Project,

to Sources, to Receivers and to measurements at each Position

**Playback:** Playback of voice annotations or signal recordings can be listened to using earphone/headphones connected to the headphone socket

**Gain Adjustment:** -60 dB to +60 dB

#### TEXT AND IMAGE ANNOTATIONS

Text and image (Type 2270 only) annotations can be attached to the Reverberation Time Project, to Sources, to Receivers and to measurements at each Position

#### GPS ANNOTATIONS

A text annotation with GPS information can be attached to the project (Latitude, Longitude, Altitude and position error). Requires connection to a GPS receiver

### Software Specifications – 2-channel Option BZ-7229

2-channel Option BZ-7229 is a standard application included with all new Type 2270 analyzers. It adds 2-channel functionality to Sound Level Meter, Frequency Analysis, Logging, Enhanced Logging and Building Acoustics Software and to Signal Recording Option on Type 2270

Please refer to Product Data BP 2190 for 2-channel Building Acoustics Software specifications

In general the 2-channel option adds an extra channel of measurement data. The two channels can have input from same type of transducers (such as two microphones) or two different transducers (such as one microphone and one accelerometer)

#### SELF-GENERATED NOISE LEVEL

Typical values at 23 °C for nominal microphone open-circuit sensitivity:

##### High Range:

Weighting	Microphone	Electrical	Total
"A"	14.6 dB	28.3 dB	28.5 dB
"B"	13.4 dB	26.9 dB	27.1 dB
"C"	13.5 dB	27.0 dB	27.2 dB
"Z" 5 Hz–20 kHz	15.3 dB	31.2 dB	31.3 dB
"Z" 3 Hz–20 kHz	15.3 dB	32.1 dB	32.2 dB

##### Low Range:

Weighting	Microphone	Electrical	Total
"A"	14.6 dB	12.4 dB	16.6 dB
"B"	13.4 dB	11.5 dB	15.6 dB
"C"	13.5 dB	12.9 dB	16.2 dB
"Z" 5 Hz–20 kHz	15.3 dB	18.3 dB	20.1 dB
"Z" 3 Hz–20 kHz	15.3 dB	25.5 dB	25.9 dB

#### MEASURING RANGES

The full level measuring range is covered in two range settings: High Range for the least sensitive range and Low Range for the most sensitive range

When using Microphone Type 4189:

##### Broadband Analysis

**Dynamic Range:** From typical noise floor to max. level for a 1 kHz pure tone signal, A-weighted:

- High Range: 28.5 to 140 dB
- Low Range: 16.6 to 110 dB

**Primary Indicator Range:** In accordance with IEC 60651, A-weighted:

- High Range: 41.7 dB to 122.3 dB
- Low Range: 23.5 dB to 92.3 dB

**Linearity Range:** In accordance with IEC 60804, A-weighted:

- High Range: 39.6 to 140.8 dB
- Low Range: 21.4 to 110.8 dB

**Linear Operating Range:** In accordance with IEC 61672:

### Data Management

**Project Template:** Defines the display and measurement setups

**Project:** Measurement data for all positions defined in a room are stored with the Project Template

**Job:** Projects are organized in Jobs

Explorer facilities for easy management of data (copy, cut, paste, delete, rename, open project, create job, set default project name)

For specifications and details on documenting results in Qualifier Type 7830 and Qualifier Light Type 7831, please refer to Product Data BP 1691

- A-weighted: 1 kHz
- High Range: 43.0 dB to 139.7 dB
- Low Range: 24.8 dB to 109.7 dB

- C-weighted: 1 kHz
- High Range: 41.7 dB to 139.7 dB
- Low Range: 25.5 dB to 109.7 dB

- Z-weighted: 1 kHz
- High Range: 45.9 dB to 139.7 dB
- Low Range: 30.6 dB to 109.7 dB

- Peak C Range: In accordance with IEC 61672, 1 kHz:
- High Range: 58.5 dB to 142.7 dB
- Low Range: 42.3 dB to 112.7 dB

- Frequency Analysis
- Dynamic Range:** From typical noise floor to max. level for a pure tone signal at 1 kHz 1/3-octave:
- High Range: 18.5 to 140 dB
- Low Range: 1.3 to 110 dB

- **Linear Operating Range:** In accordance with IEC 61260:
- High Range: ≤39.3 to 140 dB
- Low Range: ≤20.6 to 110 dB

- **Frequency Analysis**
- Dynamic Range:** From typical noise floor to max. level for a pure tone signal at 1 kHz 1/3-octave:
- High Range: 18.5 to 140 dB
- Low Range: 1.3 to 110 dB

- **Linear Operating Range:** In accordance with IEC 61260:
- High Range: ≤39.3 to 140 dB
- Low Range: ≤20.6 to 110 dB

- **Measurements with BZ-7222 and BZ-7223**

- Two channels, each with all the data from the single channel measurement, except for common housekeeping parameters like Start Time, Elapsed Time, etc. and weather and GPS data.

- **Underrange Detector:** Monitors the underrange of all the frequency-weighted detectors. Underrange is set if level is below lower limit of Linear Operating Range. Detectors available for both Ch. 1 and Ch. 2.

- **AUTORANGE**
- Manual and automatic range controls are provided

- **Spectrum Display (for BZ-7223)**
- Spectra from both channels can be superimposed. Data from different transducer types are displayed with individual Y-axis

- **Spectra for Display (microphone input):**
- Ch.1 – Ch.2  $L_{\text{Aeq}}$
- Ch.2 – Ch.1  $L_{\text{Aeq}}$
- X = A, B, C or Z

- **Spectra for Display (accelerometer or direct input):**
- Ch.1 – Ch.2 Linear
- Ch.2 – Ch.1 Linear

- **Single Values for Display (microphone input):**
- Ch.1 – Ch.2  $L_{\text{Aeq}}$
- Ch.2 – Ch.1  $L_{\text{Aeq}}$
- Ch.1 – Ch.2  $L_{\text{Aeq}}$
- Ch.2 – Ch.1  $L_{\text{Aeq}}$
- X = A or B, Y = C or Z

- **Single Values for Display (accelerometer or direct input):**
- Ch.1 – Ch.2 Linear
- Ch.2 – Ch.1 Linear

- **Ch.1 – Ch.2 Linear detector 2 (Acc. input only)**

- **Ch.2 – Ch.1 Linear detector 2 (Acc. input only)**

- **Measurements with BZ-7224 and BZ-7225**

- **Fast Logging:** Up to a total of four of the 100 ms broadband parameters from the two channels can be logged (incl. the 10 ms parameter for sound input). Up to two 100 ms spectra from the two channels

- **Broadband Data Stored at Each Logging Interval:**
- All, or up to 10 selectable broadband values from the two channels

- **Spectrum Data Stored at each Logging Interval:** All, or up to four selectable spectra from the two channels (license for BZ-7223 required)

- **2-channel Signal Recording (license for BZ-7226 required):** 2-channel Signal Recording is available in Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software

- **2-channel Signal Recording (license for BZ-7226 required):** 2-channel Signal Recording is available in Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software

- **2-channel Signal Recording (license for BZ-7226 required):** 2-channel Signal Recording is available in Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software

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- **2-channel Signal Recording (license for BZ-7226 required):** 2-channel Signal Recording is available in Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software

- **Ch.2 – Ch.1 Linear detector 2 (Acc. input only)**

### Measurements with BZ-7224 and BZ-7225

**Fast Logging:** Up to a total of four of the 100 ms broadband parameters from the two channels can be logged (incl. the 10 ms parameter for sound input). Up to two 100 ms spectra from the two channels

**Broadband Data Stored at Each Logging Interval:**

All, or up to 10 selectable broadband values from the two channels

**Spectrum Data Stored at each Logging Interval:** All, or up to four selectable spectra from the two channels (license for BZ-7223 required)

**2-channel Signal Recording (license for BZ-7226 required):** 2-channel Signal Recording is available in Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software

**2-channel Signal Recording (license for BZ-7226 required):** 2-channel Signal Recording is available in Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software

### Software Specifications – Tone Assessment Option BZ-7231

#### LICENSE

Tone Assessment Option BZ-7231 is a standard application included with all new Type 2250/2270 analyzers. The option can be used with the FFT template (BZ-7230) or with 1/3-octave and logging template (BZ-7223, BZ-7224 or BZ-7225)

#### FFT-based Tone Assessment (with BZ-7230 Only)

##### STANDARD

Tone assessment is based on the measured FFT spectrum in accordance with ISO 1996:2007 Acoustics – Description, assessment and measurement of environmental noise – part 2: Determination of environmental noise levels. Annex C (informative) Objective method for assessing the audibility of tones in noise – Reference method

##### SPECTRA ASSESSED

Any displayed sound FFT spectrum (FFT, Ref or Max) may be assessed. Assessment is made as post-processing, that is, when measurement is paused or stopped

##### SETUP ACCORDING TO STANDARD

Setups in violation of the standard are indicated as such on the display, you may then accept to apply the default setup. Tone assessment will be made if possible, in spite of standard violations

**Tone Seek Criterion:** 0.1 to 4.0 dB in 0.1 dB steps

##### TONE AT CURSOR

A sinusoidal tone is available at the headphone output, to help confirm identified tones

**Frequency:** The frequency is selected by the main cursor

**Gain:** -70 dB to +10 dB

**Options:** The generated tone can be mixed with the input signal

##### TONE ASSESSMENT CURSOR

All tones found are indicated in the display.

The tone cursor is initially placed at the most prominent tone, and can then be stepped through the tones found.

You can also use the main cursor to step through the tones

##### RESULTS

Results are displayed in the Tone panel and in the Value panel. They are not saved with the measurement

The signals from the two channels can be recorded into a "stereo" wave file of either 2 × 24-bit or 2 × 16-bit

#### SAMPLING RATE AND PRE-RECORDING FOR 2-CHANNEL RECORDING

Sampling Rate (kHz)	8	16	24	48
Maximum Pre-recording (s) 16-bit	230	110	70	30
Maximum Pre-recording (s) 24-bit	150	70	43	16
Memory (KB/s) 16-bit	32	64	96	192
Memory (KB/s) 24-bit	48	96	144	288

**All Tones:** Frequency, Tone level  $L_{\text{pt}}$ , Masking noise level  $L_{\text{pn}}$ , Audibility  $\Delta L_{\text{ts}}$ , Critical Band CB, Tone vs Noise Level difference  $\Delta L_{\text{ts}}$ , Audibility criterion  $\Delta L_{\text{ts,krit}}$

**Most Prominent Tone:** Tone Level  $L_{\text{pt}}$ , Adjustment  $K_t$

#### QUALITY INDICATORS

On the display, a quality indicator (smiley) will indicate that a hint is available for tone assessment quality. Click on the indicator to see the hint

#### 1/3-octave-based Tone Assessment (with BZ-7223/24/25 Only)

Tone assessment is based on the measured 1/3-octave spectrum in accordance with either the international 'ISO 1996:2007 Acoustics – Description, assessment and measurement of environmental noise – part 2: Determination of environmental noise levels. Annex D (informative) Objective method for assessing the audibility of tones in noise – Simplified method' or the Italian law 'DM 16-03-1998: Ministero dell'ambiente, Decreto 16 marzo 1998'

#### SPECTRA ASSESSED

The displayed 1/3-octave spectrum ( $L_{\text{eq}}$ ,  $L_{\text{max}}$  or  $L_{\text{min}}$ ) may be assessed. Assessment is made as post-processing, that is, when measurement is paused or stopped

#### SETUP ACCORDING TO STANDARD

Setups in violation of the standard are indicated as such on the display. You can then accept to apply the default setup. Tone assessment will be made if possible, in spite of standard violations. For tone assessment according to ISO 1996-2, Annex D, you can set the division between the Low and Middle frequency range, the division between the Middle and High frequency range, and the limits for the level differences between adjacent bands.

For tone assessment according to DM 16-03-1998, the tones are tested against loudness contours. Select between ISO 226: 1987 Free-field, 1987 Diffuse-field and 2003 Free-field

#### RESULTS

Tones are indicated above the spectrum when Tone is selected as spectrum parameter. The resulting adjustment can be viewed on the Value panel. It is not saved with the measurement

## Software Specifications – Enhanced Vibration and Low Frequency Option BZ-7234

Enhanced Vibration and Low Frequency Option BZ-7234 is enabled with a separate license. It adds G-weighting and human vibration parameters, and integration and double integration of the acceleration signal for vibration and displacement parameters to Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software and adds low frequency 1/1- and 1/3-octave analysis to Frequency Analysis, Logging and Enhanced Logging Software

### G-weighting

Specifications for G-weighting apply to Type 2250/2270 fitted with one of the Microphone Types 4193 or 4964 (both with or without the Low Frequency Adaptor UC-0211) and Microphone Pre-amplifier ZC-0032

### Standards

Conforms with the following national and international standards:

- ISO 7196:1995
- ANSI S1.42–2001 (R2011)

### Analysis

#### DETECTORS

G-weighted (replacing C/Z-weighted) broadband detectors with one 10 s exponential time weighting, one linearly averaging detector and one peak detector.

#### MEASUREMENTS

Y = time weightings F or S

Spectra for Display and Storage (BZ-7223 required):

$L_{Geq}$   $L_{GSmax}$   $L_{GFmax}$   
 $L_{GSmin}$   $L_{GFmin}$

Spectra for Display Only (BZ-7223 required):

$L_{GS}$   $L_{GF}$   $L_{GYN1}$   
 $L_{GYN2}$   $L_{GYN3}$   $L_{GYN4}$   
 $L_{GYN5}$   $L_{GYN6}$   $L_{GYN7}$

Single Values for Display and Storage:

$L_{Geq}$   $L_{G10max}$   $L_{G10min}$   
 $L_{Gpeak}$   $T_{Gpeak}$

### General Vibration

Specifications for General Vibration parameters apply to Type 2250/2270 fitted with an accelerometer

### Analysis

Conforms with the following International standards:

- ISO 2954
- ISO 10816 series

### Human Vibration

Specifications for Human Vibration parameters apply to Type 2250/2270 fitted with an accelerometer.

### Standards

Conforms with the following International Standards:

Single Values for Display Only:

$L_{G10}$   $L_{Gpeak,1s}$

#### MEASURING RANGES

G-weighted Linear Operating Range at G-filter reference frequency 10 Hz

#### Single Range:

Microphone	Low (dB)	High (dB)
4193	41.0	161.0
4194 + UC-0211	44.1	151.4
4964	29.6	149.0
4964 + UC-0211	32.6	139.3

#### High Range:

Microphone	Low (dB)	High (dB)
4193	41.6	161.0
4194 + UC-0211	51.8	151.4
4964	30.3	149.0
4964 + UC-0211	41.7	139.3

#### Low Range:

Microphone	Low (dB)	High (dB)
4193	41.0	131.0
4194 + UC-0211	44.1	147.4
4964	29.6	119.0
4964 + UC-0211	32.6	137.3

### Analysis

#### DETECTORS

Addition to the Acc Linear and Acc 1k-20kHz settings for the two broadband detectors:

Vel 3 – 20 000 Hz Vel 0.3 – 1000 Hz Vel 10 – 1000 Hz  
 Vel 1 – 100 Hz Dis 10 – 1000 Hz Dis 30 – 300 Hz  
 Dis 1 – 100 Hz

The weighting for the peak detector can be set to one of the settings chosen for the broadband detectors or Acc Linear

The weighting for the spectrum detectors can be set to Acc Linear or Vel 3 – 20000 Hz, Vel 0.3 – 1000 Hz, Vel 10 – 1000 Hz or Vel 1 – 100 Hz

Single Values for Display and Storage: Peak-Peak for displacement

- ISO 8041:2005
- ISO 5349-1
- ISO 2631 series
- DIN 45669-1:2010-09

## Analysis

### DETECTORS

Two broadband detectors can each be set to one of the weightings:

Acc Linear	Vel 0.3 – 1000 Hz	Vel 1 – 100 Hz
$W_b$	$W_c$	$W_d$
$W_e$	$W_j$	$W_h$
$W_k$	$W_m$	$W_{sb}$
$W_{hb}$	$W_{mb}$	

$W_{mb}$  is the band limiting part of  $W_m$ ,  $W_{hb}$  is the band limiting part of  $W_h$  and  $W_{sb}$  is the band limiting part of  $W_b$ ,  $W_c$ ,  $W_d$ ,  $W_e$ ,  $W_j$  and  $W_k$

The weighting for the peak detector can be set to one of the settings chosen for the broadband detectors or Acc Linear. The weighting for the spectrum detectors can be set to Acc Linear or Vel 0.3 – 1000 Hz or Vel 1 – 100 Hz

### MEASUREMENTS

Single Values for Display and Storage:

MTVV KBF<sub>max</sub> KBF<sub>Tm</sub>  
 Peak-Peak

Single Values for Display Only:

aW<sub>1s</sub> KBF

## Low Frequency 1/1- and 1/3-octave Analysis

### Frequency Analysis

#### CENTRE FREQUENCIES

1/1-oct. Band Centre Frequencies: 1 Hz to 16 kHz  
 1/3-oct. Band Centre Frequencies: 0.8 Hz to 20 kHz

### Standards

Conforms with the following National and International Standards:

- IEC 61260-1 (2014), 1/1-octave Bands and 1/3-octave Bands, Class 1
- IEC 61260 (1995-07) plus Amendment 1 (2001-09), 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI S1.11-1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0-C

## Specifications – Measurement Partner Suite BZ-5503

BZ-5503 is included with Types 2250 and 2270 for easy synchronization of setups and data between the PC and hand-held analyzer. BZ-5503 is supplied on ENV DVD BZ-5298

### PC REQUIREMENTS

Operating System: Windows® 7, 8.1 or 10 (all in 32-bit or 64-bit versions)

#### Recommended PC:

- Intel® Core™ i3
- Microsoft® .NET 4.5
- 2 GB of memory
- Sound card
- DVD drive
- At least one available USB port
- Solid State Drive

### ONLINE DISPLAY OF TYPE 2250/2270 DATA

Measurements on the analyzer can be controlled from the PC and displayed online with the PC, using the same user interface on the PC as on the analyzer

Display: 1024 × 768 (1280 × 800 recommended)

### DATA MANAGEMENT

Explorer: Facilities for easy management of analyzers, users, jobs, projects and project templates (copy, cut, paste, delete, rename, create)

Data Viewer: View measurement data (content of projects)

Synchronization: Project templates and projects for a specific user can be synchronized between PC and analyzer and between local and cloud archives. Measurement Partner Suite BZ-5503 merges Measurement Partner Field App annotations with the corresponding analyzer project

### USERS

Users of Type 2250/2270 can be created or deleted

### EXPORT FACILITIES

Excel®: Projects (or user-specified parts) can be exported to Microsoft® Excel® (Excel 2003 – 2016 supported)

- ANSI S1.11–2004, 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI/ASA S1.11–2014 Part 1, 1/1-octave Bands and 1/3-octave Bands, Class 1

### Sound Measurements

Low-frequency sound measurements require use of a low-frequency microphone. This can be Type 4193 or Type 4964, both together with Low-frequency Adaptor UC-0211

### Vibration Measurements

Brüel & Kjær recommends Low-level Accelerometer Type 8344 for low frequency vibration measurements

Brüel & Kjær Software: Projects can be exported\* to Predictor-Lima Type 7810, Acoustic Determinator Type 7816, Protector Type 7825, Qualifier (Light) Type 7830 (7831), PULSE Mapping for Hand-held Sound Intensity Type 7962/7752/7761 or PULSE Reflex

### POST-PROCESSING

Measurement Partner Suite is a suite of modules, including post-processing tools for data acquired with Type 2250/2270. The following post-processing modules are available:

- Logging Module BZ-5503-A
- Spectrum Module BZ-5503-B
- WAV File Analysis Module BZ-5503-C

These modules help to assess logging data and measured spectra, such as calculating contribution from markers on a logging profile or correcting spectra for background noise

### HAND-HELD ANALYZER SOFTWARE UPGRADES AND LICENSES

The software controls analyzer software upgrades and licensing of the analyzer applications

### INTERFACE TO HAND-HELD ANALYZER

USB, LAN or Internet connection

### LICENSE MOVER

To move a license from one analyzer to another use BZ-5503 together with License Mover VP-0647

### LANGUAGE

User interface in Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

### HELP

Concise context-sensitive help in English

\* Not all data are available in all exports. The data exported are dependent on the type and target of the export.

## Ordering Information

<b>Type 2250-S</b>	Hand-held analyzer
<b>Type 2270-S</b>	2-channel hand-held analyzer
<b>Type 2250-S-C</b>	Hand-held analyzer with Sound Calibrator Type 4231
<b>Type 2270-S-C</b>	2-channel hand-held analyzer with Sound Calibrator Type 4231

which include the following as standard:

### INCLUDED SOFTWARE

- BZ-7222: Sound Level Meter Software
- BZ-7223: Frequency Analysis Software
- BZ-7231: Tone Assessment Option
- BZ-7232: Noise Monitoring Software
- BZ-7229: 2-channel Option (Type 2270 only)

### INCLUDED MICROPHONE AND PREAMPLIFIER

- Type 4189: ½" Pre-polarized Free-field Microphone or
- Type 4190: ½" Free-field Microphone or
- Type 4966: ½" Free-field Microphone
- ZC-0032: Microphone Preamplifier

### INCLUDED ACCESSORIES

- FB-0679: Hinged Cover (Type 2250 only)
- FB-0699: Hinged Cover (Type 2270 only)
- QB-0061: Battery Pack
- ZG-0426: Mains Power Supply
- UA-1650: 90 mm dia. Windscreen with AutoDetect
- Compulsory Accessory Kit UA-1710-D01 including:
  - KE-0441: Protective Cover, for hand-held analyzer
  - UL-1050: Wireless USB-A (M) Adapter
  - UA-1651: Tripod Extension, for hand-held analyzer
  - UA-1654: 5 Extra Styli
  - UA-1673: Adaptor for Standard Tripod Mount
  - DH-0696: Wrist Strap
  - DD-0594: Protection Plug, for hand-held analyzer without Preamplifier
  - AO-1494: Cable, USB 2.0, USB-A (M) to USB-micro-B (M) black, 1.8 m (5.9'), max. +70 °C (158 °F)
  - BZ-5298: Environmental Software DVD

Note: These accessories are also available separately

### Analyzer Alone

To purchase a hand-held analyzer without microphone or preamplifier order:

<b>Type 2250-W</b>	Hand-held Analyzer for vibration measurements
<b>Type 2270-W</b>	2-channel Hand-held Analyzer for vibration measurements

### Software and Accessories Available Separately

#### SOFTWARE MODULES

BZ-7224	Logging Software (including memory card)
BZ-7225	Enhanced Logging Software (including memory card)
BZ-7225-UPG	Upgrade from Logging Software BZ-7224 to Enhanced Logging Software BZ-7225 (does not include memory card)
BZ-7226	Signal Recording Option
BZ-7227	Reverberation Time Software
BZ-7228	Building Acoustics Software
BZ-7230	FFT Software
BZ-7233	Sound Intensity Software (Type 2270 only)
BZ-7234	Enhanced Vibration and Low Frequency Option

#### PC SOFTWARE

BZ-5503-A	Measurement Partner, Logging Module (see product data BP 2430)
BZ-5503-B	Measurement Partner, Spectrum Module (see product data BP 2430)
BZ-5503-C	Measurement Partner, WAV File Analysis Module (see product data BP 2430)
BZ-5503-D	Measurement Partner Field App for iOS and Android (free download at App Store® and Google Play™)
BZ-5503-E	Measurement Partner Cloud Entry Level, free cloud storage
BZ-5503-F-012	Measurement Partner Cloud Basic, basic cloud storage subscription for one year
BZ-5503-G-012	Measurement Partner Cloud Professional, enterprise cloud storage subscription for one year
Type 7825	Protector™ – software for calculation of personal noise exposure
Type 7831	Qualifier Light (post-processing)
Type 7830	Qualifier (post-processing)

#### INTERFACING

UL-1016	10/100 Ethernet CF Card for hardware versions 1 – 3
UL-1019	CF WLAN Card for hand-held analyzers for hardware versions 1 – 3
UL-0250	USB to RS-232 Converter for hardware version 4

#### CALIBRATION

Type 4231	Sound Calibrator (fits in KE-0440)
Type 4226	Multifunction Acoustic Calibrator
Type 4228	Pistonphone
Type 4294	Calibration Exciter
Type 4294-002	Calibration Exciter for Type 8344

#### TRANSDUCERS

Type 4964	Low-frequency Microphone
Type 8344	Low-level Accelerometer

#### CABLES

AO-0440-D-015	Signal Cable, LEMO to BNC Male, 1.5 m (5')
AO-0646	Sound Cable, LEMO to Minijack, 1.5 m (5')
AO-0697-D-030	Microphone Extension Cable, 10-pin LEMO, 3 m (10')
AO-0697-D-100	Microphone Extension Cable, 10-pin LEMO, 10 m (33')
AO-0701-D-030	Accelerometer Cable, LEMO to M3, 3 m (10')
AO-0702-D-030	Accelerometer Cable, LEMO to 10 – 32 UNF, 3 m (10')
AO-0722-D-050	Accelerometer cable, LEMO to MIL-C-5015, 5 m (16')
AO-0726-D-030	Signal Cable, LEMO to SMB (for Tacho Probe MM-0360/2981), 3 m (10')
AO-0727-D-010	Signal Cable, LEMO to BNC Female, 1 m (3.3')
AO-0727-D-015	Signal Cable, LEMO to BNC Female, 1.5 m (5')

#### MISCELLANEOUS

Type 3535-A	All-weather Case (see product data BP 2251)
JP-1041	Dual 10 - pole Adapter
KE-0440	Travel Bag
UA-0587	Tripod
UA-0801	Small Tripod
UA-0588	Tripod Adaptor for ½" microphone/ preamplifier assemblies
UA-1317	Microphone Holder
UA-1404	Outdoor Microphone Kit
UA-1672	AutoDetect Insert for UA-1650
UC-0211	Low-frequency Adaptor
UL-1009	SD Memory Card for hand-held analyzers

UL-1013	CF Memory Card for hand-held analyzers, for hardware versions 1 – 3
UL-1017	SDHC Memory Card for hand-held analyzers
ZG-0444	Charger for QB-0061 Battery Pack
MM-0256-A	Weather Station Kit
MM-0316-A	Weather Station Kit
Included with MM-0256-A or MM-0316-A:	
• MM-0256-002:	Six-parameter Weather Station (and mounting kit)
• MM-0316-002:	Two-parameter Weather Station (and mounting kit)
• AO-0657:	USB Cable
• AO-0659:	Cable M12 8-pin (F) to LEMO 1-8 8-pin (M), 10 m (33.3')
• BR 1779:	Weather Station Field Guide
• DB-4364:	Weather Station Pole Adapter
• KE-4334:	Weather Station Carrying Case
• QX-0016:	Screwdriver
• QX-1171:	2.5 mm Hex Wrench
• UA-1707-A:	Weather Station Tripod Adaptor
• ZH-0689:	Weather Station USB Adaptor

### BUILDING ACOUSTICS AND REVERBERATION TIME ACCESSORIES

Type 2734-A	Power Amplifier
Type 2734-B	Power Amplifier with built-in UL-0256 Wireless Audio System
UL-0256	Wireless Audio System
Type 4292-L	OmniPower Sound Source
KE-0449	Flight Case for Type 4292-L
KE-0364	Tripod Carrying Case for Type 4292-L
Type 4295	Omnidirectional Sound Source
KE-0392	Carrying Case for Type 4295
AO-0523-D-100	Cable, from Type 2250/2270 to power amplifier, 10 m (33 ft)
AO-0524-D-100	Cable from Type 2250/2270 to Type 4224, 10 m (33 ft)
AQ-0673	Cable, from power amplifier to sound source, 10 m (33 ft)
UA-1476	Wireless Remote Control

### Service Products

#### MAINTENANCE

2250-EW1	Extended Warranty, one year extension
2270-EW1	Extended Warranty, one year extension

#### ACCREDITED CALIBRATION

2250-CAI	Accredited Initial Calibration of Type 2250
2250-CAF	Accredited Calibration of Type 2250
2250-CTF	Traceable Calibration of Type 2250
2250-TCF	Conformance Test of Type 2250, with certificate
2270-CAI	Accredited Initial Calibration of Type 2270
2270-CAF	Accredited Calibration of Type 2270
2270-CTF	Traceable Calibration of Type 2270
2270-TCF	Conformance Test of Type 2270, with certificate

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**Brüel & Kjær** 



## PRODUCT DATA

### Hand-held Analyzer Types 2250-W and 2270-W for Vibration Measurements using FFT Analysis Software BZ-7230 and Enhanced Vibration and Low Frequency Option BZ-7234

Types 2250-W and 2270-W are the easy, safe and clever approach to machinery noise and vibration assessment, diagnostics and quality control. The analyzers combine advanced analysis techniques, tap-and-drag operation and a wide dynamic range to become the perfect on-location machine vibration tool.

Acceleration, velocity, and displacement are parameters traditionally used to assess a machine's health when initially installed or after maintenance, repair or overhaul (MRO). The Crest Factor is used to detect and diagnose defects in roller element bearings.

Frequency analysis based on the fast Fourier transform (FFT) algorithm is an advanced tool for measurement and diagnostics of machinery noise and vibration. The frequency "profile" of a machine is its fingerprint, revealing its sources of noise and vibration and their paths to the measurement position.



#### Uses and Features

##### Uses

- Machinery troubleshooting
- Product development
- Quality control and inspection
- Maintenance, repair and overhaul (MRO)
- Single-channel FFT analysis of sound or vibration

##### Features

- Wide dynamic range
- PC software for analysis, reporting and archiving included
- User-defined metadata to aid documentation

##### Enhanced Vibration

- Time domain integration to velocity and displacement
- RMS and true peak in acceleration, velocity and displacement
- Peak-to-peak in displacement
- Optional 1/3-octave spectra in acceleration or velocity
- Crest factor with 1 kHz high-pass filter

##### FFT Spectra

- Up to 6400 lines of analysis
- Spans from 100 Hz to 20 kHz in a traditional 1-2-5 sequence
- Improved frequency resolution: down to 16 mHz, broadband or zoom

- Dual-overlay spectrum display
- Compare spectrum to reference spectrum
- Max. hold spectrum
- Capture transient events with signal level triggers, including pre-trigger

##### Measurements

- Transducer database
- CCLD input for accelerometers
- Relate noise or vibration to rotational speed with simultaneous tachometer
- Measurements in SI (metric) and UK/US units
- Unit scaling (RMS, Pwr, PSD, ESD, Peak, P-P)

##### Quality Control

- Tolerance windows with check against preset limits
- Quality Check template for quick and clear results
- TTL output for control of external devices

##### Signal Recording (optional)

- Record input signal, one channel for Types 2250-W and two channels with Type 2270-W, for later playback or analysis, 16- or 24-bit

### Types 2250-W and 2270-W

Hand-held Analyzer Types 2250-W and 2270-W are both innovative, 4th generation analyzers from Brüel & Kjær with an award-winning design based on extensive research amongst sound and vibration technicians, engineers and consultants from around the world.

Type 2270-W, with its dual-channel measurement capability, and the single-channel Type 2250-W, can host many of the same measurement application modules.

Two such modules are FFT Analysis Software BZ-7230 and Enhanced Vibration and Low Frequency Option BZ-7234. FFT Analysis Software is a single-channel application that can be used one channel at a time on Type 2270-W. Enhanced Vibration and Low Frequency Option BZ-7234 allows single-channel measurements on Type 2250-W and dual-channel measurements on Type 2270-W. The measurement procedures and functionality are the same regardless of the analyzer.

See Ordering Information on page 16 for all available application modules.

Fig. 1  
Optional accessory KE-0459, is a shoulder bag for storage and transport



Once you have taken your measurements, you need to do something with them. Your hand-held analyzer offers three storage options: internal disk, secure device (SD) memory cards or USB stick. From there, the included USB or LAN cable makes data transfer to an archive on your PC, or network location, easy. Alternatively, if you have used a memory card, just insert it into the computer's card reader.

### Enhanced Vibration and Low Frequency Option BZ-7234

Fig. 2  
Enhanced vibration allows velocity and displacement measurement



Vibration is often measured in units of velocity (in/s or mm/s) or displacement (Mil and mm). This is especially common in the maintenance, repair and overhaul (MRO) of valuable machines such as gas turbines and compressors.

Enhanced Vibration and Low Frequency Option BZ-7234 transforms the acceleration, measured by an accelerometer, to velocity and displacement. BZ-7234 uses time domain filters so that the actual peak values can be measured in acceleration, velocity and displacement and peak-to-peak values in displacement. Peak, peak-to-peak and RMS values are used to assess a machine's health, for example the ISO 10816 series of standards. It is also common to measure velocity and displacement in a limited frequency range. Enhanced Vibration and Low Frequency Option BZ-7234 also includes band-limiting filters, also in the time domain.

### FFT Analysis Software BZ-7230

The fast Fourier transformation (FFT) is a digital signal processing technique that converts a time record into a narrow-band constant bandwidth filtered spectrum. The measurement is defined by specifying a frequency span and a number of lines (or filters). A zoom facility allows you to focus on any part of the frequency range by specifying the centre frequency for the analysis span. FFT Analysis Software BZ-7230 allows resolutions down to 1/64 Hz, when you use a 100 Hz frequency span and 6400 lines of analysis.

**Fig. 3**  
Spectrum view showing high dynamic range and high frequency resolution

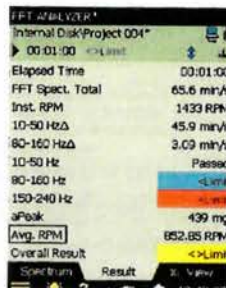


FFT spectrum analysis (Fig. 3) is ideal for noise or vibration source identification with 6400 lines of real-time frequency analysis at better than 5 Hz resolution – all the way to 20 kHz. Tapping the screen turns on the Frequency Correction algorithm\*, which computes peak frequencies with ten times better resolution. The wide dynamic range (over 150 dB) allows accurate sound and vibration measurement on the first attempt.

FFT analysis is all about the details and the beauty of Hand-held Analyzer Types 2250-W and 2270-W is their details: secure in your hand, solid in construction and pleasantly intuitive. Each analyzer's high-resolution touch-screen colour display brings enhanced usability and enables easy cursor and display parameter transition. Set-up is also easy. Connect and position your transducer, press Start/Pause and view your spectrum. If you want to zoom in, drag the stylus across the desired frequency span, tap Zoom and you can now measure using the correct range – Easy, Safe, Clever.

In addition to the standard FFT Analyzer template, the FFT Analysis Software comes with two supplementary templates:

**Fig. 4**  
FFT Analyzer Advanced provides two additional tabs with detailed test result information



**FFT Analyzer Advanced Template**  
In this template, the Results tab offers a view with 11 selectable results, which can be configured by tapping on any parameter label.

The XL View tab provides a bar graph and three selectable results. The bar graph shows the FFT spectrum total, a user-selectable delta sum or a single-value parameter. The bar graph also incorporates a quick view of the maximum value (white line) and upper limit (red line) into its display.

**Fig. 5**  
The FFT Quality Check template provides specific customizable information for well-established tasks



**FFT Quality Check Template**

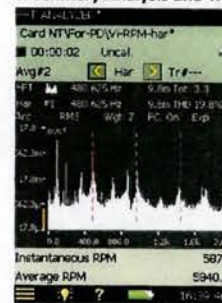
The FFT Quality Check template provides a bar graph and four selectable results in an easily readable large font. The bar graph shows the FFT spectrum total, a user-selectable delta sum or a single-value parameter. The bar graph also incorporates a quick view of the maximum value (white line) and upper limit (red line) into its display.

This template is particularly useful when tolerance windows are well established and FFT spectra are not needed for viewing, which is often the case with quality inspection tasks.

## Applications

**Fig. 6**  
View showing an RPM readout, with harmonic cursors and vibration measurement units

### Machinery Analysis and Troubleshooting



The portability of the analyzer gives you easy access to any product, lets you recall a baseline reference spectrum, and then compare it instantly with a spectrum you have just measured.

You can set the tolerance window feature over a range of frequencies to warn of machinery failure. Harmonic and delta cursors help you identify rotational and mesh frequencies, steering you efficiently toward operational deficiencies.

The analyzer's trigger input can even accept a tachometer input – providing a direct readout of RPM (see Fig. 6) with a gear ratio you define. The unique commentary feature of the analyzer lets you verbally record your field observations and attach them directly to the measurement result. The analyzer's multi-user facility allows you to define user-specific configurations and measurement points, so you can organize your field measurements, and the included Measurement Partner Suite program makes it easy to review the results on your PC.

**Fig. 7**  
Ruggedized Accelerometer Type 8341 for machine analysis and troubleshooting

### Troubleshooting



FFT Analysis Software BZ-7230 includes the analysis tools and measurement units for a wide range of troubleshooting applications. For example:

- Measuring an engine mount's movement at idle RPM as displacement. Simply attach an accelerometer and set up the tachometer trigger input and the running speed will be displayed
- Spot-checking the output of a random vibration shaker is also easy. Use the stylus to set the delta cursor for the desired frequency span and read out the Power Spectral Density (PSD), then select  $g^2/Hz$  or  $(m/s^2)^2/Hz$  as your reference units
- You can also easily find a component's resonant frequencies. Switch the analyzer's FFT from continuous to transient signals and tap the component to excite its resonances. The internal trigger starts the measurement, and the FFT software will use a rectangular time window to capture the entire transient. Save the resonance spectrum as a reference then measure a machine's vibration spectrum to see if any resonance lines up with the operational frequencies

### Quality Testing and Inspection – Tolerance Windows

Rotating or reciprocating elements (such as pistons, shafts and gears) in many machines, tools and vehicles lead to vibrations and noise. Measurements and analyses of that noise and vibration can be used to detect assembly faults and ensure compliance with required standards.

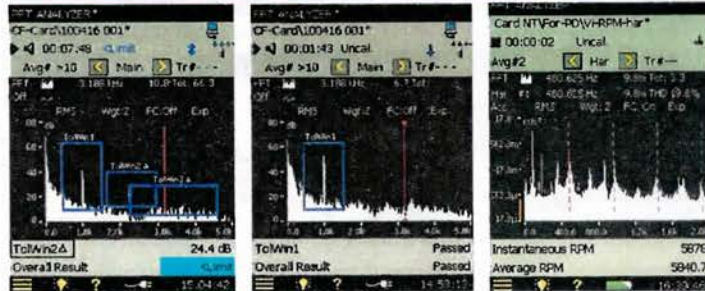
The tolerance windows feature in BZ-7230 makes quality control measurements easy.

The designers of the machine, tool or vehicle specify limits for permissible deviations. These specifications can be set up on Types 2250-W and 2270-W using one or several tolerance windows, each of which defines an upper and lower limit for the levels over a specific frequency range.

The value checked can be set to the level of the FFT lines or to the sum of FFT lines (delta sum).

\* Brüel & Kjær Technical Review No. 4 1987, "Use of Weighting Functions in DFT/FFT Analysis" (Part II), Appendix F

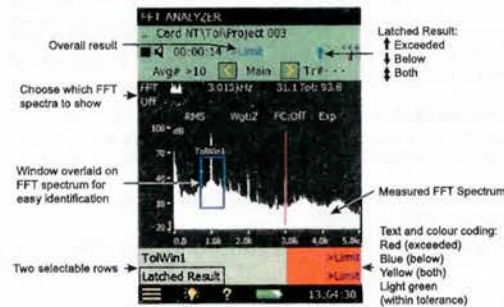
**Fig. 8**  
**Left:**  
 Drawing the tolerance window by dragging the stylus  
**Centre:**  
 Resulting tolerance window (set to check FFT lines)  
**Right:**  
 Additional tolerance windows (set to delta sum) – up to 10 windows can be active and may overlap



Settings and preferences for a particular application can be saved collectively in templates. By recalling a template, Type 2250-W/2270-W is ready for specific measurements in just seconds, including the specification of tolerances. Up to 10 tolerance windows per template can be active at the same time, making it possible to test different tolerances for different frequency ranges in one measurement. In addition, it is possible to test for two limit ranges over the same frequency range, which is as easy as overlapping tolerance windows. In addition you can define tolerances for four non-FFT values; for example, two instantaneous parameters ( $L_{AF}$  and Instantaneous RPM) and two average parameters ( $L_{Aeq}$  and Average RPM).

During measurement, the FFT spectrum and single values are compared to set limits (indicating 'above upper limit', 'within limits', 'below lower limit', 'above and below limits'). The test is performed and indicated for each window. An overall result is also indicated. It will indicate 'failed' if the spectrum or single parameters crossed the upper or lower tolerances for any window or 'passed' if within the tolerances for all windows.

**Fig. 9**  
 BZ-7230 provides comprehensive indication of the test result



The pass/fail indication is also available as an electrical signal at the analyzer's output socket. A 3.3 V DC output indicates an exceeded upper limit, a -3.3 V DC indicates levels below the lower limit, and an alternating  $\pm 3.3$  V indicates violation of both limits. This feature makes it easy to utilize Types 2250-W and 2270-W in production control systems where the output signal can trigger warnings or start specific actions for the failed item. Being able to listen to the signal makes

it easier to identify the problem source. You can therefore configure the analyzer to start recording automatically when data exceed tolerances (license for Signal Recording Option BZ-7226 is required). The input signal, which will be attached to the specific project, can be played back or exported to a PC for further analysis. For more information on BZ-7226, see page 6.

**Quality Testing and Inspection – Programmable Automation**

**2250 REST:** Using REST interface for the Type 2250/2270 platform, you can connect to an analyzer, set up and control it, and read out single values from the current measurement (but not complete projects). This interface uses HTTP and only requires the IP address of the instrument. This interface can be used from any platform (Windows®, Mac®, iOS, Android®, Linux, etc.).

**Product Development**

**Fig. 10**  
 Vibration measurement using a hand-held analyzer and Laser Tacho Probe Type 2981



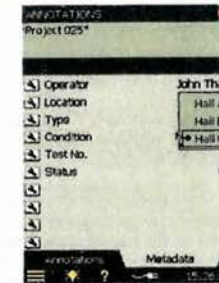
Early component performance evaluation can greatly improve product design. The FFT analyzer's dual-overlay display makes it easy to compare measurements between design iterations.

You can also benchmark competitive and previous generation products. Use narrow-band analysis to identify forcing functions and resonances to aid in setting the standards for the next generation product.

Measurement Partner Suite BZ-5503 makes it easy to transfer measurement data to a PC where data viewing, exporting and archiving complete the analysis and reporting project.

**Metadata**

**Fig. 11**  
 The Annotations page showing six user-defined metadata items and a pick-list for the Location entry



Metadata are supplementary information entries about your measurement that make archiving, retrieving and post-processing data easier and more efficient. Examples of metadata are file name, date and time, setup and annotations made by the operator.

In addition you can define the names and types of up to 30 text strings. The entry format may be editable text, a user-defined pick-list, numeric or an index number that automatically increments when a measurement is saved.

Metadata functionality can also be used for sorting measurements in Measurement Partner Suite BZ-5503.

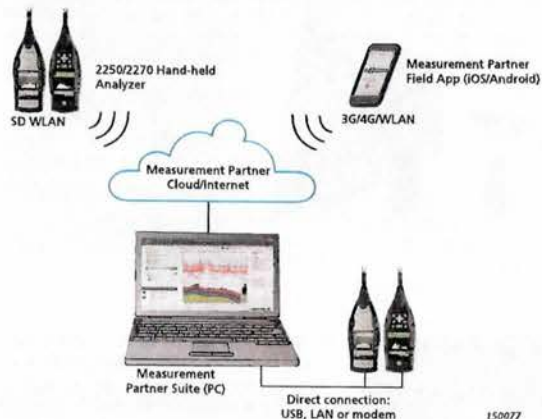
**Signal Recording Option BZ-7226**

Signal Recording Option BZ-7226 enables input signal recording for later playback or analysis. The recording can be automatic (lasting for the duration of the measurement), controlled manually, or last as long as the limit level is exceeded. Pre- and post-recording delays and duration limits can be set (FFT Analysis Software BZ-7230 only). The recording upper frequency limit can be reduced from the full 20 kHz in four steps to save memory. To optimize memory space or dynamic range, 16- or 24-bit recording resolution is available.

Signal recording files can be quite large, so you will be directed to store your measurements (and recording) on a memory card in either of the hand-held analyzer's integrated SD card slot or on an attached USB stick. Types 2250-W and 2270-W support SDHC cards, which provide memory capacity of up to 32 GB. The standard recorded .WAV files are easily input into other analysis tools, for example Brüel & Kjær's PULSE Reflex™ Core.

## Uploading Measurement Data to Measurement Partner Cloud

**Fig. 12**  
Secure access to measurement data from anywhere



Types 2250 and 2270 can send measurement data to Measurement Partner Cloud (MP Cloud) where projects are immediately available for post-processing, sharing or storage subject to account capacity. Only authorized users have access to the data when it is the MP Cloud.

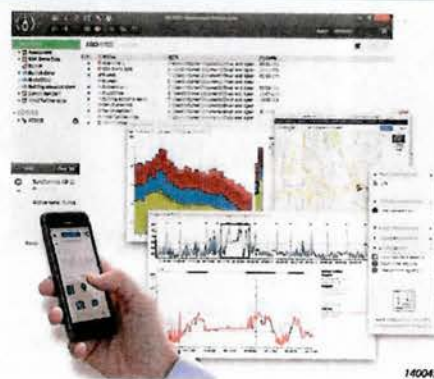
You can create a Cloud account by visiting the MP Cloud web service at [cloud.bksv.com](http://cloud.bksv.com). You open an account, register your analyzer serial numbers and perform a one-time pairing of analyzer and account, ensuring data security. You can also administer access to the account from the web service and order subscriptions to increase account capacity.

You can connect the hand-held analyzer to the Internet through modem, LAN or Wi-Fi connected to router. In the field, the analyzer can connect through Wi-Fi to hotspot on a smart device (Wi-Fi using CF-card UL-1019 for G1-G3 and Wireless USB-A Adapter UL-1050 for G4, respectively).

After measurement is completed and the project is saved, you log into the cloud, and projects are uploaded to the cloud from the analyzer. To do this, you simply need to move your data to the Cloud folder, which is automatically created when you log on to your account. The data will now be ready for post-analysis in Measurement Partner Suite by anyone who has access to the relevant Cloud archive.

## Post-processing Software

**Fig. 13**  
Measurement Partner Suite BZ-5503



Measurement Partner Suite BZ-5503, in its basic configuration, comes with your hand-held analyzer (see product data BP 2430). It is Brüel & Kjær's state-of-the-art data viewing and post-processing toolbox for environmental noise and vibration.

The free, basic configuration provides data archive, preview and export capabilities, software maintenance and online display. Archives can be stored locally, on network drives or, alternatively, in MP Cloud for easy sharing with anyone on the planet.

Measurement Partner Suite also merges Field App annotations with the corresponding instrument project.

Additional valuable data analysis and post-processing tools are available on a time-limited subscription basis. You only pay for what you need, when you need it, with no penalty should your subscription lapse.

It is also possible to annotate your measurements directly on the analyzer using notes, voice commentaries and images (Type 2270 only). These are transferred to Measurement Partner Suite along with your measurement data.

## Type 2250/2270 Platform Software Modules

Your hand-held analyzer has generous hardware and software specifications creating an extremely flexible instrument to cover your current and future measurement and analysis needs. For more information on the entire Type 2250/70 platform, see product data BP 2025.

### Standard Software Modules

The following software modules (applications) are included with every Type 2250-W/2270-W analyzer:

- **Sound Level Meter Software BZ-7222** – standard sound level meter software according to IEC 61672-1/ANSI
- **Frequency Analysis Software BZ-7223** – analyse, in real-time, the 1/1- and 1/3-octave filter bands with a dynamic range in excess of 135 dB
- **2-channel Option BZ-7229 (Type 2270 only)** – realize the full potential of your analyzer with 2-channel functionality for SLM, Frequency Analysis, Logging, Enhanced Logging, and Building Acoustics software
- **Tone Assessment Option BZ-7231** – when used in conjunction with the FFT Analysis application, this software provides an objective in-field assessment of tonal noise components
- **Noise Monitoring Software BZ-7232** – for use with Sentinel and Sentinel on Demand

### Optional Software Modules

The Type 2250/70 analyzer platform allows you to choose different combinations of software modules. Modules can be purchased when needed and are delivered as easily installed licenses. In this way your investment in the analyzer platform is securely protected: when your need for measurements and analyses expands, the analyzer can accommodate them. Brüel & Kjær is committed to maintaining an ever-growing range of Type 2250/70 applications.

For information on the optional software modules, see product data BP 2025.

### Configuration Functionality

The table below gives the functionality of Types 2250-W and 2270-W with software included as standard and with FFT Analysis BZ-7230 and Enhanced Vibration and Low Frequency Option BZ-7234.

	Type 2250-W or Type 2270-W		
	Basic Analyzer	BZ-7234	BZ-7230
Measurements in SI (metric) or UK/US units	*	*	*
FFT unit scaling (RMS, Pwr, PSD, ESD, Peak, P-P)	*	*	*
FFT span from 100 Hz to 20 kHz	*	*	*
Up to 6400 FFT lines	*	*	*
FFT zoom analysis	*	*	*
Tolerance windows with check against preset limits	*	*	*
Integration to velocity and displacement, frequency domain	*	*	*
Integration to velocity and displacement, time domain	*	*	*
Band-limited velocity and displacement	*	*	*
True peak-to-peak displacement	*	*	*
Crest factor including optional 1 kHz high-pass filter	*	*	*
RPM measurement from external tachometer probe	*	*	*
Tacho pulse embedded in recording*	*	*	*
Peak particle velocity (PPV)	*	*	*
Human vibration filters: Wb, Wc, Wd, We, Wj, Wk, Wl, Wm, Wn, Wxb and KBF	*	*	*
1/3-octave velocity for vibration criteria	*	*	*

\* Requires BZ-7226 Recording and PULSE Reflex Type 870x post-analysis software

### Accredited Calibration and Hardware Maintenance at Brüel & Kjær

For Types 2250 and 2270, you can order accredited calibration and choose between DANAK, AZLA, UKAS, Eichamt (Austria), RvA, ENAC, NATA and Inmetro. We recommend you order accredited calibration together with a new instrument. Should the technician detect the need for adjustment during calibration, this can be performed while it is in our hands so you do not have to be without your analyzer. You can minimize the risk of unexpected costs by purchasing a hardware maintenance contract with a five-year warranty.

### General Specifications – Types 2250-W and 2270-W

These specifications refer to Types 2270 and 2250 unless otherwise stated

#### Hardware Interface

##### PUSHBUTTONS

11 buttons with backlight, optimized for measurement control and screen navigation

##### ON-OFF BUTTON

Function: Press 1 s to turn on; press 1 s to enter standby; press for more than 5 s to switch off

##### STATUS INDICATORS

LEDs: Red, yellow and green

##### DISPLAY

Type: Transflective back-lit colour touchscreen 240 × 320 dot matrix  
Colour Schemes: Five different – optimized for different usage scenarios (day, night, etc.)  
Backlight: Adjustable level and time

##### USER INTERFACE

Measurement Control: Using pushbuttons

Set-up and Display of Results: Using stylus on touchscreen or pushbuttons

Lock: Pushbuttons and touchscreen can be locked and unlocked

##### USB INTERFACE

USB 2.0 OTG Micro AB and USB 2.0 Standard A sockets for Wireless USB-A Adapter UL-1050, printer or weather station

##### MODEM INTERFACE

Connection to Internet through GPRS/EDGE/HSPA modem connected through the USB Standard A Socket.  
Supports DynDNS for automatic update of IP address of host name

##### PRINTER INTERFACE

PCL printers, Mobile Pro Spectrum thermal printer or Seiko DPU S245/S445 thermal printers can be connected to USB socket

##### MICROPHONE FOR COMMENTARY

Microphone, which utilizes automatic gain control (AGC), is incorporated in underside of analyzer. Used to create voice annotations for attaching to measurements

##### CAMERA (TYPE 2270 ONLY)

Camera with fixed focus and automatic exposure is incorporated in underside of analyzer.

Used to create image annotations for attaching to measurements

Image Size: 2048 × 1536 pixels

Viewfinder Size: 212 × 160 pixels

Format: jpg with exif information

##### SECURE DIGITAL SOCKET

2 × SD sockets  
Connect SD and SDHC memory cards

##### LAN INTERFACE SOCKET

- Connector: RJ45 Auto-MDIX
- Speed: 100 Mbps
- Protocol: TCP/IP

##### INPUT SOCKET

One socket with Type 2250; two with Type 2270

Connector: Triaxial LEMO. Used for Direct input as well as input with constant current line drive (CCLD) power supply  
Input Impedance:  $\geq 1 \text{ M}\Omega$

Direct Input: Max. input voltage:  $\pm 14.14 V_{\text{peak}}$ ,  $10 V_{\text{RMS}}$  for sinusoidal input signals, no damage for signals up to  $\pm 20 V_{\text{peak}}$ . Source impedance  $\leq 1 \text{ k}\Omega$

CCLD Input: Max. input voltage:  $\pm 7.07 V_{\text{peak}}$  (no indication for violation of this level), no damage for signals in the range  $-10$  to  $+25 V_{\text{peak}}$

CCLD Current/Voltage: 4 mA/25 V

CCLD Cable Break/Short Indication: Checked before and after measurements

##### TRIGGER SOCKET

Connector: Triaxial LEMO

Max. Input Voltage:  $\pm 20 V_{\text{peak}}$ , no damage for signals up to  $+50 V_{\text{peak}}$   
Input Impedance:  $> 47 \text{ k}\Omega$

CCLD Current/Voltage: 4 mA/25 V

##### OUTPUT SOCKET

Connector: Triaxial LEMO

Max. Peak Output Level:  $\pm 4.46 \text{ V}$

Output Impedance: 50  $\Omega$

##### HEADPHONE SOCKET

Connector: 3.5 mm Minijack stereo socket

Max. Peak Output Level:  $\pm 1.4 \text{ V}$

Output Impedance: 32  $\Omega$  in each channel, short-circuit proof without affecting the measurement results

Sources: Input conditioned (gain adjustment  $-60$  to  $+60 \text{ dB}$ ), playback of voice annotations and signal recordings (gain adjustment  $-60$  to  $0 \text{ dB}$ ) and playback of recordings (gain adjustment  $-60$  to  $+60 \text{ dB}$ ); however, max. gain is 0 dB for 16-bit wave files

##### Storage

##### INTERNAL FLASH-RAM (NON-VOLATILE)

512 MB for user set-ups and measurement data

##### EXTERNAL MEMORY CARD

SD and SDHC Card: For store/recall of measurement data

##### USB MEMORY STICK

For store/recall of measurement data

##### Power

##### EXTERNAL DC POWER SUPPLY REQUIREMENTS

Used to charge the battery pack in the analyzer

Voltage: 8 – 24 V DC, ripple voltage  $< 20 \text{ mV}$

Current Requirement: min. 1.5 A

Power Consumption:  $< 2.5 \text{ W}$ , without battery charging,  $< 10 \text{ W}$  when charging

Cable Connector: LEMO Type FFA.00, positive at centre pin

##### EXTERNAL AC MAIN SUPPLY ADAPTOR

Part No.: ZG-0426

Supply Voltage: 100 – 120/200 – 240 V AC; 47 – 63 Hz

Connector: 2-pin IEC 320

##### BATTERY PACK

Rechargeable Li-ion battery

Part No.: QB-0061

Voltage: 3.7 V

Capacity: 5200 mAh nominal

Typical Operating Time:

Single-channel:  $> 11 \text{ h}$  (screen backlight dimmed);  $> 10 \text{ h}$  (full screen backlight)

Dual-channel:  $> 7.5 \text{ h}$  (full screen backlight)

Battery Cycle Life:  $> 500$  complete charge/discharge cycles

Battery Aging: Approximately 20% loss in capacity per year

Battery Indicator: Remaining battery capacity and expected working time may be read out in % and in time

Battery Fuel Gauge: The battery is equipped with a built-in fuel gauge, which continuously measures and stores the actual battery capacity in the battery unit

Charge Time: In analyzer, typically 10 hours from empty at ambient temperatures below 30 °C (86 °F). To protect the battery, charging will be terminated completely at ambient temperatures above 40 °C (104 °F). At 30 to 40 °C, charging time will be prolonged. With External Charger ZG-0444 (optional accessory), typically 5 hours

Note: It is not recommended to charge the battery at temperatures below 0 °C (32 °F) or over 50 °C (122 °F). Doing this will reduce battery lifetime

##### CLOCK

Back-up battery powered clock. Drift  $< 0.45 \text{ s}$  per 24-hour period

##### Environmental

##### WARM-UP TIME

From Power Off:  $< 2 \text{ min}$

From Standby:  $< 10 \text{ s}$  for pre-polarized microphones

##### WEIGHT AND DIMENSIONS

650 g (23 oz) including rechargeable battery

300 × 93 × 50 mm (11.8 × 3.7 × 1.9") including preamplifier and microphone

##### Wireless Connection to Mobile Device

Specifications apply to Wireless USB-A Adapter UL-1050

Operating Frequency: 2.4 GHz

Data Rate:

• IEEE 802.11n: up to 150 Mbps

• IEEE 802.11g: up to 54 Mbps

• IEEE 802.11b: up to 11 Mbps

Encryption/Authentication:

• 64/128-bit WEP

• WPA-PSK

• WPA2-PSK

Range: The range is similar to a standard WLAN unit, typically from 10 to 50 m (33 to 164'), depending on the environment and the number of other WLAN transmitters in the area (smartphones, Wi-Fi, etc.)

Power Requirements: Power Consumption:  $< 1 \text{ W}$

##### Software Interface

##### USERS

Multi-user concept with login. Users can have their own settings with jobs and projects totally independent of other users

##### PREFERENCES

Date, time and number formats can be specified per user

##### LANGUAGE

User interface in Catalan, Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

##### HELP

Concise context-sensitive help in Chinese (People's Republic of China), English, French, German, Italian, Japanese, Polish, Romanian, Serbian, Slovenian, Spanish and Ukrainian

##### UPDATE OF SOFTWARE

Update to any version using BZ-5503 through USB or update via Internet

## REMOTE ACCESS

Connect to the analyzer using:

- Measurement Partner Suite BZ-5503
  - Measurement Partner Field App (iOS or Android smartphone app)
  - the 2250/2270 SDK (software development kit)
  - a REST interface through HTTP
  - an Internet browser supporting JavaScript
- The connection is password protected with two levels of protection:
- Guest level: for viewing only
  - Administrator level: for viewing and full control of the analyzer

## CLOUD

Connect to Measurement Partner Cloud on [cloud.bksv.com](http://cloud.bksv.com) for transferring data to an archive in the cloud for storage or easy synchronization with Measurement Partner Suite BZ-5503

## Input

### DUAL CHANNELS (Type 2270 only)

All measurements are made from either Ch. 1 or Ch. 2. Two independent measurement channels are available on Type 2270 to enable you to measure various parameters, subject to having a dual-channel application license

### TRANSDUCER DATABASE

Transducers are described in a transducer database with information on Serial Number, Pre-amplifier ID, Nominal Sensitivity, CCLD Required and Weight. The analogue hardware is set up automatically in accordance with the selected transducer

## Calibration

Initial calibration is stored for comparison with later calibrations. For accelerometer Types 4397-A, 8341, 4533-B, 4533-B-001, 4533-B-002, 4534-B, 4534-B-001, 4534-B-002, 8344, 8347-C, and 8324, the lower frequency limit will be optimized to match the specifications for the accelerometer.

Initial calibrations for each transducer are stored for comparison with later calibrations

### ELECTRICAL

Uses internally generated electrical signal combined with a typed-in value of microphone sensitivity

### MECHANICAL

Using Calibrator Exciter Type 4294 or custom calibrator

### DIRECT ELECTRICAL

Using an external voltage reference

### CALIBRATION HISTORY

Up to 20 of the last calibrations made are listed and can be viewed on the analyzer

## Data Management

### METADATA

Up to 30 metadata annotations can be set per project (text from keyboard or text from pick list, number from keyboard or auto-generated number)

### PROJECT TEMPLATE

Defines the display and measurement set-ups. Set-ups can be locked and password-protected

### PROJECT

Measurement data stored with the project template

### JOB

Projects are organized in Jobs. Explorer facilities for easy management of data (copy, cut, paste, delete, rename, open project, create job, set default project name)

## Measurement Control

### MANUAL CONTROLS

Reset, Start, Pause, Back-erase, Continue and Store the measurement manually

### AUTO-START

A total of 10 timers allow set up of measurement start times up to a month in advance. Each timer can be repeated. Measurements are automatically stored when completed

### BACK-ERASE

The last 5 s of data can be erased without resetting the measurement

## Measurement Status

### ON SCREEN

Information such as overload and running/paused are displayed on screen as icons

### TRAFFIC LIGHTS

Red, yellow and green LEDs show measurement status and instantaneous overload as follows:

- Yellow LED flashing every 5 s = stopped, ready to measure
- Green LED flashing slowly = awaiting calibration signal
- Green LED on constantly = measuring
- Yellow LED flashing slowly = paused, measurement not stored
- Red LED flashing quickly = intermittent overload, calibration failed

### NOTIFICATIONS

Sends an SMS or email daily at a specified time or if an alarm condition is fulfilled

### Alarm Conditions:

- Disk Space below set value
- Trig. Input Voltage below set value
- Internal Battery enters set state
- Change in Measurement State
- Reboot of analyzer

## Annotations

### VOICE ANNOTATIONS

Voice annotations can be attached to measurements so that verbal comments can be stored together with the measurement

**Playback:** Playback of voice annotations can be listened to using an earphone/headphones connected to the headphone socket

**Gain Adjustment:** -60 dB to +60 dB

### TEXT ANNOTATIONS

Text annotations can be attached to measurements so that written comments can be stored with the measurement

### GPS ANNOTATIONS

A text annotation with GPS information can be attached (Latitude, Longitude, Altitude and position error). Requires connection to a GPS receiver

### IMAGE ANNOTATIONS (TYPE 2270 ONLY)

Image annotations can be attached to measurements. Images can be viewed on the screen

## Measurements

### DUAL-CHANNEL MEASUREMENTS (TYPE 2270 ONLY)

Two independent measurement channels are available on Type 2270 to enable you to measure various parameters, subject to having a dual-channel application license

### REFERENCE ENVIRONMENTAL CONDITIONS

Air Temperature: 23 °C  
Static Pressure: 101.325 kPa  
Relative Humidity: 50%

## Broadband Analysis

### DETECTORS

Parallel detectors on every measurement:

- **Detector 1:** Broadband detector with two exponential time weightings (Fast, Slow)
- **Detector 2:** Broadband detector (1 k – 20 kHz) with two exponential time weightings (Fast, Slow)
- **One peak detector**
- **Overload Detector:** Monitors the overload outputs of all the frequency weighted channels

### MEASUREMENTS

#### For Display and Storage:

Start Time	Stop Time	Overload %
Elapsed Time	Time Remaining	
aLinear	aLin(1k–20kHz)	
aFast max	aF max(1k–20kHz)	
aSlow max	aS max(1k–20kHz)	
aFast min	aF min(1k–20kHz)	
aPeak	aT <sub>Peak</sub>	
Crest Factor	Avg. RPM	
Linear (f1 – f2)*		

\* where f1 and f2 are frequency bands in the spectrum

#### Spectra:

Linear	Fast max.	Slow max.
Fast min.	Slow min.	

#### Only for Display as Numbers or Quasi-analog Bars:

aFast Inst	aF Inst(1k–20kHz)
aSlow Inst	aS Inst(1k–20kHz)
Inst RPM	Trig. Input Voltage

## Software Specifications – FFT Analysis Software BZ-7230

Specifications for FFT analysis are given for the analyzer with software BZ-7230 installed and fitted with one of the recommended transducers (see table below)

### FFT ANALYSIS

**Sampling Frequency:** Downsampling from 51.2 kHz  
**Frequency Span:** 100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz  
**Lines:** 100, 200, 400, 800, 1600, 3200, 6400\*  
**Zoom Centre Frequency:** Can be set so that the Frequency Span is placed in the range 0 to 20 kHz  
**Spectrum:** Averaged and Maximum  
**Pre-weighting:** Z (none), A, B or C (microphone input only)

### Measuring

Measurements can be manually started and stopped using a pushbutton or an external signal

### EXPONENTIAL AVERAGING

With an averaging time of up to 999 spectra, measured with Hanning window and 67% overlap

### LINEAR AVERAGING

Up to 8388 607 spectra measured with Hanning window and 67% overlap  
Triggered Start

\* The actual number of lines is one more than stated, to provide symmetry around the centre frequency.

BZ-7230 has only one measuring range but the spurious level depends on the peak level of the signal. Therefore, two specifications are given.

### Instantaneous GPS Data:

Latitude Longitude

### RPM MEASUREMENT

RPM is measured on the signal connected to Trigger input when Tacho is set to On

**Range:** 1 to 6 000 000 RPM

**Gear Ratio:** 10<sup>-5</sup> to 10<sup>38</sup>. The displayed RPM is the measured RPM divided by the RPM gear ratio

### MEASUREMENT DISPLAYS

**SLM:** Measurement data displayed as numbers of various sizes and one quasi-analog bar

Measured sound data are displayed as dB values, vibration data as dB values or in physical units (SI units (m/s<sup>2</sup>) or US/UK units (g)), direct data as voltage in dB or V, housekeeping data as numbers in relevant format.

Instantaneous measurement L<sub>xx</sub> or Fast Inst is displayed as a quasi-analog bar

## Frequency Analysis

### STANDARDS

- IEC 61260-1 (2014), 1/1-octave Bands and 1/3-octave Bands, Class 1
- IEC 61260 (1995-07) plus Amendment 1 (2001-09), 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI S1.11-1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0-C
- ANSI S1.11-2004, 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI/ASA S1.11-2014 Part 1, 1/1-octave Bands and 1/3-octave Bands, Class 1

### CENTRE FREQUENCIES

**1/1-oct. Band Centre Frequencies:** 8 Hz to 16 kHz

**1/3-oct. Band Centre Frequencies:** 6.3 Hz to 20 kHz

### TRANSIENT SIGNAL TYPE

Linear averaging of up to 32767 triggered spectra measured with rectangular window and 0% overlap

### CONTINUOUS SIGNAL TYPE

Linear averaging of up to 32767 spectra measured with Hanning window and 67% overlap. Up to 32767 spectra are averaged on each trigger

### TRIGGERS

**Delay:** From 16383 samples before the trigger time to 300 seconds after

**Hold Off:** 0 to 300 s

**Internal Trigger:** Uses the time signal from the measurement transducer. The Internal Level is set in the relevant measurement units

**External Trigger:** Uses the Trigger Input. The External Level is set in the range -20 to 20 V

**Offset at Trigger Input:** Typically between -70 mV and 200 mV

**Hysteresis (only for External Trigger):** 0 to 10 V

**Slope (only for External Trigger):** Rising, Falling

### MEASUREMENT RANGE

(See table below)

The lower limit of the measurement range is influenced by self-generated random noise and self-generated tones called spurious signals. The influence of the random part can be reduced to a level below the spurious signals by selecting a small analysis bandwidth (small span and many lines). Therefore, the lower limit is specified as the maximum Peak level of the spurious signal lines

One for high levels, where the upper limit is the overload limit, and one for low levels

Measurement ranges with the recommended transducers

Transducer	Nominal Sensitivity	Spurious Free Dynamic Range for High Levels	Spurious Free Dynamic Range for Low Levels	Typical Frequency Response Low Frequency: Extended/Normal
4397-A	1 mV/(m/s <sup>2</sup> )	3 mm/s <sup>2</sup> – 5 km/s <sup>2</sup> <sub>Peak</sub>	300 μm/s <sup>2</sup> – 75 m/s <sup>2</sup> <sub>Peak</sub>	1.25/6.3 Hz – 20 kHz
4533-B 4534-B	1 mV/(m/s <sup>2</sup> )	3 mm/s <sup>2</sup> – 5 km/s <sup>2</sup> <sub>Peak</sub>	300 μm/s <sup>2</sup> – 75 m/s <sup>2</sup> <sub>Peak</sub>	0.2/6.3 Hz – 12.8 kHz
4533-B-001 4534-B-001	10 mV/(m/s <sup>2</sup> )	300 μm/s <sup>2</sup> – 500 m/s <sup>2</sup> <sub>Peak</sub>	30 μm/s <sup>2</sup> – 7.5 m/s <sup>2</sup> <sub>Peak</sub>	0.2/6.3 Hz – 12.8 kHz
4533-B-002 4534-B-002	50 mV/(m/s <sup>2</sup> )	60 μm/s <sup>2</sup> – 100 m/s <sup>2</sup> <sub>Peak</sub>	6 μm/s <sup>2</sup> – 1.5 m/s <sup>2</sup> <sub>Peak</sub>	0.2/6.3 Hz – 12.8 kHz
8341	10 mV/(m/s <sup>2</sup> )	300 μm/s <sup>2</sup> – 500 m/s <sup>2</sup> <sub>Peak</sub>	30 μm/s <sup>2</sup> – 7.5 m/s <sup>2</sup> <sub>Peak</sub>	0.7/6.3 Hz – 10 kHz
8344	250 mV/(m/s <sup>2</sup> )	12 μm/s <sup>2</sup> – 20 m/s <sup>2</sup> <sub>Peak</sub>	1.2 μm/s <sup>2</sup> – 300 mm/s <sup>2</sup> <sub>Peak</sub>	0.2/6.3 Hz – 3 kHz
8347-C + 2647-D	1 mV/(m/s <sup>2</sup> )	3 mm/s <sup>2</sup> – 7 km/s <sup>2</sup> <sub>Peak</sub>	300 μm/s <sup>2</sup> – 75 m/s <sup>2</sup> <sub>Peak</sub>	1.25/6.3 Hz – 12.8 kHz

The Typical Frequency Response shows the ±1 dB limits for Direct Input and microphones, and the ±10% limits for accelerometers

**RPM MEASUREMENT**

RPM is measured on the signal connected to Trigger input when Tacho is set to On

**Range:** 1 to 6000000 RPM

**Instantaneous RPM:** Instantaneous RPM is only displayed (and not stored)

**Average RPM:** Displayed and stored together with each Spectrum result. In Linear Averaging it is an average over the same time as the spectrum. In Exponential averaging it is the last measured RPM

**Gear Ratio:** 10<sup>-5</sup> to 10<sup>35</sup>. The displayed RPM are the measured RPM divided by the RPM Gear Ratio

**OVERLOAD**

**Instantaneous Overload:** Instantaneous overload is displayed as an icon on the display and is also indicated by the traffic light

**Spectrum Overload:** Displayed and stored together with each spectrum result

**DISPLAY SPECTRA**

Two spectra superimposed

**Scaling:** RMS, Peak, Peak-to-Peak, Power, PSD, ESD

**Reference Spectrum:** Compare spectrum to stored (measured) reference

**Axis:** Logarithmic or linear Y-axis; Logarithmic or linear X-axis

**X-axis:** Display full frequency range or expand the X-axis until only 20 FFT lines are displayed. Scroll available

**Y-axis Display Range:** 5, 10, 20, 40, 60, 80, 100, 120, 140, 160, 180 or 200 dB. Auto-zoom or Auto-scale available

**Digital Post-weighting:** Z (none) or A-weighting\*

**DISPLAY PARAMETERS**

**Sound:** Sound pressure level in dB

**Vibration:** Acceleration, velocity or displacement in dB or physical units. SI units (m/s<sup>2</sup>, m/s or m) or US/UK units (g, m/s or Mil)

**Direct:** Voltage in dB or V

**CURSORS**

**Readings:** Total level within the spectrum

**Frequency Correction:** For spectra measured with a Hanning window, spectral peaks are interpolated to a higher precision

**Main:** Reads level versus frequency

**Symmetrical Delta and Delta:** Defines lower and upper frequency limit for any part of the spectrum and calculates the level sum within that frequency range

**Harmonic:** Identifies fundamental frequency and harmonics in the spectrum and calculates the Total Harmonic Distortion<sup>†</sup> (THD)

**Reference:** Reads the difference between the main cursor Y-value and the reference cursor Y-value

**TOLERANCE CHECK**

**Tolerance Window:** Determines the upper and lower levels and the top and bottom frequency at which the spectrum is checked. The check can either be made on all the FFT Lines within the specified range or on the Delta Sum of the lines.

The following parameters are measured for check on Delta Sum with exponential averaging:

- Delta Sum
- Max Delta Sum
- RPM at time for Max Delta Sum
- LAF at time for Max Delta Sum
- FFT Spectrum at time for Max Delta Sum

Up to 10 tolerance windows can be specified per template.

**Single Values Check:** Tolerances can be set for the parameters: L<sub>AF</sub>, Instantaneous RPM, L<sub>Aeq</sub> and Average RPM

**Indication:** Results for each tolerance window and for the four single values can be displayed. An Overall Result (combination of all results) and a Latched Result (latched during measurement) can be displayed and are indicated in the status panel.

When tolerance limits are violated, a recording can be started (license for BZ-7226 required) and a 3.3 V DC signal (above upper limit), a -3.3 V DC (below lower limit) or a signal alternating between 3.3 V and -3.3 V (both above and below limits) can be output to the Output Socket

**BAR GRAPH**

LAF, LZf, Total of Spectrum and Delta Sum can be displayed on a bar graph with Indication of Max Delta Sum and Upper and Lower Limits.

For engineering units, the axis on bar graph can be logarithmic or linear and can be zoomed

**Broadband Parameters**

Broadband parameters are measured simultaneously with the FFT parameters, however, their measurement starts when the Start/Pause pushbutton is pressed and it ends at the nearest whole second after the end of the FFT measurement.

When Type 2250/2270 is fitted with an accelerometer, the following broadband parameters can be displayed in engineering units:

- L<sub>Xeq</sub>
- L<sub>Yeq</sub>
- L<sub>XFmax</sub>
- L<sub>YFmax</sub>
- L<sub>XFmin</sub>
- L<sub>YFmin</sub>

<sup>†</sup> Total Harmonic Distortion (THD) is the sum (in %) of all the harmonics relative to the sum of the fundamental and all the harmonics.

\* Microphone input only.

- LVpeak
- LXF
- LYF

Software Specifications – Enhanced Vibration and Low Frequency Option BZ-7234

Enhanced Vibration and Low Frequency Option BZ-7234 is enabled with a separate license. It adds human vibration parameters, and integration and double integration of the acceleration signal for vibration and displacement parameters to Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software and adds low frequency 1/1- and 1/3-octave analysis to Frequency Analysis, Logging and Enhanced Logging Software

**General Vibration**

Specifications for general vibration parameters apply to Type 2250/2270 fitted with an accelerometer

**Analysis**

Conforms with the following International standards:

- ISO 2954
- ISO 10816 series

**Analysis**

**DETECTORS**

Addition to the Acc Linear and Acc 1k – 20 kHz settings for the two broadband detectors:

Vel 3 – 20 000 Hz	Vel 0.3 – 1000 Hz	Vel 10 – 1000 Hz
Vel 1 – 100 Hz	Dis 10 – 1000 Hz	Dis 30 – 300 Hz
Dis 1 – 100 Hz		

The weighting for the peak detector can be set to one of the settings chosen for the broadband detectors or Acc Linear

The weighting for the spectrum detectors can be set to Acc Linear or Vel 3 – 20000 Hz, Vel 0.3 – 1000 Hz, Vel 10 – 1000 Hz or Vel 1 – 100 Hz

**Single Values for Display and Storage:** Peak-Peak for displacement

**Human Vibration**

Specifications for Human Vibration parameters apply to Type 2250/2270 fitted with an accelerometer.

W <sub>k</sub>	W <sub>m</sub>	W <sub>sb</sub>
W <sub>hb</sub>	W <sub>mb</sub>	

W<sub>mb</sub> is the band limiting part of W<sub>m</sub>. W<sub>hb</sub> is the band limiting part of W<sub>k</sub> and W<sub>sb</sub> is the band limiting part of W<sub>b</sub>. W<sub>c</sub>, W<sub>d</sub>, W<sub>e</sub>, W<sub>j</sub> and W<sub>k</sub> The weighting for the peak detector can be set to one of the settings chosen for the broadband detectors or Acc Linear.

The weighting for the spectrum detectors can be set to Acc Linear or Vel 0.3 – 1000 Hz or Vel 1 – 100 Hz

**MEASUREMENTS**

**Single Values for Display and Storage:**

MTVV	KBF <sub>max</sub>	KBF <sub>tm</sub>
Peak-Peak		

**Single Values for Display Only:**

aW <sub>1s</sub>	KBF
------------------	-----

**Standards**

Conforms with the following International Standards:

- ISO 8041:2005
- ISO 5349-1
- ISO 2631 series
- DIN 45669-1:2010-09

**Analysis**

**DETECTORS**

Two broadband detectors can each be set to one of the weightings:

Acc Linear	Vel 0.3 – 1000 Hz	Vel 1 – 100 Hz
W <sub>b</sub>	W <sub>c</sub>	W <sub>d</sub>
W <sub>e</sub>	W <sub>j</sub>	W <sub>k</sub>

**Low Frequency 1/1- and 1/3-octave Analysis**

**Frequency Analysis**

**CENTRE FREQUENCIES**

1/1-oct. Band Centre Frequencies: 1 Hz to 16 kHz  
1/3-oct. Band Centre Frequencies: 0.8 Hz to 20 kHz

**Standards**

- Conforms with the following National and International Standards:
- IEC 61260-1 (2014), 1/1-octave Bands and 1/3-octave Bands, Class 1
- IEC 61260 (1995-07) plus Amendment 1 (2001-09), 1/1-octave Bands and 1/3-octave Bands, Class 0

- ANSI S1.11-1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0-C
- ANSI S1.11-2004, 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI/ASA S1.11-2014 Part 1, 1/1-octave Bands and 1/3-octave Bands, Class 1

**Vibration Measurements**

Brüel & Kjær recommends Low-level Accelerometer Type 8344 for low-frequency vibration measurements

## Software Specifications – Signal Recording Option BZ-7226

Signal Recording Option BZ-7226 is enabled with a separate license. For data storage, signal recording requires:

- SD Card
- USB Memory Stick

### RECORDED SIGNAL

A-, B-, C- or Z-weighted sound signal from the microphone or acceleration signal from the accelerometer

### AUTOMATIC GAIN CONTROL

The average level of the signal is kept within a 40 dB range, or the gain can be fixed

### SAMPLING RATE AND PRE-RECORDING

The signal is buffered for the pre-recording of the signal. This allows the beginning of events to be recorded even if they are only detected later.

Sampling Rate (kHz)	8	16	24	48
Maximum Pre-recording (s) 16-bit	470	230	150	70
Maximum Pre-recording (s) 24-bit	310	150	96	43

Memory (KB/s) 16-bit	16	32	48	96
Memory (KB/s) 24-bit	24	48	72	144

### PLAYBACK

Playback of signal recordings can be listened to using the earphone/headphones connected to the headphone socket

### RECORDING FORMAT

The recording format is either 24- or 16-bit wave files (extension .wav) attached to the data in the project, easily played back afterwards on a PC using BZ-5503, Type 7820 or 7825. Calibration information and possible tacho trigger information are stored in the .wav file allowing BZ-5503 and PULSE to analyse the recordings

### Functions

**Manual Control of Recording:** Recording can be manually started and stopped during a measurement using a pushbutton or an external signal

**Automatic Control of Recording:** Start of recording when measurement is started. Minimum and Maximum recording time can be preset

## Specifications – Measurement Partner Suite BZ-5503

BZ-5503 is included with Types 2250 and 2270 for easy synchronization of setups and data between the PC and hand-held analyzer. BZ-5503 is supplied on ENV DVD BZ-5298

### PC REQUIREMENTS

Operating System: Windows® 7, 8.1 or 10 (all in 32-bit or 64-bit versions)

### Recommended PC:

- Intel® Core™ i3
- Microsoft® .NET 4.5
- 2 GB of memory
- Sound card
- DVD drive
- At least one available USB port
- Solid State Drive

### ONLINE DISPLAY OF TYPE 2250/2270 DATA

Measurements on the analyzer can be controlled from the PC and displayed online with the PC, using the same user interface on the PC as on the analyzer

Display: 1024 × 768 (1280 × 800 recommended)

### DATA MANAGEMENT

**Explorer:** Facilities for easy management of analyzers, users, jobs, projects and project templates (copy, cut, paste, delete, rename, create)

**Data Viewer:** View measurement data (content of projects)

**Synchronization:** Project templates and projects for a specific user can be synchronized between PC and analyzer and between local and cloud archives. Measurement Partner Suite BZ-5503 merges Measurement Partner Field App annotations with the corresponding analyzer project

### USERS

Users of Type 2250/2270 can be created or deleted

### EXPORT FACILITIES

Excel®: Projects (or user-specified parts) can be exported to Microsoft® Excel® (Excel 2003 – 2016 supported)

**Brüel & Kjær Software:** Projects can be exported\* to PULSE Reflex

### POST-PROCESSING

Measurement Partner Suite is a suite of modules, including post-processing tools for data acquired with Type 2250/2270. The following post-processing modules are available:

- Logging Module BZ-5503-A
- Spectrum Module BZ-5503-B
- WAV File Analysis Module BZ-5503-C

These modules help to assess logging data and measured spectra, such as calculating contribution from markers on a logging profile or correcting spectra for background noise

### HAND-HELD ANALYZER SOFTWARE UPGRADES AND LICENSES

The software controls analyzer software upgrades and licensing of the analyzer applications

### INTERFACE TO HAND-HELD ANALYZER

USB, LAN or Internet connection

### LICENSE MOVER

To move a license from one analyzer to another use BZ-5503 together with License Mover VP-0647

### LANGUAGE

User Interface in Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

### HELP

Concise context-sensitive help in English

\* Not all data are available in all exports. The data exported are dependent on the type and target of the export.

## Ordering Information

To measure vibration, order these analyzer and software module combinations:

### Single-Channel Measurements

**Type 2250-W Hand-held Analyzer**

with one or both of:

- BZ-7230 FFT Analysis Software
- BZ-7234 Enhanced Vibration and Low Frequency Option

### Dual-Channel Measurements

**Type 2270-W Hand-held Analyzer (two-channel)**

with one or both of:

- BZ-7230 FFT Analysis Software
- BZ-7234 Enhanced Vibration and Low Frequency Option

**Both Types 2250-W and 2270-W include the following as standard:**

- BZ-7222: Sound Level Meter Software
- BZ-7223: Frequency Analysis Software
- BZ-7231: Tone Assessment Option
- BZ-7232: Noise Monitoring Software
- BZ-7229: 2-channel Option (Type 2270-W only)

### Accessories:

- FB-0679: Hinged Cover (Type 2250 only)
- FB-0699: Hinged Cover (Type 2270 only)
- QB-0061: Battery Pack
- ZG-0426: Mains Power Supply
- Accessory Kit UA-1710-D01 including:
  - KE-0441: Protective Cover for Hand-held Analyzer
  - UL-1050: Wireless USB-A (M) Adaptor
  - UA-1651: Tripod Extension for Hand-held Analyzer
  - UA-1654: 5 Extra Styli
  - UA-1673: Adaptor for Standard Tripod Mount
  - DH-0696: Wrist Strap
  - DD-0594: Protection Plug for Hand-held Analyzer without Pre-amplifier
  - AO-1494: Cable, USB 2.0, USB-A (M) to USB-micro-B (M) black, 1.8 m (5.9 ft), max. +70 °C (158 °F)
  - BZ-5298: Software, Environmental Software DVD

These accessories are also available separately

## Software and Accessories Available Separately

### SOFTWARE MODULES

- BZ-7224 Logging Software
- BZ-7225 Enhanced Logging Software
- BZ-7225-UPG Upgrade from Logging Software BZ-7224 to Enhanced Logging Software BZ-7225 (does not include memory card)
- BZ-7226 Signal Recording Option
- BZ-7229 2-channel Option (Type 2270 only)

### PC SOFTWARE

- BZ-5503-A Measurement Partner, Logging Module
- BZ-5503-B Measurement Partner, Spectrum Module
- BZ-5503-C Measurement Partner, WAV File Analysis Module
- BZ-5503-D Measurement Partner Field App for iOS and Android (free download at App Store® and Google Play™)
- BZ-5503-E Measurement Partner Cloud Entry Level, free cloud storage
- BZ-5503-F-012 Measurement Partner Cloud Basic, basic cloud storage subscription for one year
- BZ-5503-G-012 Measurement Partner Cloud Professional, enterprise cloud storage subscription for one year
- Type 7825 Protector™ – calculation software of personal noise exposure

### MEASUREMENT ACCESSORIES

- Type 4397-A Accelerometer, with 1 mV/ms<sup>-2</sup> sensitivity, suitable for high-frequency and high-level measurement, with M3 connection
- Type 4533-B Accelerometer, general purpose, with 1 mV/ms<sup>-2</sup> sensitivity and 10–32 UNF, side connection
- Type 4533-B-001 Accelerometer, suitable for low-level measurement, 10 mV/ms<sup>-2</sup> and 10–32 UNF, side connection
- Type 4533-B-002 Accelerometer, suitable for very low-level measurement, 50 mV/ms<sup>-2</sup> and 10–32 UNF, side connection
- Type 4534-B Accelerometer, general purpose, with 1 mV/ms<sup>-2</sup> sensitivity and 10–32 UNF, top connection
- Type 4534-B-001 Accelerometer, suitable for low-level measurement, 10 mV/ms<sup>-2</sup> and 10–32 UNF, top connection
- Type 4534-B-002 Accelerometer, suitable for very low-level measurement, 50 mV/ms<sup>-2</sup> and 10–32 UNF, top connection

- Type 8324 Piezoelectric Charge Accelerometer, Industrial, with 1 pC/ms<sup>-2</sup> sensitivity and 2-pin 7/16-27 UNS connection
- Type 8341 Accelerometer, Industrial, with 10.2 mV/ms<sup>-2</sup> sensitivity and MIL-C-5015 top connection
- Type 8344 High-sensitivity Accelerometer, with 250 mV/ms<sup>-2</sup> sensitivity and 10–32 UNF side connection
- Type 2647-D-004 Charge-to-CCLD Converter with integrated cable and connectors for Accelerometer Type 8324 and Type 2250/2270; 80 Hz – 10 kHz

### MISCELLANEOUS

- Type 2981 Laser Tachometer Probe
- Type 4294 Calibration Exciter
- UA-0588 Tripod Adaptor for 1/8" Microphone/Pre-amplifier Assemblies
- UA-0801 Small Tripod
- UL-1009 SD Memory Card
- UL-1017 SDHC Memory Card
- ZG-0444 Charger for QB-0061 Battery Pack
- QS-0007 Tube of Cyanoacrylate Adhesive
- UA-0642 Mounting Magnet for accelerometer 10–32 UNF mounting
- UA-1077 Mounting Magnet for accelerometer M3 mounting
- YJ-0216 Beeswax for mounting accelerometer
- KE-0440 Travel Bag
- KE-0459 Shoulder Bag

### CABLES

- AO-0440-D-015 Signal Cable, LEMO to BNC, 1.5 m (5 ft)
- AO-0701-D-030 Accelerometer Cable, LEMO to M3, 3 m (10 ft)
- AO-0702-D-030 Accelerometer Cable, LEMO to 10–32 UNF, 3 m (10 ft)
- AO-0722-D-050 Accelerometer Cable, LEMO to MIL-C-5015, 5 m (16 ft)
- AO-0726-D-030 Cable for Laser Tachometer Probe, LEMO to SMB, 3 m (10 ft)
- AO-0726-D-050 Cable for Laser Tachometer Probe, LEMO to SMB, 5 m (16 ft)
- AO-0727-D-015 Signal Cable, LEMO to BNC Female, 1.5 m (5 ft)

## Service Products

2270-CAI	Accredited Initial Calibration of Type 2270	2250-CTF	Traceable Calibration of Type 2250
2270-CAF	Accredited Calibration of Type 2270	2250-TCF	Conformance Test of Type 2250, with certificate
2270-CTF	Traceable Calibration of Type 2270	4533-CAF	IEPE Accelerometer, Accredited Calibration
2270-TCF	Conformance Test of Type 2270, with certificate	4533-CTF	IEPE Accelerometer, Traceable Calibration
2250-CAI	Accredited Initial Calibration of Type 2250		
2250-CAF	Accredited Calibration of Type 2250		

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Brüel & Kjær 

## PRODUCT DATA

### Hand-held Analyzer Types 2250 and 2270 for Building Acoustics Measurements with Building Acoustics Software BZ-7228

Building Acoustics is the assessment of sound insulation in buildings and building elements. It is important for the well-being of people in their homes, workplace or public venues, thus minimum standards are set in the building regulations of each country.

BZ-7228 software is available for Hand-held Analyzer Type 2250 and Type 2270. It provides the flexibility and ease of use and is optimized for field rather than laboratory measurements

Type 2270 analyzers with 2-channel Option BZ-7229 can be used as 2-channel building acoustics analyzers. BZ-7229 is a standard application included on all new Type 2270 analyzers.

Back at the office, Qualifier Type 7830 offers versatile post-processing and reporting of your measurement results.

For customers only requiring reverberation time measurements, Reverberation Time Software BZ-7227 is also available. Please contact your Brüel & Kjær representative for details.



#### Uses and Features

##### Uses (BZ-7228)

- Measurement of:
  - Airborne sound insulation
  - Facade sound insulation
  - Impact sound insulation

##### Features (BZ-7228)

- Complete hand-held building acoustics analyzer
- Built-in pink and white noise generator
- Measures source and receiving room level spectra:
  - Equalization of sound source spectra
  - Parallel or serial measurements
- Measures reverberation time spectra:
  - Impulse and Interrupted Noise methods
- Measurement position management
- Calculates final results on the spot: ISO 16283, ISO 140 plus 13 national standards
- Measurement quality indicators

- Colour touch screen user interface
- Signal recording, voice commentary and integrated camera (Type 2270 only) to document test environment
- Single-channel measurements (Types 2250 and 2270)
- 2-channel measurements (Type 2270 only, requires BZ-7229 which is included on all new Type 2270 analyzers)

##### Uses (Type 7830)

- Building acoustics calculation
- Report generation
- Data archiving

##### Features (Type 7830)

- Building acoustics results calculation
- Analysis and report generation in one application
- Automatic data integrity checking (smileys)
- ISO plus 13 national standards

## The Hand-held Analyzers

Fig. 1  
Hand-held Analyzer  
Types 2250 and 2270



Types 2250 and 2270 are robust, hand-held analyzer platforms designed to host a wide range of sound and vibration measurement applications. Their uses range from assessing environmental and workplace noise to industrial quality control and product development (product data BP 2025).

Easy to use – their light and ergonomic design makes them easy to grip, hold and operate single-handedly. Their colour touch screens show the analyzer setup, status and data at a glance, and with a tap of the stylus, you can make quick selections. The “traffic light” indicator, positioned centrally on the pushbutton panel, shows you the current measurement status, even from a distance.

Robust – the hand-held analyzers are built for the tough environment of field measurements. They will work reliably in rain, dust, heat, frost, and during day or night.

To document your measurement, you can add spoken or written comments and make signal recordings during any measurement.

**Note:** Signal recordings require Signal Recording Option BZ-7226.

Type 2250 is a single-channel analyzer, while Type 2270 is 2-channel and has additional features such as a built-in camera (allowing you to attach photos to your measurements).

## Tasks in Building Acoustics

Fig. 2  
Typical configuration for building acoustics measurements: sound source, amplifier, analyzer (including signal generator) and PC for reporting



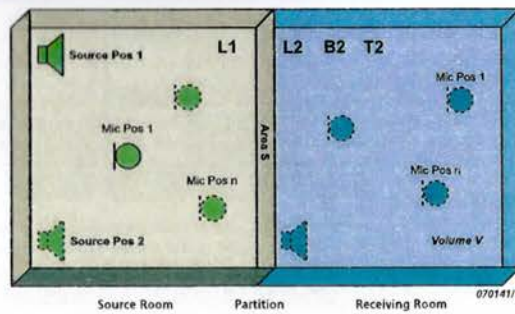
Fig. 2 shows a typical configuration for the most common task in building acoustics measurements: airborne sound insulation.

Fig. 3 shows a typical airborne task setup using a loudspeaker (emitting pink noise) and a number of microphone positions to measure the average source room spectrum L1, and the average receiving room spectrum L2. The average background noise spectrum B2 is also measured to verify the true L2 spectrum.

The average reverberation time spectrum, T2, is measured to correct for the amount of absorption in the receiving room. Finally, the single number result (for example:  $D_{nTw}$ ) is calculated from the L1, L2, B2 and T2 spectra, and the result can then be compared with the minimum requirements stated in the building regulations.

**Fig. 3**  
Sound source and microphone positions for measuring airborne sound insulation

L1 = Source room level  
L2 = Receiving room level  
B2 = Background level  
T2 = Reverberation Time

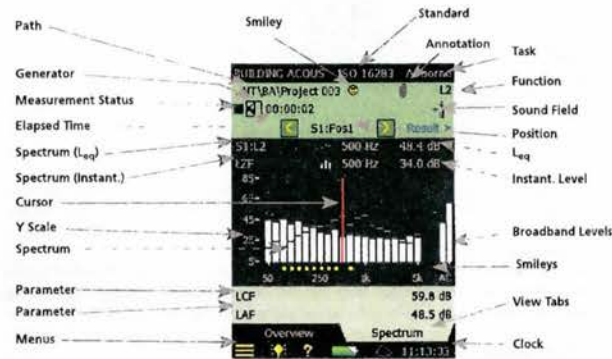


The sound level depends on the position in the rooms, so several microphone positions are used to measure the average of the source room level, L1, the average of the receiving room level L2 and the average of the background noise level B2. The average reverberation time T2 is also measured using several positions.

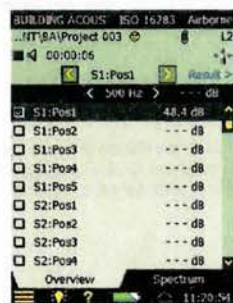
### In Touch with your Measurements

The spectra required (L1, L2, etc.) can be measured in any order, to suit field conditions and your preferences. Fig. 4 shows a typical building acoustics display when you are ready to measure the first L2 position, with source position 1.

**Fig. 4**  
Typical single-channel Spectrum display when you are ready to measure the first L2 position, with source position 1



**Fig. 5**  
Typical single-channel Overview display



The instantaneous (live) spectrum is shown and the high-resolution, colour, touchscreen shows the setup, status and data at a glance. Using the stylus (or navigation pushbuttons) you can directly activate the indicated features (except those with dashed lines in Fig. 4). You can check the generator and loudspeaker signal level by tapping the Generator icon to switch the generator on and off.

**Fig. 6**  
Type 2270 connected to two microphones through the Dual 10-pole Adapter



2-channel measurements (Type 2270 only) are as easy as single-channel measurements with the advantage that you can reduce the total measurement time by measuring source and receiver positions simultaneously or by measuring two positions in the same room simultaneously.

### Reverberation Time

**Fig. 7**  
Reverberation time measurement – measured using the interrupted noise method



Reverberation time (RT) is an important parameter describing the acoustic quality of a room or space. It is important for sound levels, speech intelligibility and the perception of music. In building acoustics, it is used to correct for the effects of RT on building acoustics and sound power measurements.

Reverberation Time is the decay time for sound in a room after the excitation stops. It is the time for a 60 dB drop in level, but the decay is usually measured over a 20 or 30 dB drop and then extrapolated to the 60 dB range. It is labelled T20 and T30, respectively, for those two evaluation ranges.

Reverberation time varies between positions in a room, so it is usually measured at several positions. The average can be determined for the RT spectra, or the decays for each frequency band can be averaged and the reverberation time spectrum then calculated for the averaged decays (ensemble average).

Reverberation time can be measured by using either impulsive excitation (Schroeder Method), from a starting pistol or balloon burst, or interrupted noise.

All it takes to measure reverberation time is to press the Start/Pause pushbutton (and burst the balloon in the case of impulsive excitation). Reverberation times from 0.1 to up to 30 seconds are then measured at peak sound levels up to 143 dB. No trial measurements, no overloads, and the 'traffic light' clearly shows the measurement status from a distance.

A Reverberation time spectrum, showing T20 and T30, is shown in Fig. 8 (left). A reverberation decay curve for a 1/3-octave band is included in Fig. 8 (centre) and an overview of results at one frequency band is included in Fig. 8 (right).

**Fig. 8**  
Reverberation time spectrum (left); reverberation decay curve (centre); and overview of results (right)



## Calculations

### Standards

Even though the measurement functions (L1, L2, B2, T2) are the same for any building acoustics measurement, the detailed measurement setup and calculation procedures depend on your national building regulations. To ensure that your measurements comply, select the relevant standard before you save your first measurement. This will automatically activate the required setup for measurement and calculation. An overview of the available standards is shown in Table 1 (page 9), and the calculated parameters in Table 2 (page 10).

### Results

In addition to measurement data, you may also need the receiving room volume and the partition area for some calculations. These can be entered using the stylus or navigation pushbuttons on the appropriate instrument display page. You may want to reuse some of your earlier measurements (like a T2 spectrum known from a similar receiving room), to save time. This is also possible, by using a reuse facility in the Explorer display.

**Fig. 9**  
With the required data measured, final results are shown, including the reference curve. For some results, the volume of the receiving room and the area of the partition must be entered



The calculations use a reference curve for frequency weighting of the sound reduction spectrum, resulting in a single number like  $R'w = 52$  dB (the weighted field sound reduction index according to the ISO 140-4). This means that you will know on site whether your construction under test fulfils the minimum requirements of the local building regulations. Examples of final results are shown in Fig. 9.

## Other Tasks

### Facade Sound Insulation

Facade sound insulation is a variant of airborne sound insulation, with its own standards. The "source room" is the space outside the facade, and the sound source may be road traffic or a loudspeaker representing outdoor noise. When using traffic noise, the indoor and outdoor sound levels must be measured simultaneously, requiring 2-channel measurements (Type 2270 only).

### Impact Sound Insulation

Impact sound is typically caused by footsteps, and to measure impact sound insulation a standardized impact sound source (tapping machine) is placed in the source room. The receiving room levels are measured as for airborne sound insulation, with several positions of the tapping machine. Calculations are like those for airborne sound insulation, except the results represent absolute (not relative) levels.

## Wireless Systems

**Fig. 10**  
Optional wireless systems are available to control the sound source for airborne and impact sound insulation measurements



In the field, using Wireless Audio System Kit UL-0256 can speed up measurements by reducing the number of cables and make it easier for you to control the amplifier when not in the same room.

## Annotating your Measurement Data

Measurement Partner Field App is the recommended solution for on-site annotation of your measurement data.

### Measurement Partner Field App

Measurement Partner Field App transforms the way you work with your hand-held analyzer. It is an advanced companion app for the sound and vibration professional offering:

- Remote analyzer control
- Remote display
- Remote annotation of measurement data
- Cloud support

Whenever you stand next to your analyzer to operate it, you disturb the sound field. Therefore, we have released a field app that lets you stay away from your analyzer. Once your analyzer is powered on, you can wirelessly connect to it using Wireless USB-A Adapter UL-1050 for G4, Ethernet CF Card UL-1019 for G3.

**Fig. 11**  
View and edit annotations collected with the field app



Once connection is made to the analyzer, you are ready to start, stop and pause your measurement from a safe distance. During noise measurements, the instantaneous LAF profile is displayed on the field app. During vibration measurements, the Fast inst. profile is shown.

This allows you to keep an eye on the status of your measurement without being close to the analyzer. This is particularly important when low noise levels are being measured such as for indoor measurements.

MP Field App supports notes, voice commentary, image, video and GPS annotations. All annotations can be uploaded to MP Cloud for merging with the project in Measurement Partner Suite.

It is also possible to annotate your measurements directly on the analyzer using notes, voice commentaries and images (Type 2270 only). These are transferred to Measurement Partner Suite along with your measurement data.

#### Uploading Measurement Data to Measurement Partner Cloud

Types 2250 and 2270 can send measurement data to Measurement Partner Cloud (MP Cloud) where projects are immediately available for post-processing, sharing or storage subject to account capacity. Only authorized users have access to the data when it is the MP Cloud.

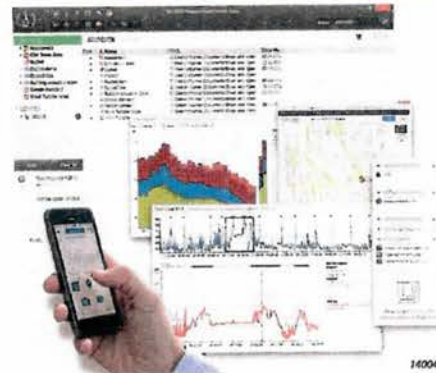
You can create a Cloud account by visiting the MP Cloud web service at [cloud.bksv.com](http://cloud.bksv.com). You open an account, register your analyzer serial numbers and perform a one-time pairing of analyzer and account, ensuring data security. You can also administer access to the account from the web service and order subscriptions to increase account capacity.

You can connect the hand-held analyzer to the Internet through modem, LAN or Wi-Fi connected to router. In the field, the analyzer can connect through Wi-Fi to hotspot on a smart device (Wi-Fi using CF-card UL-1019 for G1-G3 and Wireless USB-A Adapter UL-1050 for G4, respectively).

After measurement is completed and the project is saved, you log the analyzer into the cloud, and projects are uploaded to the cloud from the analyzer. To do this, you simply need to move your data to the Cloud folder, which is automatically created when you log on to your account. The data will now be ready for post-analysis in Measurement Partner Suite by anyone who has access to the relevant Cloud archive.

#### Post-processing Software

**Fig. 12**  
Measurement Partner Suite BZ-5503



Measurement Partner Suite BZ-5503, in its basic configuration, comes with your hand-held analyzer (see product data BP 2430). It is Brüel & Kjær's state-of-the-art data viewing and post-processing toolbox for environmental noise and vibration.

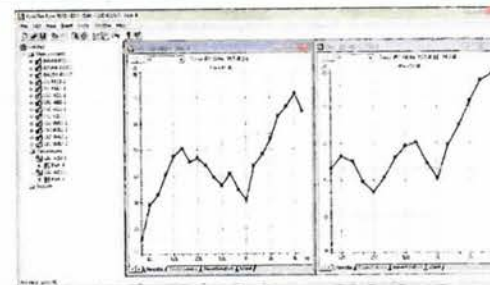
The free, basic configuration provides data archive, preview and export capabilities, software maintenance and online display. Archives can be stored locally, on network drives or, alternatively, in MP Cloud for easy sharing with anyone on the planet.

Measurement Partner Suite also merges Field App annotations with the corresponding instrument project.

Additional valuable data analysis and post-processing tools are available on a time-limited subscription basis. You only pay for what you need, when you need it, with no penalty should your subscription lapse.

#### Reviewing and Reporting using Qualifier Type 7830

**Fig. 13**  
Typical building acoustics project using Type 7830



With Qualifier Type 7830, you can view, recalculate, document and report data. Measured and calculated data are viewed just as with Types 2250 and 2270. Qualifier's Project Tree enables easy browsing and copy/pasting across data folders. Selected data can be displayed as tables, 3D plots and graphs. Editing options include adjustment of reverberation decay graphical alignment, manual data entries, copy/paste data and changing the calculation standard (where compatible). All changes to data are annotated accordingly.

Qualifier also allows you to report your calculations (or recalculations) using templates based on specific standards. Templates are available for a selection of national and international standards. You can also customize a template to include your company's logo in the report, or create a report from a blank report template.

## Building Acoustics Measurement Standards

Table 1 Building acoustics standards supported by BZ-7228 and Qualifier Type 7830

Measurement	Measurement Standards														
	International	Germany	Austria	Italy	UK	England Wales	Sweden	Switzerland	France	Spain		Netherlands		USA	
Typical Parameters	ISO	DIN	ÖNORM	UNI	BS	BREW	SS	Sia	NF-531	NBE	CTE	NEN	NEN'06	ASTM	
	R' L'n	R L'n	DnT L'nT	Dn Ln	DnT L'nT	DnT	R' L'n	DnT L'nT	DnAT LnAT	DnAT LnAT	DnTA LnTA	llu lco	DnTA LnTA	FTL Ln	
Airborne	Lab	10140-2*	EN 20140-3	S 5101	8270-1	EN 20140-3			051	74-040-84/3	CTE 2008				
	Field	140-4 16283-1	52210-1	S 5100-1	8270-4	2750-4	BREW	EN 20140-4	181	054, -057	74-040-84/4	CTE 2008	5077	5077	E336-90
Facade	140-5	52210-5	S 5100-3	8270-5	2750-5		EN 20140-5	181	055, -057	74-040-84/5	CTE 2008	5077	5077	E966-90	
Impact	Lab	10140-3*	52210-1	S 5101	8270-6	2750-6	EN 20140-6		-052	74-040-84/6	CTE 2008				
	Field	140-7 16283-2	52210-1	S 5100-2	8270-4	2750-7	EN 20140-7	181	056, -057	74-040-84/7	CTE 2008	5077		E1007-11	
Rating	Airborne	717-1	52210-4	S 5100-1	8270-7	5821-1, -3	BS EN 717-1	SS- ISO 717-1	181	-057	NBECA-88	CTE 2008	5077	NPR 5079	E413-73 E1332-90
	Impact	717-2	52210-4	S 5100-2	8270-7	5821-2	SS- ISO 717-2	181	-057	NBECA-88	CTE 2008	5077		E989	

\* Partially fulfilled (does not support correction of the result for the contribution of flanking transmission).

Table 2 Calculated parameters

Basic Standards	Measurement Standards									
	ISO, DIN, ÖNORM, UNI, BS, BREW	SS	Sia	NF	NBE	CTE	NEN	NEN'06	ASTM	
Airborne	ISO 16283* ISO 140 ISO 717	ISO 140 ISO 717	ISO 140 ISO 717	NF 531-05x	ISO 140	ISO 140	NEN 5077	NEN 5077-2006	ASTM E336, 1007, E966, E1332	
Calculated Parameters	D Dn DnT R' R Dw Dw+C Dw+Ctr Dnw Dnw+C Dnw+Ctr	ISO plus: Dw8 DnTw8 R'w8 Rw8	ISO plus: DnTw+C-Cv	D DnT R DnATrose Rose Rroute	ISO plus: DA DnTA RA R'A	ISO plus: DA DnTA RA R'A	DnT llu;k	DnT DnT,A,k	NR NNR FTL NIC NNIC FSTC	
Facade	R'45° R tr,s Dls,2m Dls,2m,n Dls,2m,nT Dtr,2m Dtr,2m,nT	See ISO	ISO plus: D45°nT Dls,2m,nT,w+C-Cv Dtr,2m,nT,w+C-Cv D45°nT,w+Ctr-Cv	DnT45° DnTtr	ISO plus: R'45° R'45°Aav R'45°Aef R'45°Atr R'A R'Atr D2m,A D2m,Aav D2m,Aef D2m,Atr D2m,n,A D2m,n,Aav D2m,n,Aef D2m,n,Atr D2m,nT,A D2m,nT,Aav D2m,nT,Aef D2m,nT,Atr Dls,2m,n,w+C Dls,2m,n,w+Ctr	ISO plus: R'45°A R'45°Aav R'45°Aef R'45°Atr R'A R'Atr D2m,A D2m,Aav D2m,Aef D2m,Atr D2m,n,A D2m,n,Aav D2m,n,Aef D2m,n,Atr D2m,nT,A D2m,nT,Aav D2m,nT,Aef D2m,nT,Atr Dls,2m,n,w+C Dls,2m,n,w+Ctr	Gi	Gi	OILR OITL	
Calculated Parameters	Dls,2m,w Dls,2m,n,w Dls,2m,nT,w Dls,2m,nT,w+C Dls,2m,nT,w+Ctr Dtr,2m,w Dtr,2m,n,w Dtr,2m,nT,w+C Dtr,2m,nT,w+Ctr R'45°w or R' tr,s,w +C+Ctr +C50-3150 +C50-5000 +C100-5000 +Ctr50-3150 +Ctr100-5000 +Ctr50-5000			DnATroute45° DnATroute			GA GA,k	GA GA,k	OITC	
Impact	L'nT Ln	ISO plus: L'nw8 L'nTw8 Lnw8	See ISO	LnT Ln LnAT LnA	ISO plus: LnAT LnA	See ISO	LnT	lco	LnT Ln IIC NISR	
Calculated Parameters	L'nw L'nTw or Lnw +Cl+Cl50-2500									

\* ISO 16283: Additional low-frequency measurement procedure for low frequencies in small rooms. The  $L_{corner}$  and  $L_{LF}$  results are used for calculating and displaying the final results.

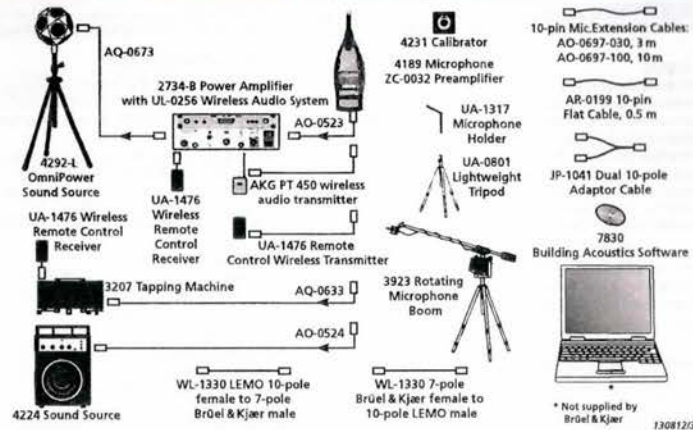
### Complete System

Brüel & Kjær provides a wide range of accessories (Fig. 14) to help you build a complete building acoustics measurement system, such as:

- Power amplifier and a choice of sound sources
- Tapping machine for impact sound insulation measurements
- Tripods, extension cables and flat cables
- Microphone and cable for 2-channel applications
- Wireless transmission of generator signal and wireless remote control of tapping machine
- Rotating microphone boom
- Calibrators

The combination of cables and accessories necessary will depend on whether it is a single- or 2-channel measurement, whether wireless transmission of the generator signal is being used and the layout of the partition and rooms being measured.

**Fig. 14**  
Accessories for  
building acoustics  
measurements



**Accredited Calibration Services at Brüel & Kjær**

Ensure traceable measurement history from day one with accredited calibration for your Type 2250/2270. We recommend calibration at a Brüel & Kjær ISO 7025 certified laboratory biannually or annually. Any errors detected during calibration will be repaired prior to returning the instrument to you.

**Compliance with Environmental Standards**

	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China WEEE mark indicates compliance with the EU WEEE Directive
<b>Safety</b>	EN/IEC 61010–1, ANSI/UL 61010–1 and CSA C22.2 No.1010.1: Safety requirements for electrical equipment for measurement, control and laboratory use
<b>EMC Emission</b>	EN/IEC 61000–6–3: Generic emission standard for residential, commercial and light industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards <b>Note:</b> The above is only guaranteed using accessories listed in this document
<b>EMC Immunity</b>	EN/IEC 61000–6–2: Generic standard – Immunity for industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards <b>Note:</b> The above is only guaranteed using accessories listed in this document
<b>Temperature</b>	IEC 60068–2–1 & IEC 60068–2–2: Environmental Testing. Cold and Dry Heat. Operating Temperature: –10 to +50 °C (14 to 122 °F) Storage Temperature: –25 to +70 °C (–13 to 158 °F)
<b>Humidity</b>	IEC 60068–2–78: Damp Heat: 93% RH (non-condensing at +40 °C (104 °F)). Recovery time 2 ~ 4 hours
<b>Mechanical</b>	Non-operating: IEC 60068–2–6: Vibration: 0.3 mm, 20 m/s <sup>2</sup> , 10 ~ 500 Hz IEC 60068–2–27: Bump: 1000 bumps at 400 m/s <sup>2</sup> IEC 60068–2–27: Shock: 1000 m/s <sup>2</sup> , 6 directions
<b>Enclosure</b>	IEC 60529 (1989): Protection provided by enclosures: IP 44*

\* With preamplifier, extension cable or protection plug connected to the top socket and the hinged cover protecting the bottom connectors.

**General Specifications**

**Transducer**

**SUPPLIED TRANSDUCER**

**One of the Following Microphones:**

- Type 4189: Pre-polarized Free-field 1/2" Microphone
- Type 4190: Free-field 1/2" Microphone
- Type 4966: Free-field 1/2" Microphone

**Nominal Open-circuit Sensitivity:** 50 mV/Pa (corresponding to –26 dB re 1 V/Pa) ±1.5 dB  
**Capacitance:** 14 pF (at 250 Hz)

**SUPPLIED MICROPHONE PREAMPLIFIER**

**Part No.:** ZC-0032

**Nominal Preamplifier Attenuation:** 0.25 dB

**Connector:** 10-pin LEMO

**Extension Cables:** Up to 100 m in length between the microphone preamplifier and Type 2250/2270, without degradation of the specifications

**MICROPHONE POLARIZATION VOLTAGE**

Selectable between 0 V and 200 V

**SELF-GENERATED NOISE LEVEL**

Typical values at 23 °C for nominal microphone open-circuit sensitivity:

Weighting	Microphone	Electrical	Total
"A"	14.6 dB	12.4 dB	16.6 dB
"B"	13.4 dB	11.5 dB	15.6 dB
"C"	13.5 dB	12.9 dB	16.2 dB
"Z" 5 Hz–20 kHz	15.3 dB	18.3 dB	20.1 dB
"Z" 3 Hz–20 kHz	15.3 dB	25.5 dB	25.9 dB

**Hardware Interface**

**PUSHBUTTONS**

11 buttons with backlight, optimized for measurement control and screen navigation

**ON-OFF BUTTON**

**Function:** Press 1 s to turn on; press 1 s to enter standby; press for more than 5 s to switch off

**STATUS INDICATORS**

**LEDs:** Red, yellow and green

**DISPLAY**

**Type:** Transflective back-lit colour touchscreen 240 × 320 dot matrix

**Colour Schemes:** Five different – optimized for different usage scenarios (day, night, etc.)

**Backlight:** Adjustable level and time

## USER INTERFACE

**Measurement Control:** Using pushbuttons

**Set-up and Display of Results:** Using stylus on touchscreen or pushbuttons

**Lock:** Pushbuttons and touchscreen can be locked and unlocked

## USB INTERFACE

USB 2.0 OTG Micro AB and USB 2.0 Standard A sockets for Wireless USB-A Adapter UL-1050, printer or weather station

## MODEM INTERFACE

Connection to Internet through GPRS/EDGE/HSPA modem connected through the USB Standard A Socket.

Supports DynDNS for automatic update of IP address of host name

## PRINTER INTERFACE

PCL printers, Mobile Pro Spectrum thermal printer or Selko DPU S245/S445 thermal printers can be connected to USB socket

## MICROPHONE FOR COMMENTARY

Microphone, which utilizes automatic gain control (AGC), is incorporated in underside of analyzer. Used to create voice annotations for attaching to measurements

## CAMERA (TYPE 2270 ONLY)

Camera with fixed focus and automatic exposure is incorporated in underside of analyzer.

Used to create image annotations for attaching to measurements

**Image Size:** 2048 × 1536 pixels

**Viewfinder Size:** 212 × 160 pixels

**Format:** jpg with exif information

## SECURE DIGITAL SOCKET

2 × SD sockets

Connect SD and SDHC memory cards

## LAN INTERFACE SOCKET

• Connector: RJ45 Auto-MDIX

• Speed: 100 Mbps

• Protocol: TCP/IP

## INPUT SOCKET

One socket with Type 2250; two with Type 2270

**Connector:** Triaxial LEMO

**Input Impedance:** ≥ 1 MΩ

**Direct Input:** Max. input voltage: ±14.14 V<sub>peak</sub>

**CCLD Input:** Max. input voltage: ±7.07 V<sub>peak</sub>

**CCLD Current/voltage:** 4 mA/25 V

## TRIGGER SOCKET

**Connector:** Triaxial LEMO

**Max. Input Voltage:** ±20 V<sub>peak</sub>

**Input Impedance:** >47 kΩ

**Precision:** ±0.1 V

## OUTPUT SOCKET

**Connector:** Triaxial LEMO

**Max. Peak Output Level:** ±4.46 V

**Output Impedance:** 50 Ω

## HEADPHONE SOCKET

**Connector:** 3.5 mm Minijack stereo socket

**Max. Peak Output Level:** ±1.4 V

**Output Impedance:** 32 Ω in each channel

## Storage

### INTERNAL FLASH-RAM (NON-VOLATILE)

512 MB for user set-ups and measurement data

### EXTERNAL MEMORY CARD

SD and SDHC Card: For store/recall of measurement data

### USB MEMORY STICK

For store/recall of measurement data

## Power

### EXTERNAL DC POWER SUPPLY REQUIREMENTS

Used to charge the battery pack in the analyzer

**Voltage:** 8 – 24 V DC, ripple voltage <20 mV

**Current Requirement:** min. 1.5 A

**Power Consumption:** <2.5 W, without battery charging, <10 W when charging

**Cable Connector:** LEMO Type FFA.00, positive at centre pin

### EXTERNAL AC MAIN SUPPLY ADAPTOR

**Part No.:** ZG-0426

**Supply Voltage:** 100 – 120/200 – 240 V AC; 47 – 63 Hz

**Connector:** 2-pin IEC 320

### BATTERY PACK

Rechargeable Li-Ion battery

**Part No.:** QB-0061

**Voltage:** 3.7 V

**Capacity:** 5200 mAh nominal

**Typical Operating Time:**

**Single-channel:** >11 h (screen backlight dimmed); >10 h (full screen backlight)

**Dual-channel:** >10 h (full screen backlight)

**Battery Cycle Life:** >500 complete charge/discharge cycles

**Battery Aging:** Approximately 20% loss in capacity per year

**Battery Indicator:** Remaining battery capacity and expected working time may be read out in % and in time

**Battery Fuel Gauge:** The battery is equipped with a built-in fuel gauge, which continuously measures and stores the actual battery capacity in the battery unit

**Charge Time:** In analyzer, typically 10 hours from empty at ambient temperatures below 30 °C (86 °F). To protect the battery, charging will be terminated completely at ambient temperatures above 40 °C

(104 °F). At 30 to 40 °C, charging time will be prolonged. With External Charger ZG-0444 (optional accessory), typically 5 hours

**Note:** It is not recommended to charge the battery at temperatures below 0 °C (32 °F) or over 50 °C (122 °F). Doing this will reduce battery lifetime

### CLOCK

Back-up battery powered clock. Drift <0.45 s per 24-hour period

## Environmental

### WARM-UP TIME

**From Power Off:** <2 min

**From Standby:** <10 s for prepolarized microphones

### WEIGHT AND DIMENSIONS

650 g (23 oz) including rechargeable battery

300 × 93 × 50 mm (11.8 × 3.7 × 1.9") including preamplifier and microphone

## Software Interface

### USERS

Multi-user concept with login. Users can have their own settings with jobs and projects totally independent of other users

### PREFERENCES

Date, time and number formats can be specified per user

### LANGUAGE

User interface in Catalan, Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

### HELP

Concise context-sensitive help in Chinese (People's Republic of China), English, French, German, Italian, Japanese, Polish, Romanian, Serbian, Slovenian, Spanish and Ukrainian

## UPDATE OF SOFTWARE

Update to any version using BZ-5503 through USB or update via Internet

## REMOTE ACCESS

Connect to the analyzer using:

- Measurement Partner Suite BZ-5503
  - Measurement Partner Field App (iOS or Android smartphone app)
  - the 2250/2270 SDK (software development kit)
  - a REST interface through HTTP
  - an Internet browser supporting JavaScript
- The connection is password protected with two levels of protection:
- Guest level: for viewing only
  - Administrator level: for viewing and full control of the analyzer

## CLOUD

Connect to Measurement Partner Cloud on [cloud.bksv.com](http://cloud.bksv.com) for transferring data to an archive in the cloud for storage or easy synchronization with Measurement Partner Suite BZ-5503

## Input

### DUAL CHANNELS (Type 2270 only)

All measurements are made from either Ch. 1 or Ch. 2 or both simultaneously

### TRANSDUCER DATABASE

Transducers are described in a transducer database with information on Serial Number, Nominal Sensitivity, Polarization Voltage, Free-field Type, CCLD Required, Capacitance, and additional information. The analogue hardware is set up automatically in accordance with the selected transducer

### CORRECTION FILTERS

For microphone Types 4189, 4190, 4191, 4192, 4193, 4950, 4952, 4964 and 4966, BZ-7228 is able to correct the frequency response to compensate for sound field and accessories

## Calibration

Initial calibration is stored for comparison with later calibrations

### ACOUSTIC

Using Sound Calibrator Type 4231 or custom calibrator. The calibration process automatically detects the calibration level when Sound Calibrator Type 4231 is used

### ELECTRICAL

Uses internally generated electrical signal combined with a typed-in value of microphone sensitivity

### CALIBRATION HISTORY

Up to 20 of the last calibrations made are listed and can be viewed on the analyzer

## Data Management

### METADATA

Up to 30 metadata annotations can be set per project (text from keyboard or text from pick list, number from keyboard or auto-generated number)

### PROJECT TEMPLATE

Defines the display and measurement set-ups. Set-ups can be locked and password-protected

### PROJECT

Measurement data for all positions defined in source room (L1) and in receiving room (L2, B2 and T2) are stored with the Project Template

### JOB

Projects are organized in jobs.

Explorer facilities for easy management of data (copy, cut, paste, delete, rename, open project, create job, set default project name)

## REUSE OF DATA

Data for L1, B2 or T2 in one project can be re-used in another project

## Measurement Control

**Measurement Sequence:** Supports measuring:

- at all microphone positions before using another source
  - at a microphone position for all sources before measuring at a new position
  - at subsequent microphone positions without source information
  - at manually selected source and microphone positions
- Measurements are started manually and can be automatically stored on completion of measurement
- Generator (L1, L2 and T2):** The noise generator is turned on and off automatically

**Escape Time:** 0 to 60 s

**Build-up Time:** 1 to 10 s

The generator can be turned on and off manually for checking equipment and sound levels

## EXCITATION T2

**Interrupted Noise:** Measurements are started manually and can be automatically stored on completion of measurement

**Number of Decays per Measurement:** 1 to 100, ensemble averaged into one decay

**Impulse:** Manual start of first measurement. When level (say from starter pistol) exceeds the user-selected trigger level, the decay is recorded and backwards integration performed (Schroeder method). The trigger can then be armed automatically for measuring at the next position

**Signal Recording:** Recording of the 2-weighted measured signal can be done at each position

## BACK-ERASE

The last 5 s of data can be erased without resetting the measurement

## Measurement Status

### ON SCREEN

Information such as overload, awaiting trigger and running/paused are displayed on screen as icons

### TRAFFIC LIGHTS

Red, yellow and green LEDs show measurement status and instantaneous overload as follows:

- Yellow LED flashing every 5 s = stopped, ready to measure
- Green LED flashing slowly = awaiting trigger or calibration signal
- Green LED on constantly = measuring
- Yellow LED flashing slowly = paused, measurement not stored
- Red LED flashing quickly = intermittent overload, calibration failed

### NOTIFICATIONS

Sends an SMS or email daily at a specified time or if an alarm condition is fulfilled

**Alarm Conditions:**

- Disk Space below set value
- Trig. Input Voltage below set value
- Internal Battery enters set state
- Change in Measurement State
- Reboot of analyzer

## Annotations

### VOICE ANNOTATIONS

Voice annotations can be attached to measurements so that verbal comments can be stored together with the measurement

**Playback:** Playback of voice annotations can be listened to using an earphone/headphones connected to the headphone socket

**Gain Adjustment:** –60 dB to +60 dB

\* Signal recording requires an SD card or USB stick for data storage and a license for Signal Recording Option BZ-7226

## TEXT ANNOTATIONS

Text annotations can be attached to measurements so that written comments can be stored with the measurement

## GPS ANNOTATIONS

A text annotation with GPS information can be attached (Latitude, Longitude, Altitude and position error). Requires connection to a GPS receiver

## Specifications – Building Acoustics Software BZ-7228

Specifications apply to BZ-7228 unless otherwise stated.  
2-channel Option BZ-7229 is for Type 2270 only

### Standards

Conforms with the relevant parts of the following:

- IEC 61672-1 (2013) Class 1
- IEC 60651 (1979) plus Amendment 1 (1993-02) and Amendment 2 (2000-10), Type 1
- ANSI S1.4-1983 plus ANSI S1.4A-1985 Amendment, Type 1
- IEC 61260-1 (2014), 1/1-octave Bands and 1/3-octave Bands, Class 1
- IEC 61260 (1995-07) plus Amendment 1 (2001-09), 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI S1.11-1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0-C
- ANSI S1.11-2004, 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI/ASA S1.11-2014 Part 1, 1/1-octave Bands and 1/3-octave Bands, Class 1
- ISO 16283, ISO 140, SS, DIN, Önorm, BS, BREW, Sia, UNI, NF-S31, NBE, NEN, NEN'06, ASTM, see tables under "Building Acoustics Standards"

**Note:** The international IEC standards are adopted as European standards by CENELEC. When this happens, the letters IEC are replaced with EN and the number is retained. Type 2250/2270 also conforms to these EN standards

### Broadband Analysis

#### DETECTORS

**A- and C-weighted:** Broadband detectors with Fast exponential time weighting

**Overload Detector:** Monitors the overload outputs of all the frequency weighted channels

**Underrange Detector:** Monitors the under range of all the frequency weighted detectors. Underrange is set if level is below lower limit of linear operating range

**Type 2270:** Detectors available for both Ch. 1 and Ch. 2

#### MEASUREMENTS

$L_{AF}$  and  $L_{CF}$  for display as numbers or quasi-analogue bars

#### MEASURING RANGES

When using Microphone Type 4189:

**Dynamic Range:** From typical noise floor to max. level for a 1 kHz pure tone signal, A-weighted:

- Single Range: 15.6 to 140 dB
- High Range: 28.5 to 140 dB
- Low Range: 16.6 to 110 dB

**Primary Indicator Range:** In accordance with IEC 60651, A-weighted:

- Single Range: 23.5 to 123 dB
- High Range: 41.7 to 123 dB
- Low Range: 23.5 to 93 dB

**Linear Operating Range:** In accordance with IEC 61672, A-weighted:

- Single Range: 24.8 to 140 dB
- High Range: 43.0 to 140 dB
- Low Range: 24.8 to 110 dB

## IMAGE ANNOTATIONS (TYPE 2270 ONLY)

Image annotations can be attached to measurements. Images can be viewed on the screen

### Frequency Analysis

#### CENTRE FREQUENCIES

**1/1-octave Band Centre Frequencies:** 63 Hz to 8 kHz

**1/3-octave Band Centre Frequencies:** 50 Hz to 10 kHz

#### MEASURING RANGES

When using Microphone Type 4189:

**Dynamic Range:** From typical noise floor to max. level for a pure tone signal at 1 kHz 1/3-octave:

- Single Range: 1.1 to 140 dB
- High Range: 11.3 to 140 dB
- Low Range: 1.1 to 110 dB

**Linear Operating Range:** In accordance with IEC 61260:

- Single Range:  $\leq 20.5$  to 140 dB
- High Range:  $\leq 39.1$  to 140 dB
- Low Range:  $\leq 20.5$  to 110 dB

#### Internal Generator

Built-in pseudo-random noise generator

**Spectrum:** Selectable Pink or White

**Crest Factor:**

- Pink Noise: 4.4 (13 dB)
- White Noise: 3.6 (11 dB)

**Bandwidth:** Follows measurement frequency range

- Lower Limit: 50 Hz (1/3-oct.) or 63 Hz (oct.)
- Upper Limit: 10 kHz (1/3-oct.) or 8 kHz (oct.)

**Output Level:** Independent of bandwidth

- Max.: 1 V<sub>rms</sub> (0 dB)
- Gain Adjustment: -80 to 0 dB

When bandwidth is changed, the level for all bands is automatically adjusted to comply with the set output level

**Correction Filters:** For sound sources Type 4292-L, Type 4295 and Type 4296: Flat or Optimum

**Turn-on Time and Turn-off Time:** Equivalent to RT = 70 ms

**Repetition Period:** 175 s

**Output Connector:** Output Socket

**Control:** See Measurement Control

#### External Generator

Selectable as alternative to internal generator

For controlling external noise generator

**Levels:** 0 V (Generator off), 3.3 V (Generator on)

**Rise-time and Fall-time:** 10  $\mu$ s

**Control:** See Measurement Control

#### Measurements

Measurements are done at a number of positions and categorized in functions (L1 for source room levels, L2 for receiving room levels, B2 for receiving room background noise levels and T2 for receiving room reverberation time measurements)

#### LEVELS L1, L2 AND B2

$L_{ZF}$  spectrum for display only

$L_{Zeq}$  in 1/1-octave or 1/3-octave bands

L1 and L2 simultaneously or as single channels

**Averaging time:** 1 s to 1 h

**Range (L1 and L2 simultaneously only):** Auto-range or manually set to High Range or Low Range

**Averaging:** Up to 10 source positions each with up to 10 measurement positions or up to 100 measurements may be averaged

**Status Indications:** Overload, under range, etc.

**Crosstalk:**

- 5 Hz - 10 kHz  $\leftarrow$  -110 dB
- 10 kHz - 20 kHz  $\leftarrow$  -100 dB

#### REVERBERATION TIME T2

T20 and T30 in 1/1-octave or 1/3-octave bands

**Decays:**  $L_{Zeq}$  spectra sampled at 5 ms intervals

**Evaluation Range:** -5 to -25 dB for T20 and -5 to -35 dB for T30

**Measurement Time:** Automatic selection of measurement time for the decays based on the actual reverberation time of the room

**Maximum Measurement Time:** From 2 to 20 s

**Averaging:** T20 and T30 measurements can be averaged (arithmetic averaging or ensemble averaging)

**T20 and T30 Calculation:** From slope in evaluation range

**Slope Estimation:** Least squares approximation

**Quality Indicators:** Quality indicators with status information like

Overload, Curvature in %, etc.; extensive list of status information.

Quality indicators are available on reverberation time spectra for each frequency band, and as overall quality indicators for each measurement position and for the averaged result

**Reverberation Time Range:** Max. 30 s, min. 0.1 - 0.7 s, depending on bandwidth and centre frequency

**Manual Data Entry:** A T2 value may be entered in any frequency band of a measured spectrum

#### Measurement Displays

##### OVERVIEW

Table of measurement positions for each function (L1, L2, B2 or T2) with readout for selectable frequency band on each position together with quality indicator.

Positions can be included/excluded from average

##### SOUND LEVEL SPECTRUM

L2F spectrum plus A and C broadband bars

$L_{Zeq}$  spectrum for L1@Pos, L2@Pos, B2@Pos, L1, L2, B2, L1-L2, L2-B2

**Y-axis:** Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto-zoom or auto-scale available

**Cursor:** Readout of selected band quality indicator for each frequency band

##### REVERBERATION TIME SPECTRUM

One or two spectra can be displayed

**Y-axis:** Range: 0.5, 1, 2, 5, 10 or 20 s. Auto-zoom available

**Cursor:** Readout of selected band quality indicator for each frequency band

##### SPECTRUM TABLE

One or two spectra can be displayed in tabular form

##### DECAY

Decay curve for a position or the room average available for each

frequency band (if Ensemble Average selected)

Display of evaluation range and regression line

Readout of Curvature in %

**Y-axis:** Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto-zoom or auto-scale available

#### Result Displays

##### OVERVIEW

Table of measurement positions for all functions (L1, L2, B2 or T2) with readout of quality indicators.

Positions can be included/excluded from result

##### CALCULATIONS

Shows the sound reduction index (spectrum and weighted) according to the selected standard, along with the reference curve (if any), or deviations (from the reference curve). See Table 2 under "Building Acoustics Measurement Standards"

#### Signal Monitoring

Input signal A-, C- or Z-weighted can be monitored using an earphone/headphones connected to the headphone socket

**Headphone Signal:** Input signal can be monitored using this socket

with headphones/earphones

**Gain Adjustment:** -60 dB to 60 dB

## Software Specifications – Signal Recording Option BZ-7226

Signal Recording Option BZ-7226 is enabled with a separate license. It works with all analyzer software: Sound Level Meter, Frequency Analysis, and Logging Software, Enhanced Logging Software and Reverberation Time Software.

For data storage, signal recording requires:

- SD Card
- USB Memory Stick

#### RECORDED SIGNAL

A-, B-, C- or Z-weighted signal from the measurement transducer

#### AUTOMATIC GAIN CONTROL

The average level of the signal is kept within a 40 dB range, or the gain can be fixed

#### SAMPLING RATE AND PRE-RECORDING

The signal is buffered for the pre-recording of the signal. This allows the beginning of events to be recorded even if they are only detected later.

Sampling Rate (kHz)	Maximum Pre-recording (s)	Sound Quality	Memory (KB/s)
8	470	Low	16
16	230	Fair	32
24	150	Medium	48
48	70	High	96

## Specifications – Qualifier Type 7830

### STANDARDS

See Tables 1 and 2 under "Building Acoustics Measurement Standards"

### LANGUAGES

English, French, German, Italian and Spanish

### VIEWS

**Result Level Views:** A collection of views showing the resulting single values, reduction curve and underlying average curves (L1, L2, B2 and T20/T30)

**Average Level Views:** Each of the parameters (L1, L2 and B2) has a corresponding view showing all of the measurement curves included in the average calculation and a view of the resulting average curve. In T20/T30 Average mode, it is possible to see all of the T20/T30s included in the average calculation. In Ensemble Average mode, it is possible to see the averaged 3D and averaged single frequency decay curves. Both modes gives the user the ability to see the resulting T20/T30 spectrum

**Position Level Views:** Each of the level measurements (L1, L2 and B2) can be viewed as a spectrum. In addition, the T2 reverberation measurement can be viewed as 3D-multispectra and as single frequency decay curves. Furthermore it is possible to see the calculated T20/T30 spectrum

**Data Sheets:** All of the measurement and the most relevant intermediate and final results can be viewed as values in a table (not decays)

### CURSOR READ-OUT

All curves have cursor read-out

### MANUAL INPUT

Allows graphical input and modification of the regression line in reverberation decay curves. Calculated sound reduction curves can

also be adjusted graphically (The impact on the single value index is shown simultaneously). To give maximum flexibility, position, average and calculated data can be overridden by manually inputting data in the data sheets

### CALCULATIONS

Supports calculation of insulation and reverberation tasks. Insulation calculations include airborne and impact sound insulation (lab/field). In addition, airborne facade calculation is supported.

### REPORT GENERATION

Based on document templates it is possible to make reports conforming to the supported standards

### OUTPUT

Relevant views and sheets can be printed or exported to the clipboard. Text or graphs may be transferred to word processors in RTF (Rich Text Format)

### HELP

Online context-sensitive and user guide

### DATA TRANSFER

• Via USB using Measurement Partner Suite BZ-5503

### MINIMUM PC

- Windows\* 7, 8 or 8.1 (all in 32-bit or 64-bit versions)
- Intel\* Core™ i3
- 2 GB RAM
- Sound card
- DVD drive
- Mouse

## Specifications – Measurement Partner Suite BZ-5503

BZ-5503 is included with Types 2250 and 2270 for easy synchronization of setups and data between the PC and hand-held analyzer. BZ-5503 is supplied on ENV DVD BZ-5298

### PC REQUIREMENTS

**Operating System:** Windows\* 7, 8.1 or 10 (all in 32-bit or 64-bit versions)

### Recommended PC:

- Intel\* Core™ i3
- Microsoft\*.NET 4.5
- 2 GB of memory
- Sound card
- DVD drive
- At least one available USB port
- Solid State Drive

### ONLINE DISPLAY OF TYPE 2250/2270 DATA

Measurements on the analyzer can be controlled from the PC and displayed online with the PC, using the same user interface on the PC as on the analyzer

**Display:** 1024 × 768 (1280 × 800 recommended)

### DATA MANAGEMENT

**Explorer:** Facilities for easy management of analyzers, users, jobs, projects and project templates (copy, cut, paste, delete, rename, create)

**Data Viewer:** View measurement data (content of projects)

**Synchronization:** Project templates and projects for a specific user can be synchronized between PC and analyzer and between local and cloud archives. Measurement Partner Suite BZ-5503 merges Measurement Partner Field App annotations with the corresponding analyzer project

### USERS

Users of Type 2250/2270 can be created or deleted

### EXPORT FACILITIES

**Excel\*:** Projects (or user-specified parts) can be exported to Microsoft\* Excel\* (Excel 2003 – 2016 supported)

**Brüel & Kjær Software:** Projects can be exported\* to Predictor-LimA Type 7810, Acoustic Determinator Type 7816, Protector Type 7825, Qualifier (Light) Type 7830 (7831), PULSE Mapping for Hand-held Sound Intensity Type 7962/7752/7761 or PULSE Reflex

### POST-PROCESSING

Measurement Partner Suite is a suite of modules, including post-processing tools for data acquired with Type2250/2270. The following post-processing modules are available:

- Logging Module BZ-5503-A
- Spectrum Module BZ-5503-B
- WAV File Analysis Module BZ-5503-C

These modules help to assess logging data and measured spectra, such as calculating contribution from markers on a logging profile or correcting spectra for background noise

### HAND-HELD ANALYZER SOFTWARE UPGRADES AND LICENSES

The software controls analyzer software upgrades and licensing of the analyzer applications

### INTERFACE TO HAND-HELD ANALYZER

USB, LAN or Internet connection

\* Not all data are available in all exports. The data exported are dependent on the type and target of the export.

### LICENSE MOVER

To move a license from one analyzer to another use BZ-5503 together with License Mover VP-0647

### LANGUAGE

User Interface in Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German,

Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

### HELP

Concise context-sensitive help in English

## Ordering Information

### Building Acoustics Kits

The following kits are designed to provide Type 2250 and Type 2270 users with the necessary accessories to perform single-channel building acoustics measurements:

#### BZ-7228-200 Building Acoustics Kit for single-channel airborne sound insulation

includes:

- BZ-7228: Building Acoustics Software (includes Reverberation Time Software BZ-7227)
- Type 2734-A: Power Amplifier
- Type 4292-L: OmniPower™ Sound Source (tripod and carrying bag KE-0462 included)
- AO-0523-D-100: Signal Cable, Triaxial LEMO to XLR3M, 10 m (33 ft)
- AQ-0673: Speaker Cable, speakON\* 4-pin (M) to speakON 4-pin (M), 10 m (33 ft)
- KE-0364: Carrying bag for Type 4292-L Tripod
- UA-0801: Tripod for Type 2250

**Note:** Flight case KE-0449 for OmniPower sound source must be purchased separately

#### BZ-7228-300 Building Acoustics Kit for single-channel airborne or impact sound insulation

includes the same items as BZ-7228-200 plus:

- Type 3207: Tapping Machine
- UA-1477: Battery Kit for Type 3207

#### TWO-CHANNEL MEASUREMENTS

Type 2270 users ONLY can upgrade a BZ-7228-200 or BZ-7228-300 kit to perform 2-channel building acoustics measurements with a combination of the following accessories, depending on your measurement scenario:

- BZ-7229: 2-channel Option
- Type 4189: Prepolarized Free-field ½" Microphone
- AO-0697-D-100: Microphone Extension Cable, 10-pin LEMO, 10 m (33 ft)
- AR-0199: Flat Cable, 10-pin LEMO, 0.5 m (1.64 ft)
- JP-1041: Dual 10-pole Adapter Cable
- UA-0801: Lightweight Tripod
- UA-1317: ½" Microphone Holder
- ZC-0032: Microphone Preamplifier

For help determining the type and quantity of required accessories, please contact your local Brüel & Kjær sales representative

## Software and Accessories Available Separately

### Software Modules

BZ-7228	Building Acoustics Software for Types 2250 and 2270
BZ-7228-100	Upgrade of Reverberation Time Software BZ-7227 to Building Acoustics Software BZ-7228
BZ-7229	2-channel Option Type 2270
BZ-7223	Frequency Analysis Software
BZ-7224	Logging Software
BZ-7225	Enhanced Logging Software
BZ-7225-UPG	Upgrade from Logging Software BZ-7224 to Enhanced Logging Software BZ-7225 (does not include memory card)
BZ-7226	Signal Recording Option
BZ-7227	Reverberation Time Software
BZ-7230	FFT Analysis Software
BZ-7231	Tone Assessment Option
BZ-7234	Low Frequency Option

### PC SOFTWARE

BZ-5503-A	Measurement Partner Suite, Logging Module
BZ-5503-B	Measurement Partner Suite, Spectrum Module
BZ-5503-C	Measurement Partner Suite, WAV file analysis module

### Type 7830

### MEASUREMENT ACCESSORIES

Type 3923	Rotating Microphone Boom
Type 4231	Sound Calibrator
AO-0440-D-015	Signal Cable, LEMO to BNC, 1.5 m (5 ft)
AO-0646	Sound Cable, LEMO to Minijack, 1.5 m (5 ft)
AO-0697-030	Microphone Extension Cable, 10-pin LEMO, 3 m (10 ft)
AO-0697-100	Microphone Extension Cable, 10-pin LEMO, 10 m (33 ft)

AR-0199	Flat Cable, 10-pin LEMO, 0.5 m (1.64 ft)
JP-1041	Dual 10-pole Adaptor
KE-0449	Flight case for OmniPower Sound Source Type 4292-L
UA-0587	Tripod
UA-0801	Lightweight Tripod
UA-1317	½" Microphone Holder
UA-1404	Outdoor Microphone Kit
UA-1476	Wireless Remote Control Unit
UL-0256	Wireless Audio System kit, B&K specified
UL-0256-A	Wireless Audio System (AKG WMS 470 Set, RF Band VII-50 mW)
UL-1009	SD Memory Card for hand-held analyzers
UL-1013	CF Memory Card for hand-held analyzers, hardware versions 1 – 3
UL-1017	SDHC Memory Card for hand-held analyzers
ZG-0444	Charger for Battery Pack QB-0061

Brüel & Kjær supplies a wide range of microphones and microphone accessories. Please contact your local Brüel & Kjær office for more information regarding the different types and their use, or visit the website at [www.bksv.com](http://www.bksv.com).

### INTERFACING

BZ-5503-D	Measurement Partner Field App for iOS and Android (free download at App Store* and Google Play™)
BZ-5503-E	Measurement Partner Cloud Entry Level, free cloud storage
BZ-5503-F-012	Measurement Partner Cloud Basic, basic cloud storage subscription for one year
BZ-5503-G-012	Measurement Partner Cloud Professional, enterprise cloud storage subscription for one year
AO-1449-D-010	LAN Cable

UL-0250 USB to RS-232 Converter  
UL-1050 Wireless USB-A Adapter

**SOUND SOURCES**

Type 4292-L OmniPower Sound Source  
Type 4295 OmniSource™ Sound Source  
Type 3207 Tapping Machine  
Type 2734-A Power Amplifier  
Type 2734-B Power Amplifier with Wireless Audio System  
UL-0256

For further information please refer to the Sound Sources for Building Acoustics product data, BP 1689

Type 4224 Portable Battery & Mains Powered Sound Source  
For further information please refer to the Sound Source Type 4224 product data, BP 0066

**Service Products**

**ACCREDITED CALIBRATION**

2250-CAI Accredited Initial Calibration of Type 2250  
2250-CAF Accredited Calibration of Type 2250  
2270-CAI Accredited Initial Calibration of Type 2270  
2270-CAF Accredited Calibration of Type 2270

**HARDWARE MAINTENANCE**

2250-EW1 Extended Warranty of Type 2250, one year extension  
2270-EW1 Extended Warranty of Type 2270, one year extension

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# PRODUCT DATA

## 1/2" Prepolarized Free-field Microphone — Type 4189

Type 4189 is designed for high-precision, free-field measurements where a microphone with high sensitivity is required. Being prepolarized, Type 4189 can be used with both DeltaTron® and classical preamplifiers.



080143

### USES

- Precision sound measurement
- Premium class sound level meters
- Equipment complying with IEC 61672 class 1

### Use of Free-field Microphones

At higher frequencies, reflections and diffractions causes a pressure increase in front of the diaphragm of a microphone. If not corrected, for this would result in an increased output voltage. A free-field optimisation means that the frequency response of the microphone has been designed in such a way that the free-field response at 0 degrees incidence is flat. This microphone is optimised for use with the protection grid in place.

Free-field microphones are commonly used for sound measurement in an anechoic chamber or far away from reflecting buildings, etc. Another area for free-field microphones is for general electroacoustic measurements purposes like loudspeaker and microphone measurements.

Type 4189 is suited for use in class I Sound Level Meters and for all high-precision acoustic measurements where a robust and stable free-field microphone with an upper frequency of 20 kHz is required.

### Manufacturing and Stability

A press-fitted, stainless-steel diaphragm ensures superior long-term stability and mechanical robustness – Type 4189 will withstand the 1 m drop test of IEC 60068-2-32.

All Brüel & Kjær Measuring Microphones are assembled in a clean room. This ensures that the microphones maintain their inherent low noise floor and high stability,

### FEATURES

- Sensitivity: 50 mV/Pa
- Frequency: 6.3 Hz – 20 kHz
- Dynamic Range: 14.6 – 146 dB
- Temperature: –30 to +150°C (–22 to +302°F)
- Polarization: Prepolarized

even when used in environments with a combination of high humidity and high temperature.

### Polarization Voltage

Being prepolarized, Type 4189 is especially well suited for battery operated equipment and operation in environments with high humidity.

### TEDS Microphones

Type 4189 is available in TEDS combinations with either classical or DeltaTron type preamplifier. The TEDS microphone is considered one unit and has been sealed in a clean environment. The TEDS is programmed with the loaded sensitivity of the actual cartridge and the data is therefore readily available. The default TEDS template is to IEEE P1451.4 but TEDS to IEEE 1451.4 is available on request.

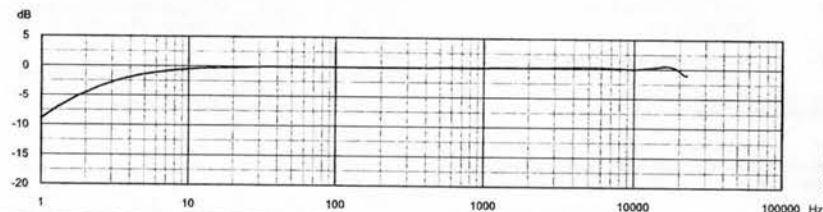
### Individual Calibration Data

Each Type 4189 comes with an individual calibration chart including information about the open-circuit sensitivity, the frequency response in a free field as well as the electrostatic actuator response.

An enclosed mini-CD contains the individual calibration data at 1/12-octave frequencies plus a wealth of technical information, such as the influence of different accessories, response in different sound fields and much more. Using the CD data and the REq-X feature of PULSE™, a real-

time correction for different measurement situations, can increase measurement accuracy.

Fig. 1 Typical free-field response of the microphone with protection grid. The low-frequency response is valid when the vent is exposed to the sound field



### Specifications – 1/2" Free-field Microphone Type 4189 (valid from serial number 2495387)

IEC 61094-4 Type Designation: WS2F  
 Polarization Voltage: 0 V (prepolarized)  
 Open-circuit Sensitivity (250 Hz)<sup>a</sup>: 50 mV/Pa, –26 dB ± 1.5 dB re 1 V/Pa  
 0° Incidence Free-field Response<sup>a</sup>: 10 Hz to 8 kHz: ± 1 dB  
 6.3 Hz to 20 kHz ± 2 dB  
 Lower Limiting Frequency (–3 dB)<sup>b</sup>: 2 to 4 Hz  
 Pressure Equalization Vent: Rear vented  
 Diaphragm Resonance Frequency: 14 kHz (90° phase shift)  
 Cartridge Capacitance<sup>a</sup>: 14 pF at 250 Hz  
 Equivalent Air Volume: 46 mm<sup>3</sup> (250 Hz)  
 Pistonphone Correction (Type 4228 with DP-0776) 0.00 dB  
 Cartridge Thermal Noise: 14.6 dB(A), 15.3 dB(Lin)  
 Upper Limit of Dynamic Range (3% Distortion): > 146 dB SPL<sup>b</sup>

Max. Sound Pressure Level: 158 dB (peak)  
**ENVIRONMENTAL**  
 Operating Temperature Range: –30 to +150°C (–22 to +302°F)  
 Storage Temperature: –22 to +158°F  
 With Mini-CD: 5 to 50°C (41 to 122°F)  
 Temperature Coefficient (250 Hz): –0.006 dB/K (–10 to +50°C, 14 to 122°F)  
 Pressure Coefficient: –0.01 dB/kPa  
 Operating Humidity Range: 0 to 100% RH (without condensation)  
 Influence of Humidity: < 0.1 dB in the absence of condensation  
 Vibration Sensitivity (< 1000 Hz): 62.5 dB equivalent SPL for 1 m/s<sup>2</sup> axial vibration

**Magnetic Field Sensitivity:** 6 dB SPL for 80 A/m, 50 Hz field  
**Estimated Long-term Stability:**  
 > 1000 years/dB in dry air at 20°C (68°F)  
 > 2 hours/dB in dry air at 150°C (302°F)  
 > 40 years/dB in air at 20°C (68°F), 90% RH  
 > 1 year/dB in air at 50°C (122°F), 90% RH

**DIMENSIONS**  
**Diameter with Grid:** 13.2 mm (0.52")  
**Diameter without Grid:** 12.7 mm (0.50")  
**Height with Grid:** 17.6 mm (0.69")  
**Height without Grid:** 16.3 mm (0.64")

**Thread for Preamplifier Mounting:** 11.7 mm – 60 UNF

**Note:** All values are typical at 23°C (73.4°F), 101.3 kPa and 50% RH unless otherwise specified

a. Individually calibrated

b. 137 dB (peak) with DeltaTron preamplifier and 24 V supply and 140 dB (peak) with ± 15 V supply

CE Compliance with EMC Directive

### Ordering Information

Type 4189	1/2" Prepolarized Free-field Microphone	4189-C-001	1/2" Free-field Microphone with Preamplifier Type 2669-C	Type 4226	Multifunction Acoustic Calibrator
Includes the following accessories:		4189-L-001	1/2" Free-field Microphone with Preamplifier Type 2669-L	DP-0776	Calibration Adaptor for 1/2" Microphones
• BC-0224: Calibration Chart <sup>c</sup>		4189-W-003	1/2" Free-field Microphone with Preamplifier Type 2671-W-001	UA-0033	Electrostatic Actuator
• BC-5002: Microphone Mini-CD <sup>c</sup>		<b>OPTIONAL ACCESSORIES</b>		UA-1260	1/2" Angle Adaptor (approx. 80°)
<b>TEDS COMBINATIONS</b>		Type 2669	1/2" Microphone Preamplifier	UA-0386	Nose Cone for 1/2" Microphone
4189-A-021	1/2" Free-field Microphone with Preamplifier Type 2671	Type 2671	1/2" DeltaTron Preamplifier	UA-0237	Windscreen for 1/2" microphone, 90 mm diameter
4189-A-031	1/2" Free-field Microphone with Preamplifier Type 2699	2671-W-001	1/2" DeltaTron Preamplifier (version with LLF < 1.2 Hz)	UA-0459	Windscreen for 1/2" microphone, 65 mm diameter
4189-B-001	1/2" Free-field Microphone with Preamplifier Type 2669-B	Type 2699	1/2" DeltaTron Preamplifier, A-weighted	BA 5105	The Microphone Handbook
		Type 4231	Sound Calibrator	<b>CALIBRATION SERVICES</b>	
		Type 4228	Pistonphone	4189-CAI	Accredited Initial Calibration
				4189-CAF	Accredited Calibration
				4189-CFF	Factory Standard Calibration

Brüel & Kjær reserves the right to change specifications and accessories without notice

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Local representatives and service organisations worldwide

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# PRODUCT DATA

## Piezoelectric Accelerometer DeltaTron® Accelerometer — Type 8344

### Features

- Low-level measurement
- Low noise
- High sensitivity
- TEDS
- 10–32 UNF output side connector
- Hermetically sealed



### Description

Type 8344 is a piezoelectric DeltaShear® accelerometer with integral electronics. It can be mounted on a test object with a M5-threaded steel stud. The transducer is hermetically sealed and has a Transducer Electronic Data Sheet (TEDS) containing sensor and application-specific information, including frequency response compensation.

### Characteristics

This piezoelectric accelerometer features a built-in DeltaTron preamplifier, so it must be supplied with a constant current and treated as a voltage source. The sensitivity is expressed in terms of voltage per unit acceleration (mV/g).

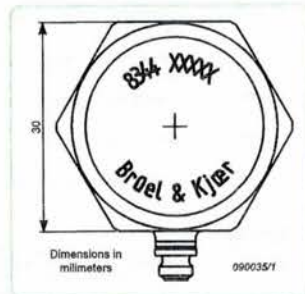
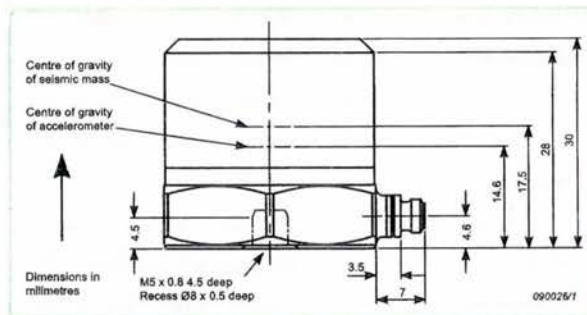
The DeltaShear design involves three piezoelectric elements and three masses arranged in a triangle around a triangular centre post that is bolted to the housing. The ring pre-stresses the

piezoelectric elements to give a high degree of linearity. The signal is collected between the housing and the clamping ring and then amplified by the built-in DeltaTron preamplifier. The piezoelectric element used is a PZ27 lead zirconate titanate element. The housing material is stainless steel.

### Calibration

Each transducer is individually calibrated using state-of-the-art random FFT technology, providing 1600-point high-resolution calibration (magnitude and phase), ultimately giving a unique characterisation and securing the integrity of the vibration measurement.

The sensitivity given in the included calibration chart has been measured at 159.2 Hz and an acceleration of 10 g. For 99.9% confidence level, the accuracy of the factory calibration is ± 2%.



## Specifications – DeltaTron Accelerometer Type 8344

	Unit	8344*
<b>Dynamic Characteristics</b>		
Voltage Sensitivity (@ 159.2 Hz and 4 mA supply current)	mV/ms <sup>-2</sup> (mV/g)	250 ± 20% (2500 ± 20%)
Measuring Range	ms <sup>-2</sup> peak (g peak)	± 26 (2.6)
Frequency Range (± 10% limit) Amplitude Response	Hz	0.2–3000
Frequency Response		See individual Frequency Response on calibration chart
Mounted Resonance Frequency	kHz	> 10
Transverse Sensitivity (@ 30 Hz, 100 ms <sup>-2</sup> )	%	< 5 of the sensitivity of the axis in question
Transverse Resonance Frequency	kHz	3.5
Polarity		Polarity of the electrical signal is positive for an acceleration in the direction of the arrow on the drawing
<b>Electrical Characteristics</b>		
Bias Voltage (at full temperature and current range)	V <sub>dc</sub>	13 ± 1
Power Supply		
Constant current	mA	2 to 20
Unloaded Supply Voltage	V	+ 24 to + 30
Output Impedance	Ω	< 30
Start-up Time	s	< 30
Residual Noise (RMS)		
Broadband noise (0.2 Hz to 3 kHz)	μV (μg)	113(45)
Spectral:	ms <sup>-2</sup> /√Hz (μg/√Hz)	1.1 × 10 <sup>-4</sup> (11)
10 Hz		7.75 × 10 <sup>-6</sup> (0.78)
100 Hz		7.75 × 10 <sup>-7</sup> (0.078)
1000 Hz		3.46 × 10 <sup>-7</sup> (0.035)
Signal Grounded		Connected to case
<b>Environmental Characteristics</b>		
Operating Temperature Range	°C (°F)	-50 to +100 (-58 to +212)
Temperature Coefficient of Sensitivity	%/°C	+ 0.05
Temperature Transient Sensitivity (3 Hz LLF, 20 dB/decade)	ms <sup>-2</sup> /°C	0.001
Base Strain Sensitivity (at 250 μm in base plane)	Equiv. ms <sup>-2</sup> /μm (g/μm)	0.002 (0.0002)
Magnetic Sensitivity (50 Hz, 0.038 T)	ms <sup>-2</sup> /T (g/T)	0.5 (0.05)
Max. Non-destructive Shock	ms <sup>-2</sup> peak (g peak)	3500 (350)
Humidity		100% RH non-condensing
<b>Physical Characteristics</b>		
Case Material		Stainless steel AISI 316–L
Sensing Element		Piezoelectric, Type PZ27
Construction		DeltaShear
Sealing		Hermetically sealed
Weight (excluding cable)	gram (oz.)	176 (6.2)
Electrical Connector		10–32 UNF
Mounting		M5
Mounting Torque	Nm (lbf-in)	Max. 3.5 (31), Min 0.5 (4.4)
Dimensions		See outline drawing

\* All values are typical at 25°C (77°F) unless otherwise specified

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## Ordering Information

Type 8344 includes the following accessory:  
• Calibration Chart

Optional Accessories*	
AO-0038-D-xxx	Teflon® super low-noise cable, 10–32 UNF to 10–32 UNF, -75 °C to +250 °C.
AO-0531-D-xxx	PVC coaxial single-screen cable, 10–32 UNF to BNC, -20 °C to +70 °C
QA-0068	Tap for M5 thread
JP-0145	Plug adaptor, BNC to 10–32 UNF
UA-0186	Extension connector for 10–32 UNF cables, set of 25
QS-0007	Tube of cyanoacrylate adhesive
YJ-0216	Beeswax for mounting
Type 4294-002	Calibration Exciter
Calibration Services	
8344-CFF	Factory Standard Calibration including programming of TEDS
8344-CAF	Accredited Calibration including programming of TEDS
8344-CAI	Accredited Initial Calibration including programming of TEDS
8344-CTF	Traceable Calibration including programming of TEDS

\* Additional accessories, cables and services are available (see www.bksv.com)

CE Compliance with EMC Directive and Low Voltage Directive of the EU  
Compliance with the EMC requirements of Australia and New Zealand



Brüel & Kjær

## Cenová nabídka - příloha č.2

**SVMTech s.r.o.**
**NABÍDKA č. 18NPV00112**

<p>Dodavatel:</p>  <p><b>SVMTech s.r.o.</b>  <b>Počernická 272/96</b>  <b>108 00 Praha 10</b>          IČ: 04004205          DIČ: CZ04004205</p> <p>Telefon: +420 296 411 900          Mobil: +420 606 800 196          Fax: +420 296 411 901          E-mail: info@svmttech.cz          www.svmttech.cz</p> <p>Nabídka č.: 18NPV00112          Datum nabídky: 17.12.2018          Platnost do: 17.01.2019          Platební podmínky: Příkazem          Splatnost: 14 dní</p>	<p>Odběratel: IČ: 60460709          DIČ: CZ60460709</p> <p><b>Česká zemědělská univerzita v Praze</b>  <b>Kamýcká 961/129</b>  <b>165 00 Praha</b></p> <p><b>Česká republika</b>          Tel.:</p> <p>Konečný příjemce:</p>
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**Měřicí systém pro stavební akustiku**

Kód	Název	Množství	J.cena	Sleva	Cena Kč	%DPH
<b>Stavební akustika</b>						
2270-S-C:	Dvoukanálový ruční analyzátor 2270, kalibrátor 4231	1 ks	264 425,00	5,0%	251 203,75	21%
BZ-7228-300:	Sada pro měření zvuk. vzduchové a kročejové neprůzv.: BZ-7228, 4292-L, 2734-A, 3207 s přísl.	1 ks	519 820,00	5,0%	493 829,00	21%
4189:	1/2" mikrofon do volného pole, 6 Hz-20 kHz, předpolarizovaný	1 ks	40 020,00	5,0%	38 019,00	21%
AO-0697-D-050:	Mikrofonní kabel, circular-1B 10-pin (M) - circular-1B 10-pin (F), 5m, max.+70°C	2 ks	13 746,00	5,0%	26 117,40	21%
ZC-0032:	Mikrofonní předzesilovač pro ruční analyzátor	1 ks	21 315,00	5,0%	20 249,25	21%
AO-0697-D-100:	Mikrofonní kabel, circular-1B 10-pin (M) - circular-1B 10-pin (F), 10m, max.+70°C	1 ks	15 950,00	5,0%	15 152,50	21%
AO-0697-D-200:	Mikrofonní kabel, circular-1B 10-pin (M) - circular-1B 10-pin (F), 20m, max.+70°C	1 ks	20 300,00	5,0%	19 285,00	21%
AR-0199:	Kabel plochý, XF-0081, konektory circular 10-pin (M) - circular 10-pin (F), 0,5m	2 ks	15 370,00	5,0%	29 203,00	21%
JP-1041:	Adaptér-kabel, konektory long-body-circular-1B 10-pin (M) - 2x circular 1B 10-pin (F)	1 ks	11 484,00	5,0%	10 909,80	21%
UA-0750:	Kompaktní statív, hliník, 0,4m - 1,31m, černý	3 ks	4 495,00	5,0%	12 810,75	21%
UA-1317:	Držák pro 1/2" mikrofony	2 ks	2 625,00	5,0%	4 987,50	21%
UA-1650:	Kryt mikrofonu (90mm) pro analyzátor 2250 s autodetekcí	1 ks	2 593,00	5,0%	2 463,35	21%
<b>Software</b>						
BZ-7230:	Software FFT Analýza pro analyzátor 2250 & 2270	1 ks	48 024,00	5,0%	45 622,80	21%
7830:	Software Qualifier - zpracování a report dat a výsledků (Stavební akustika)	1 ks	84 854,00	5,0%	80 611,30	21%
BZ-7234:	Software pro měření nízkých kmitočtů a rozšířené měření vibrací (2250 & 2270)	1 ks	24 012,00	5,0%	22 811,40	21%
<b>Měření vibrací</b>						
8344:	Akoelerometr s vysokou citlivostí	1 ks	40 783,00	5,0%	38 743,85	21%

Int. č. dodavatele:

Strana 1 dokladu 18NPV00112

Kód	Název	Množství	J.cena	Sleva	Cena Kč	%DPH
AO-0702-D-080:	Kabel, nízkošumový, 10-32 UNF(M) - triax-00 (M), 8,0m , max. +200°C (392°F)	1 ks	10 817,00	5,0%	10 276,15	21%
YJ-0216:	Bílý včelí vosk pro upevnění akcelerometrů	5 ks	94,00	5,0%	446,50	21%
<b>Ostatní</b>						
ST-PSKOH-IND:	Školení individuální školení u zákazníka (1den)	1 ks	15 000,00		15 000,00	21%
ST-SHIP-050:	Balné, doprava (do 50 kg)	1 ks	5 250,00		5 250,00	21%
DPH Celkem					240 028,39 Kč	
Zaokrouhlení					0,31 Kč	
<b>Celkem (bez DPH)</b>					<b>1 142 992,30 Kč</b>	
Celkem k úhradě (vč. DPH)					1 383 021,00 Kč	
<p>Využijte služeb našeho AKREDITOVANÉHO KALIBRAČNÍHO CENTRA.</p> <p>Vystavil: Pavla Vaňková pavla.vankova@svmtech.cz</p> <p>Záruční doba: 24 měsíců Termín dodání: 21 dní</p> <p>Volitelné položky nejsou započítány v celkové ceně. Pro zboží s klasifikací zboží dvojího užití (dual use) je nezbytné uvádět koncového zákazníka.</p> <p>Dodací podmínky: CIP (INCOTERMS 2010)</p> <p>Všeobecné obchodní podmínky SVMTech s.r.o. jsou v aktuální verzi dostupné na <a href="http://www.svmtech.cz">www.svmtech.cz</a>.</p> <p>Společnost je držitelem certifikátu ISO 9001:2015 - Prodej a servis přístrojové techniky, organizace souvisejících vzdělávacích kurzů.</p>						
Int. č. dodavatele:				Strana 2 dokladu 18NPV00112		

