

# **Technická specifikace nabízeného zařízení**

**Pro V 00632 – dodávka měřících přístrojů  
Část 2: 3 plynové chromatografy s příslušenstvím**

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## **1. HPST – autorizovaný distributor analytických přístrojů Agilent Technologies**

S pořízením plynového chromatografu Agilent od společnosti HPST s.r.o. (dále jen HPST) nezákáte pouze výkonný a robustní analytický přístroj. Díky dominantnímu postavení na českém trhu a rozšířenosti plynových chromatografů Agilent disponuje firma HPST nejširším týmem odborníků (7 odborně zaměřených zaměstnanců – 6 servisních techniků a aplikační specialista) pro oblast plynové chromatografie v ČR. Tito lidé pravidelně procházejí servisním a aplikačním školením. Firma HPST také nabízí pokročilá uživatelská školení zaměřená na software i hardware a odbornou aplikační podporu prostřednictvím zkušených aplikačních specialistů, kteří jsou schopni vyvinout či optimalizovat metody přesně podle Vašich potřeb. Koupí plynového chromatografu Agilent Technologies od firmy HPST tak získáte jistotu bezproblémových analýz a bezkonkurenčních servisních služeb.

## 2. Technická specifikace – splnění požadavků zadavatele

- a) Příklad č. 1 - Technické požadavky pro zařízení plynový chromatograf s hmotnostní detekcí a termální desorpce pro stanovení formaldehydu, organických halogenových sloučenin a siřných látek

| Základní technické parametry                                                                                                                                                                                                                                                                                                                                                                                     | Požadovaná úroveň parametrů        | Specifikace parametrů nabízeného zařízení                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------------------------------------------------------|
| <b>Plynový chromatograf</b>                                                                                                                                                                                                                                                                                                                                                                                      |                                    | <b>Plynový chromatograf 8890</b>                                                 |
| Provozní teploty termostatu (pece) chromatografu                                                                                                                                                                                                                                                                                                                                                                 | +4 °C nad okolní teplotu až 450 °C | Ano,<br>+4 °C nad okolní teplotu až 450 °C                                       |
| Minimální rychlost ohřevu termostatu v plném rozsahu teplot do 450 °C                                                                                                                                                                                                                                                                                                                                            | min 65 °C/min                      | Ano,<br>pro jednokanálový systém je minimální rychlost ohřevu 65 °C/min          |
| Minimální počet teplotních ramp a prodlev                                                                                                                                                                                                                                                                                                                                                                        | 20                                 | Ano,<br>20 ramp a 21 prodlev                                                     |
| Maximální doba chlazení z teploty 450 °C na 50 °C                                                                                                                                                                                                                                                                                                                                                                | 210 sec                            | Ano,<br>chlazení ze 450 na 50°C 210 sekund (okolní teplota 22°C, insert v peci). |
| Průtoky plynů řízené elektronicky pro automatickou kontrolu průtoků nebo tlaku plynů jak ve vstupních portech a kolonách, tak v detektorech. Možnost volby zobrazení hodnot tlaku v alespoň dvou jednotkách (psi, kPa nebo bar).                                                                                                                                                                                 | ano                                | Ano                                                                              |
| Inteligentní jednotka plynového chromatografu umožňující <ul style="list-style-type: none"> <li>- automaticky nebo ručně uživatelem spouštěné diagnostické testy</li> <li>- možnost vzdáleného připojení přes webový prohlížeč</li> <li>- automatické upozornění uživatele na včasnou výměnu opotřebitelných dílů</li> <li>- diagnostiku nejčastějších problémů včetně poskytnutí doporučeného řešení</li> </ul> | ano                                | Ano                                                                              |

|                                                                                                                                                                            |                                                                                                                   |                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| - zobrazení návodných postupů běžné údržby plynového chromatografu                                                                                                         |                                                                                                                   |                                                                                                                                                     |
| Napojení kolony na modul termální desorpce pomocí nerezové spojky umožňující její snadnou výměnu                                                                           | ano                                                                                                               | Ano                                                                                                                                                 |
| <b>Přístroj pro termální desorpci</b>                                                                                                                                      |                                                                                                                   | Termální desorbér MARKES Unity <sup>xr</sup> , vybavený moduly Ultra, CIA a Kori                                                                    |
| Propojení s dodávaným plynovým chromatografem                                                                                                                              | ano                                                                                                               | Ano                                                                                                                                                 |
| Technologie fokusačního trapu s možností automatického splitování a automatické rekolekce vzorku na záložní trubičku pro optimalizaci nástřiku a možnost opakování analýzy | ano                                                                                                               | Ano                                                                                                                                                 |
| Všechny požadované provozní teploty musí být dosaženy elektronicky bez využití kryogenního chlazení                                                                        | ano                                                                                                               | Ano                                                                                                                                                 |
| Elektronická kontrola všech průtoků plynů v celém zařízení (včetně splitování).                                                                                            | ano                                                                                                               | Ano                                                                                                                                                 |
| Kompatibilní s heliem, vodíkem a dusíkem jako nosným plynem                                                                                                                | ano                                                                                                               | Ano                                                                                                                                                 |
| Provozní teploty desorpční pece                                                                                                                                            | Minimálně v rozsahu od 50 do 400 °C, nastavitelné v krocích po 1 °C                                               | Ano, Teplotní rozsah pro desorpci zakoncentrovávacího trapu od 35 °C to 425 °C, nastavitelné po 1 °C.                                               |
| Provozní teploty zakoncentrovávacího trapu                                                                                                                                 | Minimálně v rozsahu od mínus 30 °C až do 400 °C                                                                   | Ano, provozní teplota zakoncentrovávacího trapu mínus 30 až 425 °C.                                                                                 |
| Kompatibilní s trubičkami o rozměru 3,5"                                                                                                                                   | ano                                                                                                               | Ano                                                                                                                                                 |
| Automatický dávkovač trubiček                                                                                                                                              | Ano, s kapacitou minimálně 50 trubiček                                                                            | Ano, jednotka ULTRA od výrobce MARKES. 99 pozic.                                                                                                    |
| Jednotka pro dávkování vzorků z bagů a kanystrů (a to včetně kanystrů naplněných pouze za atmosférického tlaku)                                                            | Ano, kapacita alespoň 14 kanálů, vybavené hmotnostním regulátorem průtoku a možností opakovaného dávkování vzorku | Ano, jednotka CIA od výrobce MARKES.<br>Kapacita 14 inertních kanálů, hmotnostní regulátor průtoku, možnost opakovaného dávkování na fokusační trap |

|                                                                                                                                                                                               |                                                                                                                                                                  |                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                               | na fokusační trap před nástřikem do plynového chromatografu                                                                                                      |                                                                                                     |
| Zařízení pro odstranění vlhkosti ze vzorku před jeho dávkováním na fokusační trap vhodné k sériovému zapojení s dávkovačem vzorků z kanystrů a bagů. Zařízení nesmí odstraňovat jiné analyty. | ano                                                                                                                                                              | Ano,<br>jednotka Kori od výrobce MARKES.                                                            |
| Zařízení pro kondicionaci trubiček                                                                                                                                                            | Kapacita alespoň 20 trubiček kondiciovaných současně, vybavené zařízením pro zápis informace o kondicionaci přímo na zapisovací zařízení kondiciovaných trubiček | Ano,<br>modul TC-20TAG od výrobce MARKES včetně tubeTAG startovacího kitu.                          |
| Fokusační trapy potřebné pro požadovanou analýzu                                                                                                                                              | ano                                                                                                                                                              | Ano,<br>Dva trapy vhodné pro zamýšlenou analýzu                                                     |
| Izolace cest (např. spojovacích trubiček) pro zabránění kondenzace analyzovaných látek na chladných stěnách                                                                                   | ano                                                                                                                                                              | Ano,<br>Inertní vyhřívané cesty včetně cesty pro dávkování vzorku do modulu CIA.                    |
| Příruční leak detektor pro kontrolu těsnosti                                                                                                                                                  | ano                                                                                                                                                              | Ano                                                                                                 |
| Příruční detektor pro měření průtoku                                                                                                                                                          | ano                                                                                                                                                              | Ano                                                                                                 |
| <b>Hmotnostní detektor</b>                                                                                                                                                                    |                                                                                                                                                                  | <b>Hmotnostní detektor Agilent Technologies, model 5977C s iontovým zdrojem typu InertExtractor</b> |
| Hmotnostní detektor na bázi jednoduchého kvadrupólu                                                                                                                                           | ano                                                                                                                                                              | Ano                                                                                                 |
| Ionizační techniky: elektronová ionizace (EI)                                                                                                                                                 | ano                                                                                                                                                              | Ano                                                                                                 |
| Systém duálních (dvou) vláken na EI zdroji                                                                                                                                                    | ano                                                                                                                                                              | Ano                                                                                                 |
| Minimální nejvyšší provozní teplota inertního iontového zdroje                                                                                                                                | 350 °C                                                                                                                                                           | Ano,<br>350 °C                                                                                      |
| Minimální nejvyšší teplota samostatně vyhřívaného interface                                                                                                                                   | 350 °C                                                                                                                                                           | Ano,<br>350 °C                                                                                      |

|                                                                                                                                                                                                                                                                                                                                                                                            |                                                   |                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------------|
| Provozní teplota kvadrupólového analyzátoru pro možnost automatického tepelného čištění v průběhu analýzy, maximální robustnost a eliminace použití předfiltrů vyžadujících údržbu/výměnu                                                                                                                                                                                                  | Alespoň 180 °C                                    | Ano,<br>200 °C                                          |
| Kontrola výstupního vakua                                                                                                                                                                                                                                                                                                                                                                  | ano                                               | Ano                                                     |
| Minimální hmotnostní rozsah                                                                                                                                                                                                                                                                                                                                                                | 1 - 1050 m/z                                      | Ano,<br>0,6 – 1091 m/z                                  |
| Minimální skenovací rychlost                                                                                                                                                                                                                                                                                                                                                               | 20000 amu/sec                                     | Ano,<br>20000 amu/sec                                   |
| Detekční limit přístroje pro oktafluornaftalen (OFN)                                                                                                                                                                                                                                                                                                                                       | Minimálně 10 fg                                   | Ano,<br>10 fg OFN                                       |
| Možnost budoucího upgrade přístroje za účelem zvýšení citlivosti detektoru pouhou výměnou iontového zdroje                                                                                                                                                                                                                                                                                 | Zvýšení detekčního limitu na minimálně 1,5 fg OFN | Ano,<br>iontový zdroj typu High Efficiency source (HES) |
| Možnost budoucího upgrade GC/MSD iontovým zdrojem v inertním provedení typu hydroinert nebo analogický zajišťující prokazatelnou eliminaci spektrálních anomálií při použití vodíku jako nosného plynu.                                                                                                                                                                                    | ano                                               | Ano,<br>iontový zdroj typu HydroInert                   |
| <b>Vyhodnocovací a ovládací software</b>                                                                                                                                                                                                                                                                                                                                                   |                                                   | OpenLab                                                 |
| Přístroj bude připojen a ovládán analytickým SW, jehož požadavky jsou uvedeny níže.                                                                                                                                                                                                                                                                                                        | ano                                               | Ano                                                     |
| <b>Další příslušenství</b>                                                                                                                                                                                                                                                                                                                                                                 |                                                   |                                                         |
| Diafragmová vakuová pumpa bezolejová, min. výkonost alespoň 60 l/min.                                                                                                                                                                                                                                                                                                                      | ano                                               | Ano                                                     |
| Vhodná kolona pro stanovení požadovaných analytů                                                                                                                                                                                                                                                                                                                                           | ano                                               | Ano                                                     |
| Záložní zdroj (UPS) v provedení RT Rack/Tower s ližinami, vhodné pro nabízený přístroj za účelem ochrany proti přepětí a překlenutí krátkého výpadku proudu (cca 10 minut), minimální výkon 3 kVA. Minimální požadavky: výstupní napětí v podobě čistého sinusového průběhu (nikoli modifikovaný), celkově alespoň 2 zásuvky s IEC 16 A a další alespoň 3 zásuvky s IEC 10 A, grafický LCD | ano, 3 ks                                         | Ano,<br>UPS od výrobce Eaton, viz. produktový list níže |

|                                                                                                                                                                |     |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| display s informacemi o stavu UPS a měřených veličinách (spotřeby el. energie na úrovni skupin zásuvek) a funkcí tzv. Cybersecurity – UL 2900-1 + IEC62443-4-2 |     |     |
| <b>Další požadavky</b>                                                                                                                                         |     |     |
| Pokročilé zaškolení a zavedení metod zkušeným aplikačním specialistou v rozsahu min. 7 dnů                                                                     | ano | Ano |

**b) Přístroj č. 2 - Technické požadavky pro zařízení plynový chromatograf pro stanovení argonu, kyslíku a dusíku**

| Základní technické parametry                                                                                                                                                                                            | Požadovaná úroveň parametrů        | Specifikace parametrů nabízeného zařízení                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------------------------------------------------|
| <b>Plynový chromatograf</b>                                                                                                                                                                                             |                                    | <b>Plynový chromatograf 8890 s detektorem PDHID</b>                                |
| Provozní teploty termostatu (pece) chromatografu                                                                                                                                                                        | +4 °C nad okolní teplotu až 450 °C | Ano,<br>+4 °C nad okolní teplotu až 450 °C                                         |
| Minimální rychlost ohřevu termostatu v plném rozsahu teplot do 450 °C                                                                                                                                                   | 65 °C/min                          | Ano,<br>pro jednokanálový systém je minimální rychlost ohřevu 65 °C/min            |
| Minimální počet teplotních ramp a prodlev                                                                                                                                                                               | 20                                 | Ano,<br>20 ramp a 21 prodlev                                                       |
| Maximální doba chlazení z teploty 450 °C na 50 °C                                                                                                                                                                       | 210 sec                            | Ano,<br>chlazení ze 450 na 50 °C 210 sekund (okolní teplota 22 °C, insert v peci). |
| Průtoky plynů řízené elektronicky pro automatickou kontrolu průtoků nebo tlaku plynů jak ve ventilech, kolonách, tak v detektorech. Možnost volby zobrazení hodnot tlaku v alespoň dvou jednotkách (psi, kPa nebo bar). | ano                                | Ano                                                                                |
| Zařízení umožňující pomocí kapalného dusíku vychladit termostat chromatografu                                                                                                                                           | Dosažitelná teplota alespoň -20 °C | Ano                                                                                |
| Inteligentní jednotka plynového chromatografu umožňující<br>- automaticky nebo ručně uživatelem spouštěné diagnostické testy                                                                                            | ano                                | Ano                                                                                |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>- možnost vzdáleného připojení přes webový prohlížeč</li> <li>- automatické upozornění uživatele na včasnou výměnu opotřebitelných dílů</li> <li>- diagnostiku nejčastějších problémů včetně poskytnutí doporučeného řešení</li> <li>- zobrazení návodných postupů běžné údržby plynového chromatografu</li> </ul>                                                                                                                                                                                                 |           |                                                            |
| Detektor využívající ionizovaného helia pro analýzu a stanovení požadovaných hladin dusíku, argonu a kyslíku. Nesmí obsahovat radioaktivní materiál.                                                                                                                                                                                                                                                                                                                                                                                                      | ano       | Ano,<br>detektor PDHID od výrobce VICI.                    |
| Vyhřívané, plně SW řízené 1x 6-ti a 1x 10-ti cestné ventily pro flexibilní nastavení metodiky analýzy plyných vzorků, s možností napojení kapilárních i náplňových kolon, s pneumatickými aktuátory zajišťující přepínání poloh ventilů                                                                                                                                                                                                                                                                                                                   | ano       | Ano                                                        |
| <b>Vyhodnocovací a ovládací software</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                                                            |
| Přístroj bude připojen a ovládán analytickým SW, jehož požadavky jsou uvedeny níže.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ano       | Ano                                                        |
| <b>Další příslušenství</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |                                                            |
| Vhodné kolony pro stanovení požadovaných analytů                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ano       | Ano                                                        |
| Záložní zdroj (UPS) v provedení RT Rack/Tower s ližinami, vhodný pro nabízený přístroj za účelem ochrany proti přepětí a překlenutí krátkého výpadku proudu (cca 10 minut), minimální výkon 3 kVA. Minimální požadavky: výstupní napětí v podobě čistého sinusového průběhu (nikoli modifikovaný), celkově alespoň 2 zásuvka s IEC 16 A a další alespoň 3 zásuvky s IEC 10 A, grafický LCD display s informacemi o stavu UPS a měřených veličinách (spotřeby el. energie na úrovni skupin zásuvek) a funkcí tzv. Cybersecurity – UL 2900-1 + IEC62443-4-2 | ano, 1 ks | Ano,<br>UPS od výrobce Eaton, viz.<br>produktový list níže |

|                                                                                                    |                                                                    |                                                                  |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------|
| Generátor vodíku                                                                                   | Kapacita minimálně<br>1200 ml/min,<br>čistota alespoň<br>99,9999 % | Ano,<br>od výrobce PEakScientific, viz.<br>produktový list níže. |
| Směšovač plynů pro ředění<br>standardu včetně certifikátu o<br>provedené kalibraci podle ISO 17025 | 2 kanály, ředění<br>v poměru od min. 1<br>do 100 %                 | Ano,<br>od výrobce LNI, viz. produktový list<br>níže.            |
| <b>Další požadavky</b>                                                                             |                                                                    |                                                                  |
| Pokročilého zaškolení a zavedení<br>metod zkušeným aplikačním<br>specialistou v rozsahu min. 5 dnů | ano                                                                | Ano                                                              |

**c) Příklad č. 3 - Technické požadavky pro zařízení plynový chromatograf pro stanovení helia a celkové hladiny uhlovodíků**

| Základní technické parametry                                                                                                                                                                                            | Požadovaná úroveň parametrů        | Specifikace parametrů nabízeného zařízení                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------------------------------------------------|
| <b>Plynový chromatograf</b>                                                                                                                                                                                             |                                    | <b>Plynový chromatograf 8890 s detektory FID a TCD</b>                             |
| Provozní teploty termostatu (pece) chromatografu                                                                                                                                                                        | +4 °C nad okolní teplotu až 450 °C | Ano,<br>+4 °C nad okolní teplotu až 450 °C                                         |
| Minimální rychlost ohřevu termostatu v plném rozsahu teplot do 450 °C                                                                                                                                                   | 65 °C/min                          | Ano,<br>pro jednokanálový systém je minimální rychlost ohřevu 65 °C/min            |
| Minimální počet teplotních ramp a prodlev                                                                                                                                                                               | 20                                 | Ano,<br>20 ramp a 21 prodlev                                                       |
| Maximální doba chlazení z teploty 450 °C na 50 °C                                                                                                                                                                       | 210 sec                            | Ano,<br>chlazení ze 450 na 50 °C 210 sekund (okolní teplota 22 °C, insert v peci). |
| Průtoky plynů řízené elektronicky pro automatickou kontrolu průtoků nebo tlaku plynů jak ve ventilech, kolonách, tak v detektorech. Možnost volby zobrazení hodnot tlaku v alespoň dvou jednotkách (psi, kPa nebo bar). | ano                                | Ano                                                                                |
| Zařízení umožňující pomocí kapalného dusíku vychladit termostat chromatografu                                                                                                                                           | Dosažitelná teplota alespoň -20 °C | Ano                                                                                |
| Inteligentní jednotka plynového chromatografu umožňující                                                                                                                                                                | ano                                | Ano                                                                                |

|                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                               |                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>- automaticky nebo ručně uživatelem spouštěné diagnostické testy</li> <li>- možnost vzdáleného připojení přes webový prohlížeč</li> <li>- automatické upozornění uživatele na včasnou výměnu opotřebitelných dílů</li> <li>- diagnostiku nejčastějších problémů včetně poskytnutí doporučeného řešení</li> <li>- zobrazení návodných postupů běžné údržby plynového chromatografu</li> </ul> |                                                                                                                               |                                                                                                     |
| Detektor FID                                                                                                                                                                                                                                                                                                                                                                                                                        | Maximální provozní teplota až do minimálně 450 °C<br>Detekční limit alespoň 1,2 pg C/s<br>Rychlost sběru dat minimálně 800 Hz | Ano,<br>provozní teplota max 450 °C, detekční limit 1,2 pg C/s, rychlost sběru dat 1000 Hz.         |
| Detektor TCD                                                                                                                                                                                                                                                                                                                                                                                                                        | Jednovláknové uspořádání<br>Provozní teplota minimálně 400 °C<br>Detekční limit alespoň 400 pg/ml (na standard tridekan)      | Ano,<br>Jednovláknové uspořádání, provozní teplota max. 400 °C, detekční limit 400 pg/ml tridekanu. |
| Vyhřívané, plně SW řízené 2x 10-ti cestné ventily pro flexibilní nastavení metodiky analýzy plyných vzorků, s možností napojení kapilárních i náplňových kolon, s pneumatickými aktuátory zajišťující přepínání poloh ventilů                                                                                                                                                                                                       | ano                                                                                                                           | Ano                                                                                                 |
| <b>Vyhodnocovací a ovládací software</b>                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                               | Ano                                                                                                 |
| Přístroj bude připojen a ovládán analytickým SW, jehož požadavky jsou uvedeny níže.                                                                                                                                                                                                                                                                                                                                                 | ano                                                                                                                           | Ano                                                                                                 |
| <b>Další příslušenství</b>                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                               |                                                                                                     |
| Vhodné kolony pro stanovení požadovaných analytů                                                                                                                                                                                                                                                                                                                                                                                    | ano                                                                                                                           | Ano                                                                                                 |
| Záložní zdroj (UPS) v provedení RT Rack/Tower s ližinami, vhodný pro nabízený přístroj za účelem ochrany proti přepětí a překlenutí krátkého                                                                                                                                                                                                                                                                                        | ano, 1 ks                                                                                                                     | Ano,<br>UPS od výrobce Eaton, viz. produktový list níže                                             |

|                                                                                                                                                                                                                                                                                                                                                                                                              |     |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| výpadku proudu (cca 10 minut), minimální výkon 3 kVA. Minimální požadavky: výstupní napětí v podobě čistého sinusového průběhu (nikoli modifikovaný), celkově alespoň 2 zásuvka s IEC 16 A a další alespoň 3 zásuvky s IEC 10 A, grafický LCD display s informacemi o stavu UPS a měřených veličinách (spotřeby el. energie na úrovni skupin zásuvek) a funkcí tzv. Cybersecurity – UL 2900-1 + IEC62443-4-2 |     |     |
| <b>Další požadavky</b>                                                                                                                                                                                                                                                                                                                                                                                       |     |     |
| Pokročilé zaškolení a zavedení metod zkušeným aplikačním specialistou v rozsahu min. 5 dnů                                                                                                                                                                                                                                                                                                                   | ano | Ano |

**d) Technické požadavky pro analytický SW**

| Základní technické parametry                                                                                                                                                                | Požadovaná úroveň parametrů |                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------------------|
| <b>Chromatografický SW v uspořádání client-server</b>                                                                                                                                       |                             | OpenLab ve verzi client/server         |
| Minimální podporovaný operační systém                                                                                                                                                       | Windows Server 2019         | Ano                                    |
| Podpora virtualizace všech komponent                                                                                                                                                        | ano                         | Ano                                    |
| Plná kompatibilita s dodanou instrumentací                                                                                                                                                  | ano                         | Ano                                    |
| Společné úložiště dat pro všechny instrumenty                                                                                                                                               | ano                         | Ano                                    |
| Minimální počet licencí pro uživatele/klienty                                                                                                                                               | 10/10                       | Ano                                    |
| Audit Trail, revize souborů – historie                                                                                                                                                      | ano                         | Ano                                    |
| Nastavení práv na jednom místě                                                                                                                                                              | ano                         | Ano                                    |
| Podpora MS Active Directory autentifikace                                                                                                                                                   | ano                         | Ano                                    |
| Systém splňující 21 CFR Part 11                                                                                                                                                             | ano                         | Ano                                    |
| Počítač pro zajištění funkce klient (ovládání přístrojů v laboratořích) s minimálními parametry HDD 500 GC, 8 GB RAM, procesor s minimálním hodnocením CPU Mark 12000, OS Win 10, LAN karta | Ano, 2 ks                   | Ano, 2 ks dle požadovaných specifikací |
| Připojení všech dodaných zařízení                                                                                                                                                           | GC, GC, GCMSD               | Ano                                    |

|                                                           |                                  |     |
|-----------------------------------------------------------|----------------------------------|-----|
| Podrobné zaškolení pro obsluhu nabízeného analytického SW | Rozsah alespoň 3 dny pro 3 osoby | Ano |
|-----------------------------------------------------------|----------------------------------|-----|

### 3. Technický list GC 8890

Data Sheet



## Agilent 8890 Gas Chromatograph

### Chromatographic performance\*

- Retention time repeatability <0.008 % or <0.0008 minutes
- Area repeatability <0.5 % RSD

The Agilent 8890 GC is a state-of-the-art gas chromatograph that provides superior performance for all applications.

Key to its performance is the use of advanced electronic pneumatic control (EPC) modules and high-performance GC oven temperature control, which lead to extremely precise retention time reproducibility, the basis for all chromatographic measurement.

The 8890 7-inch capacitive touchscreen interface provides real-time access to instrument status, configuration, and flowpath information. A signal plot confirms that analyses are running as intended. Additional tabs provide quick access to key functions such as editing method parameters, diagnostics, maintenance, logs, and help screens.

The Browser Interface is the most extensive interface to the 8890 GC's intelligence and mobile access features. Optimized for a 10-inch tablet, the Browser Interface can be used on tablets or a PC. Now you can view setup information, troubleshoot problems, check for leaks (autonomous hands-free), backflush columns, pause and start sample runs, and manage method development. GC performance can be monitored by automatically evaluating blanks using advanced onboard analytical techniques.

The 8890 has expanded configuration capabilities, where up to two inlets and four detectors can be installed and operated simultaneously. Six GC column smart keys and three USB ports are provided.

Agilent proprietary Capillary Flow Technology provides a new dimension in chromatography with reliable, leak-free, in-oven capillary connections that stand up to repeated GC oven cycling over time. The 8890 GC has enhanced hardware to extend Capillary Flow capabilities, and enhanced data system software to simplify setup and operation of backflush techniques. Programmable eco-friendly Sleep Mode reduces power and gas consumption during periods of inactivity, while Wake Mode readies the system for high-throughput operation.

\* Using 8890 with EPC (splitless), ALS, and Agilent Data System for the analysis of tetradecane (2 ng on column). Results may vary with other samples and conditions.

Agilent GC systems are known for their reliability, ruggedness, and long life. The 8890 EPC is based on Agilent 6th generation microchannel-based EPC architecture. Unique to Agilent, this design protects against gas contaminants such as particulates, water, and oils, and provides significant improvements in reliability and longevity over earlier generation GC designs. The Agilent 10-year use guarantee provides greater assurance for a low-cost of ownership throughout the GC's life.

## System capabilities

- Supports simultaneously:
  - Two inlets
  - Four detectors
  - Four detector signals
- State-of-the-art detector electronics and the full-range digital data path enable peaks to be quantified over the entire dynamic range of the detector (10<sup>7</sup> for the FID) in a single run.
- Full EPC is available for all inlets and detectors. Control range and resolution are optimized for the specific inlet or detector module.
- Up to eight EPC modules can be installed, providing control of up to 19 channels of EPC.
- Pressure setpoint and control precision to 0.001 psi provides more retention time locking precision for low-pressure applications.
- EPC with capillary columns provides four column flow control modes: constant pressure, ramped pressure (three ramps), constant flow, or ramped flow (three ramps). Column average linear velocity is calculated.

- Atmospheric pressure and temperature compensation is standard, so results do not change, even when the laboratory environment does.
- Serial port interface for Remote Advisor
- Easy access to Maintenance and Service modes from touchscreen and Browser Interface
- Autonomous (hands-free) leak tests
- Automatic Liquid Sampling is fully integrated into mainframe control
- Setpoint and automation control can be done from the local user interface, or Browser Interface, or a networked data system. Clock-time programming can be initiated from the local user interface or Browser Interface to initiate events (on/off, method start, and so forth).
- A run time deviation log is created for each analysis to ensure that all method parameters were achieved and maintained.
- A full array of traditional gas sampling and column switching valves are available
- 550 timed events
- Display of all GC and ALS setpoints at the touchscreen, Browser Interface, or data system
- Context-sensitive online help

## Column oven

- **Dimensions:** 28 × 31 × 16 cm. Accommodates up to two 105 m × 0.530 mm id capillary columns, or two 10-ft glass packed columns (9 in. coil diameter, 1/4 in. od), or two 20-ft stainless steel packed columns (1/8 in. od)
- Operating temperature range suitable for all columns and chromatographic separations. Ambient temperature +4 to 450 °C
  - With LN<sub>2</sub> cryogenic cooling: -80 to 450 °C
  - With CO<sub>2</sub> cryogenic cooling: -40 to 450 °C
- Temperature setpoint resolution: 0.1 °C
- Supports 20 oven ramps with 21 plateaus. Negative ramps are allowed.
- Maximum achievable temperature ramp rate: 120 °C/min (120 V units are limited to 75 °C/min, see Table 1)
- Maximum run time: 999.99 minutes (16.7 hours)
- Oven cool down (22 °C ambient) 450 to 50 °C in 4.0 minutes (3.5 minutes with oven insert accessory)
- Ambient rejection: <0.01 °C per 1 °C

Table 1. Typical 8890 GC oven ramp rates.

| Temperature range (°C) | 120 V Oven <sup>a</sup> rates (°C/min) | Fast ramp rates <sup>**</sup> (°C/min) |                               |
|------------------------|----------------------------------------|----------------------------------------|-------------------------------|
|                        |                                        | Dual-channel                           | Single-channel <sup>***</sup> |
| 50 to 70               | 75                                     | 120                                    | 120                           |
| 70 to 115              | 45                                     | 95                                     | 120                           |
| 115 to 175             | 40                                     | 65                                     | 110                           |
| 175 to 300             | 30                                     | 45                                     | 80                            |
| 300 to 450             | 20                                     | 35                                     | 65                            |

<sup>a</sup> Results obtained with line voltage maintained at 120V

<sup>\*\*</sup> Fast ramp rates require power >200 volts at >15 amps.

<sup>\*\*\*</sup> Requires G2646-60500 oven insert accessory.

## Electronic Pneumatics Control (EPC)

- Compensation for barometric pressure and ambient temperature changes is standard.
- Pressure has typical control of  $\pm 0.001$  psi for the range of 0 to 150 psi. Pressure setpoints may be adjusted in increments of 0.001 for the range 0.000 to 99.999 psi, and 0.01 for the range 100.00 to 150.00 psi.
- The user may select pressure units of psi, kPa, or bar
- Pressure/flow ramps: three maximum.
- Carrier and makeup gas settings selectable for He, H<sub>2</sub>, N<sub>2</sub>, and argon/methane
- Flow or pressure setpoints for each inlet or detector parameter with both the 8890 local user interface, Browser Interface, or Agilent Data System
- Constant flow mode is available when capillary column dimensions are entered into the 8890
- Split/Splitless, Multimode, VI, and PTV inlets have flow sensors for the control of split ratio
- **Inlet modules**
  - **Pressure sensors:**  
Accuracy:  $\leq \pm 2\%$  full scale,  
Repeatability:  $\leq \pm 0.05$  psi,  
Temperature coefficient:  $\leq \pm 0.01$  psi/°C,  
Drift:  $\leq \pm 0.1$  psi/6 months
  - **Flow sensors:**  
Accuracy:  $\leq \pm 5\%$  depending on carrier gas,  
Repeatability:  $\leq \pm 0.35\%$  of setpoint,  
Temperature coefficient  $\leq \pm 0.20$  mL/min (NTP)\* per °C for He or H<sub>2</sub>;  $\leq \pm 0.05$  mL/min NTP per °C for N<sub>2</sub> or Ar/CH<sub>4</sub>.

\* NTP = 25 °C and 1 atmosphere

- **Detector modules:**  
Accuracy:  $\leq \pm 3$  mL/min NTP or 7 % of setpoint,  
Repeatability:  $\leq \pm 0.35\%$  of setpoint

## Inlets

- Maximum of two inlets installed
- EPC compensated for atmospheric pressure and temperature variation
- Inlets available:
  - Packed purged injection port (PPIP)
  - Standard and Inert Flow Path Split/Splitless capillary inlets (S/SL)
  - Multimode inlet (MMI)
  - Temperature-programmable cool on-column (PCOC)
  - Programmable temperature vaporizer (PTV)
  - Volatiles inlet (VI)

## S/SL

- Suitable for all capillary columns (50 to 530  $\mu$ m id)
- Split ratios up to 7,500:1 to avoid column overload. Setting split ratios (particularly low split ratios) is limited by column parameters and control of system flows (particularly low system flows).
- Splitless mode for trace analysis. Pressure-pulsed splitless is easily accessible for best performance.
- Maximum temperature: 400 °C
- EPC available in two pressure ranges: 0 to 100 psig (0 to 680 kPa) for best control for columns  $\geq 0.200$  mm diameter; 0 to 150 psig for columns  $< 0.200$  mm diameter
- Gas saver mode to reduce gas consumption without compromising performance.

- Electronic septum purge flow control to eliminate ghost peaks.
- Total flow setting range:  
0 to 500 mL/min N<sub>2</sub>,  
0 to 1,250 mL/min H<sub>2</sub> or He  
0 to 200 mL/min argon/methane
- Turn-top inlet sealing system is built in standard with each 8890 S/SL inlet for quick, easy injector liner changes.
- Optional inert S/SL inlet includes a chemical deactivation process for the weldment and weldment insert.

## MMI

- Provides the flexibility of a standard Agilent split/splitless inlet, combined with temperature-programmable capability, enabling large-volume injections. Also supports cool injections for improved signal response.
- Temperature control: LN<sub>2</sub> (to  $-160$  °C), LCO<sub>2</sub> (to  $-70$  °C), air cooling (to ambient  $+10$  °C with oven temperature  $< 50$  °C) (due to high consumption, air cooling with cylinders is not advised). Temperature programming of up to 10 ramps at up to 900 °C/min. Maximum temperature: 450 °C
- Injection modes:
  - Hot or cold split/splitless
  - Pulsed split/splitless
  - Solvent vent
  - Direct
- Suitable for all capillary columns (50 to 530  $\mu$ m)
- EPC pressure range (psig): 0 to 100 psig
- Split ratio: up to 7,500:1 to avoid column overload. Setting split ratios (particularly low split ratios) is limited by column parameters and control of system flows (particularly low system flows).

- Splitless mode for trace analysis. Pressure pulsed splitless is easily accessible for improved performance.
- Electronic septum purge flow control
- Compatible with Merlin Microseal septum
- Setup of parameters facilitated with Agilent Solvent Elimination Calculator
- Total flow setting range:  
0 to 500 mL/min N<sub>2</sub>  
0 to 1,250 mL/min H<sub>2</sub> or He  
0 to 200 mL/min argon/methane
- Turn-top inlet sealing system is built-in standard with each 8890 Multimode inlet for quick, easy injector liner changes

## PCOC

- Direct injection onto cool capillary column ensures quantitative sample transfer with no thermal degradation
- Automatic liquid injection supported directly onto columns ≥0.250 mm id
- Maximum temperature: 450 °C. Temperature programming in three ramps or tracking oven. Subambient control to -40 °C is optional.
- Electronic pressure control range: 0 to 100 psig
- Electronic septum purge flow control
- Optional solvent vapor exit for large-volume injections
  - Electronically controlled, inert, three-way valve allows solvent venting
  - Includes software for method optimization
  - Preassembled retention gaps/vent line/analytical column for easy installation

## PPIP

- Direct injection onto packed and wide-bore capillary columns.
- Electronic flow/pressure control: 0 to 100 psig pressure range, 0.0 to 200.0 mL/min flow range. Ranges are chosen to provide optimum performance over normal packed column setpoint ranges.
- Electronic septum purge flow control
- 400 °C maximum operating temperature
- Adapters included for 1/8-in. packed columns and 0.530-mm capillary columns

## PTV

- Supports hot/cold split and splitless modes as well as large-volume injections.
- Temperature control: either LN<sub>2</sub> (to -160 °C) or LCO<sub>2</sub> (to -65 °C) cooling. Temperature programming of up to three ramps at up to 720 °C/min. Maximum temperature: 450 °C.
- EPC pressure range: 0 to 100 psig
- Split ratio up to 7,500:1. Setting split ratios (particularly low split ratios) is limited by column parameters and control of system flows (particularly low system flows).
- Electronic septum purge flow control
- Choice of Gerstel septumless head or Merlin Microseal septum head
- 450 °C maximum operating temperature
- Total flow setting range:  
0 to 500 mL/min N<sub>2</sub>  
0 to 200 mL/min argon/methane  
0 to 1,250 mL/min H<sub>2</sub> or He

## VI

- Very low volume (32 µL) interface suitable for gas or prevaporized samples. Recommended for use with headspace, purge and trap, or thermal desorption samplers.
- Three modes for optimized sample introduction: split (up to 100:1 split ratio), splitless, and direct.
- Optimized EPC (H<sub>2</sub> or He carrier, 0.00 to 100 psig pressure control, 0.0 to 100 mL/min flow control)
- Electronic septum purge flow control
- Treated flowpath provides inert surface for minimum component adsorption
- Maximum temperature: 400 °C

## Detectors

- Up to four detectors may be installed and operated simultaneously.
- Electronic pneumatics control and electronic on/off for all detector gases
- EPC compensated for atmospheric pressure and temperature variation

### Detectors available

#### Flame ionization detector (FID)

- Responds to most organic compounds
- Minimum detectable level (for tridecane): <1.2 pg C/s
- Linear dynamic range: >10<sup>7</sup> (±10 %). Full-range digital data path enables peaks to be quantified over the entire 10<sup>7</sup> concentration range in a single run.
- Data rates up to 1,000 Hz accommodate peaks as narrow as 5 msec at half height.

- Standard electronic pneumatic control for three gases:

- Air: 0 to 800 mL/min
- H<sub>2</sub>: 0 to 100 mL/min
- Make-up gas (N<sub>2</sub> or He): 0 to 100 mL/min

- Available in two versions: capillary and column-optimized. 1/8 in. and 1/4 in. adapters will be available
- Flameout detection and automatic reignition
- 450 °C maximum operating temperature

#### Thermal conductivity detector (TCD)

- Universal detector that responds to all compounds, excluding the carrier gas
- Minimum detectable level: 400 pg tridecane/mL with He carrier. (This value may be affected by laboratory environment).
- Linear dynamic range:  $>10^5 \pm 5\%$
- Unique fluidic switching design provides rapid stabilization from turn-on, low-drift performance.
- Signal polarity can be run-programmed for components having higher thermal conductivity than the carrier gas.
- Maximum temperature: 400 °C
- Standard EPC for two gases (He, H<sub>2</sub>, or N<sub>2</sub>, matched to carrier gas type)
- Make-up gas: 0 to 12 mL/min
- Reference gas: 0 to 100 mL/min
- The 8890 GC can accommodate a third detector.

#### Electron capture detector

- A very sensitive detector for electrophilic compounds such as halogenated organic compounds.
- Minimum detectable level: <3.8 fg/mL lindane at standard checkout conditions.
- Proprietary signal linearization. Linear dynamic range:  $>5 \times 10^4$  with lindane
- Data acquisition rate: up to 50 Hz
- Uses  $\beta$  emission of  $<15$  mCi <sup>63</sup>Ni as the electron source
- Unique micro-cell design minimizes contamination and optimizes sensitivity
- 400 °C maximum operating temperature
- Standard EPC makeup gas types: argon/5 % methane or nitrogen; 0 to 150 mL/min
- The 8890 GC can accommodate a third detector, as the micro-ECD is located on the left side of the GC.

#### Nitrogen-phosphorus detector (NPD)

- A detector specific to nitrogen- or phosphorus-containing compounds.
- NPD available: Blos (glass) bead offering:
  - Longer lifetime
  - More stable operation during the bead's lifetime
- MDL: <0.08 pg N/s, <0.01 pg P/s with azobenzene/malathion/octadecane mixture
- Dynamic range:  $>10^5$  N,  $>10^5$  P with azobenzene/malathion mixture
- Selectivity: 25,000 to 1 g N/g C, 200,000 to 1 g P/g C with azobenzene/malathion/octadecane mixture
- Data acquisition rate: up to 1,000 Hz

- Standard EPC for three gases:

- Air: 0 to 200 mL/min
- H<sub>2</sub>: 0 to 30 mL/min
- Make-up gas: 0 to 100 mL/min

- Available for capillary columns only, with adapters available
- 400 °C maximum operating temperature

#### Flame photometric detector (FPD)+ (Plus)

- Newly designed single-wavelength FPD, or dual-wavelength flame photometric detector (DFPD)—a sensitive, specific detector to sulfur- or phosphorus-containing compounds.
- MDL: <45 fg P/s, <2.5 pg S/s with methylparathion
- Dynamic range:  $>10^3$  S,  $10^4$  P with methylparathion
- Selectivity:  $10^6$  g S/g C,  $10^6$  g P/g C
- Data acquisition rate: up to 200 Hz
- Standard EPC for three gases:
  - Air: 0 to 200 mL/min
  - H<sub>2</sub>: 0 to 250 mL/min
  - Make-up gas: 0 to 130 mL/min
- Available in single- or dual-wavelength versions.
- 400 °C maximum operating temperature
- Can be mounted as AUX1 detector

#### SCD (Model 8355)

- Highest sensitivity and selectivity for sulfur-containing compounds
- MDL: Typical <0.5 pg/s, dimethyl sulfide in toluene
- Linear dynamic range:  $>10^4$
- Selectivity:  $>2 \times 10^3$  g S/g C

#### NCD (Model 8255)

- High selectivity for nitrogen-containing compounds
- MDL: <3 pg N/s, in both N and nitrosamine modes, 25 ppm N as nitrobenzene in toluene
- Linear dynamic range: >10<sup>4</sup>
- Selectivity: >2 × 10<sup>7</sup> g N/g C (selectivity in nitrosamine mode is matrix-dependent)

See Agilent Sulfur Chemiluminescence Detector and Nitrogen Chemiluminescence Detector Specification Guide for additional information regarding performance and physical and environmental specifications.

#### Mass spectrometers

See specifications for:

- 5977 Series MSD
- 7000 triple quadrupole GC/MS
- 7010 Series triple quadrupole GC/MS
- 7250 Q-TOF

#### Other detectors

Specialized detectors are available through Agilent Channel Partners including: atomic emission, Pulsed Flame Photometric (PFPD), Photoionization (PID), Electrolytic Conductivity (ELCD), Halogen Specific (XSD), Oxygenate Flame Ionization (O-FID), and Pulsed Discharge Helium Ionization (PDHID)

## Auxiliary EPC devices

The 8890 GC has four positions for auxiliary EPC devices located on the back of the GC. Each position can be any combination of auxiliary EPC or pneumatics control module. Two of the positions also accommodate detectors.

**Note:** The communication for a third detector such as a TCD or ECD EPC module (located on the left side of the GC) interfaces through one of these auxiliary EPC module positions. If a third detector (TCD or ECD) is installed, one of these auxiliary positions is taken. Two of these positions are also compatible with a top-mounted or side-mounted detector.

#### Auxiliary EPC module

- Three channels of pressure control
- EPC compensated for atmospheric pressure and temperature variation when connected to a user-defined capillary column
- Psig (gauge) and psia (absolute) pressure control
- Forward pressure regulated
- Maximum of three auxiliary EPC modules per GC

#### Pneumatics Control Module (PCM)

- Two channels for operation
- EPC compensated for atmospheric pressure and temperature variation when connected to a user-defined capillary column
- **First channel:**
  - Pressure or flow control
  - Psig (gauge) and psia (absolute) pressure control
  - Forward pressure regulated

- **Second channel:**

- Pressure control
- Psig (gauge) and psia (absolute) pressure control
- Forward pressure or back pressure regulated
- PCM can be located in either/both inlet EPC positions, and any auxiliary position on the back of the 8890 GC
- Maximum of four PCMs/PSDs per GC

#### Pneumatics Switching Device (PSD)

- EPC compensated for atmospheric pressure and temperature variation when connected to a user-defined capillary column
- The PSD is a pneumatic module specifically designed for backflush
- First channel: same as PCM; engineered bleed restrictor built in

## Capillary Flow Technology

The Agilent proprietary Capillary Flow Technology provides devices with reliable, leak-free, in-oven capillary connections to help analyze complex samples and provide gains in productivity. Devices feature:

- Photolithographic chemical milling for low-dead-volume flow pathways
- Diffusion bonding to form a single flow plate
- 'Credit card' profile for fast thermal response
- Projection-welded connections for leak-tight fittings
- Deactivation of all internal surfaces in the sample path for inertness

All of the following purged Capillary Flow devices require one channel from an auxiliary EPC, PCM, or PSD module.

Purged capillary flow devices, such as the Deans switch, purged effluent splitters, and purged ultimate unions

introduce an additional flow into the sample stream. For detectors that operate at low flow rates, such as the MSD and TCD, some decrease in sensitivity will occur.

#### Deans switch

Deans switching provides additional selectivity using two-dimensional GC analysis. Peaks of interest that may be coeluting on one column are diverted to a separate column of different stationary phase. This technique can also reduce maintenance costs by having troublesome solvents or other components bypass detectors or columns.

#### Purged effluent splitters

A three-way purged effluent splitter sends column effluent to three detectors, even an MSD. More information can be obtained in a single run to help locate target peaks in unknowns. A two-way purged effluent splitter version is also available.

#### Backflush

An Agilent Purged Ultimate Union or any of the above purged Capillary Flow devices also provides the ability to backflush. An auxiliary EPC or PCM can be used for backflushing, but a PSD module is preferred. By reversing column flow immediately after the last compound of interest has eluted, you can eliminate long bake-out times for highly retained (or high-boiling) contaminants, thereby shortening cycle times and protecting the column and detector. As backflush occurs after peaks of interest have eluted, the chromatographic method for peaks of interest does not need to change. Backflush is available when the column is attached to a split/splitless, Volatiles interface, Multimode, or PTV inlet.

The 8890 GC firmware has been optimized for backflush operation:

- Displays positive and negative flows
- Inlet/outlet pressures settable to the limits of the controlling EPC devices
- EPC can be introduced at any column or restrictor connection
- Capillary flow configuration of up to six columns/restrictors

Backflush Wizard software works with Agilent CDS to provide a step-by-step procedure for configuring the backflush hardware and column plumbing. The chromatogram must have three well separated peaks. See Backflush brochure for additional system requirements.

#### Automated sample injectors and samplers

- The 7693A ALS interface on the 8890 provides power and communications for up to two 7693A automatic injectors, one automatic sampler tray, and one heater/mixer/bar code reader. Injectors and tray install easily without the need for alignment.
- Agilent PAL Injector on 8890. Specialized software controls available on OpenLab CDS ChemStation and EzChrom editions, MassHunter, and MSD Productivity ChemStation.
- The 7650A ALS interface on the 8890 provides power and communications for one 7650 automatic injector. It is also compatible with one additional 7693A mounted on the back inlet. The injector installs easily without the need for alignment.

#### Data communications

- LAN
- Two analog output channels (1-V and 10-V output available) as standard
- Remote start/stop
- Touchscreen control of the Agilent Automatic Liquid Sampler (ALS)
- Binary-coded decimal input for a stream selection valve
- Serial port interface for Remote Advisor

#### Maintenance and support services

- Integrated early maintenance counters allows planned maintenance, and helps eliminate unnecessary downtime.
- Instrument events or shutdowns displayed on keyboard display or Data System
- Remote diagnostics
- Performance verification services
- Easy parts identification and part number finder software (standalone software, does not require Agilent CDS)

#### Environmental conditions

- Ambient operating temperature: 15 to 35 °C
- Ambient operating humidity: 5 to 90 % (noncondensing)
- Storage extremes: -40 to 70 °C
- Power requirements
  - Line voltage: 120/200/220/230/240 Volts  $\pm 10$  % of nominal
  - Frequency: 50/60 Hz  $\pm 5$  %

## Safety and regulatory certifications

Conforms to the following safety standards:

- Canadian Standards Association (CSA) C22.2 No. 60101-1
- Nationally Recognized Test Laboratory (NRTL): ANSI/UL 61010-1
- International Electrotechnical Commission (IEC): 61010-1, 60101-2-010, 60101-2-081
- EuroNorm (EN): 61010-1

Conforms to the following regulations on Electromagnetic Compatibility (EMC) and Radio Frequency Interference (RFI):

- CISPR 11/EN 55011: Group 1, Class A
- IEC/EN 61326-1
- AUS/NZ CISPR 11
- This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada.
- Designed and manufactured under a quality system registered to ISO 9001; Declaration of Conformity available.
- This product complies with the EU RoHS Directive 2011/65/EU, and conforms to EN 50581.

## Other specifications

- Height: 49 cm (19.2 in.)
- Width: 58 cm (22.9 in.) with EPC inlet and detectors; 68 cm (26.8 in.) with detector as TCD or with certain valving options mounted on the left side of the GC
- Depth: 51 cm (20.2 in.)
- Typical weight: 49 kg (108 lb)
- Four internal 24-volt connections (up to 150 mA)
- Two external 24-volt connections (up to 150 mA)
- Two on/off contact closures (48 V, 250 mA max)
- 550 Timed events through a data system
- Support for up to 10 valves:
  - Valves 1 to 4, 12 V DC, 13 watt in a heated valve box
  - Valves 5 and 6, 24 V DC, 100 mA unheated, for low power valve applications
  - Valves 7 and 8, externally powered as a remote event from separate contact closure
- Independent heated zones, not including oven: Eight (two inlets, three detectors, and three auxiliary). Third/fourth detector can use any available zone from inlet or auxiliary zones.
- Maximum operating temperatures for auxiliary zones: 400 °C
- Six column ID ports
- Three USB ports

## References

1. A Guide to Interpreting Detector Specifications for Gas Chromatography. *Agilent Technologies*, publication number 5989-3423EN.
2. The Importance of Area and Retention Time Precision in Gas Chromatography. *Agilent Technologies*, publication number 5989-3425EN.

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## 4. Technický list MSD 5977

Data Sheet



### Agilent 5977C GC/MSD System

The Agilent 8890/5977C Series gas chromatograph/mass selective detector (GC/MSD) builds on a tradition of leadership in GC and MS technology, with the world's most competitive performance and productivity features.

#### Agilent GC/MSD system features

**Agilent 5977C GC/MSD** — the most sensitive and robust MSD provides:

- Four EI source options including the revolutionary high-efficiency source (HES), which offers the industry's lowest instrument detection limit (IDL) and best signal-to-noise ratio (S/N) and a HydroInert source for H<sub>2</sub> carrier gas applications.
- A heated monolithic quartz gold quadrupole (heatable up to 200 °C) for rapid elimination of contamination to keep the analyzer clean.
- A second-generation triple-axis detector (TAD) for eliminating neutral noise.
- Scan speeds up to 20,000 u/sec (extractor ion source and HES).
- An optional oil-free IDP-3 roughing pump: a cleaner, quieter, and greener alternative (for use with turbo molecular pump systems).

#### 10-Year value promise

Support is guaranteed for 10 years from the date of purchase, or Agilent will provide credit for the residual value of the system toward a model upgrade.

## Installation checkout specifications

Agilent verifies GC/MSD system performance at the customer site. IDL is a statistically based metric that more accurately confirms system performance than an S/N measurement. Test specifications are based on splitless injection into an Agilent J&W HP-5ms Ultra Inert 30 m × 0.25 mm, 0.25 µm column for helium and a 20 m × 0.18 mm, 0.18 µm column for HydroInert with hydrogen. IDL analyses use lab helium (hydrogen for HydroInert) with GC gas filters installed. See more about the IDL test at <http://www.chem.agilent.com/Library/technicaloverviews/Public/5990-8341EN.pdf>

| Instrument Detection Limit (IDL)                                                         |
|------------------------------------------------------------------------------------------|
| The industry's most rigorous performance metric                                          |
| Based on eight consecutive injections and their statistical analysis of precision (%RSD) |
| Measured at an amount near the detection limit                                           |
| Accurate assessment of the true detection limit and lower limit of quantification (LLQ)  |
| IDL tested and proved at installation for applicable configurations                      |

| IDL Specifications                        |                           |                             |                                                  |
|-------------------------------------------|---------------------------|-----------------------------|--------------------------------------------------|
| Instrument                                | IDL* (Helium Carrier Gas) | IDL* (Hydrogen Carrier Gas) | Source                                           |
| Installation Specifications               |                           |                             |                                                  |
| Agilent 5977C HES MSD                     | 1.5 fg                    | –                           | HES                                              |
| Agilent 5977C EI/CI MSD                   | 10 fg                     | –                           | Extractor for EI                                 |
| Agilent 5977C Inert Plus EI MSD           | 10 fg                     | –                           | Extractor                                        |
| Agilent 5977C EI MSD                      | 20 fg                     | –                           | Stainless steel                                  |
| Agilent 5977C EI MSD with Agilent 8860 GC | 40 fg                     | –                           | Stainless steel                                  |
| Agilent 5977C HydroInert MSD              | –                         | 50 fg                       | HydroInert source for H <sub>2</sub> carrier gas |
| Reference Specifications                  |                           |                             |                                                  |
| Agilent 5977C HES MSD                     | 1.0 fg                    | 10 fg                       | HES                                              |
| Agilent 5977C EI/CI MSD                   | –                         | 50 fg                       | Extractor for EI                                 |
| Agilent 5977C Inert Plus EI MSD           | –                         | 50 fg                       | Extractor                                        |
| Agilent 5977C EI MSD                      | –                         | 70 fg                       | Stainless steel                                  |

- \* IDL was statistically derived at 99% confidence level from the area precision of eight sequential splitless injections of OFN (octafluoronaphthalene). Demonstration of IDL specifications require a compatible system configuration, including a liquid autosampler with a 5 µL syringe.
- HES IDL was measured using 10 fg injection, 1 µL injection.
  - Other IDLs were measured using 100 fg, 1 µL injection.
  - A 30 m column was used for helium IDL checkout; a 20 m column was used for hydrogen IDL checkout.
  - Helium carrier gas for Installation Specifications of the HES, Extractor, and Stainless steel sources; hydrogen carrier gas for Installation Specification of the HydroInert source only.
  - Reference IDL specifications from the above table will be confirmed only when purchased as an additional service with a compatible new system (GC and MS) installation.

## Signal-to-noise (S/N) specifications

| S/N Reference Specifications*      |                                            |                                   |                                     |                                       |                           |                           |
|------------------------------------|--------------------------------------------|-----------------------------------|-------------------------------------|---------------------------------------|---------------------------|---------------------------|
| Instrument Configuration           | Source                                     | EI Scan S/N <sup>b</sup> (Helium) | EI Scan S/N <sup>b</sup> (Hydrogen) | Sample Concentration (1 µL Injection) | PCI Scan S/N <sup>c</sup> | NCI Scan S/N <sup>d</sup> |
| Agilent 5977C HES MSD              | HES                                        | 2,000.1                           | 1,000.1                             | 0.1 pg/µL OFN                         |                           |                           |
| Agilent 5977C EI/CI MSD            | Extractor for EI, Agilent CI source for CI | 5,000.1 (EI)                      | –                                   | 1 pg/µL OFN                           | 1,200.1                   | 2,000.1                   |
| Agilent 5977C Inert Plus EI MSD    | Extractor                                  | 5,000.1                           | 2,500.1                             | 1 pg/µL OFN                           |                           |                           |
| Agilent 5977C HydroInert MSD       | HydroInert                                 | –                                 | 2,500.1                             | 1 pg/µL OFN                           |                           |                           |
| Agilent 5977C EI MSD               | Stainless steel                            | 600.1                             | 300.1                               | 1 pg/µL OFN                           |                           |                           |
| Agilent 5977C with Agilent 8860 GC | Stainless steel                            | 250.1                             | –                                   | 1 pg/µL OFN                           |                           |                           |

\* S/N checkout is performed only if there is no compatible autosampler (which is required for IDL checkout). Helium carrier gas, manual injection using a 30 m × 0.25 mm, 0.25 µm column and in scan mode. Hydrogen carrier gas, manual injection using 20 m × 0.18 mm, 0.18 µm column and in scan mode. When the autosampler (ALS) is present, these specifications are a reference of the performance. Reference S/N specifications from the above table will not be confirmed at installation or introduction for ALS equipped systems.

<sup>b</sup> Standard scanning from 50 to 300 u at nominal 272.0 u ion.

<sup>c</sup> 1 µL injection of 100 pg/µL benzophenone (BZP) standard, 80 to 230 u scan at nominal 183 u ion, using methane reagent gas.

<sup>d</sup> 2 µL injection of 100 fg/µL OFN standard scanning from 50 to 300 u at nominal 272 u ion, using methane reagent gas.

| Agilent 5977C Series GC/MSD System Specifications            |                                                                                                                                                             |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ionization Mode (Standard)                                   | EI                                                                                                                                                          |
| Ionization Modes (Optional)                                  | PCI, NCI, EI acquisition with CI source                                                                                                                     |
| EI Ion Source Type                                           | Five supported sources: stainless steel, inert, extractor, HydroInert, HES                                                                                  |
| Electron Energy                                              | 5 to 241.5 eV                                                                                                                                               |
| Emission Current                                             | 0 to 315 $\mu$ A                                                                                                                                            |
| CI Gases                                                     | Dual gas inlet                                                                                                                                              |
| Filaments                                                    | Dual for EI, single for CI                                                                                                                                  |
| Transfer Line Temperature                                    | 100 to 350 °C                                                                                                                                               |
| Ion Source Temperature                                       | 150 to 350 °C                                                                                                                                               |
| Quadrupole Temperature                                       | 106 to 200 °C                                                                                                                                               |
| Mass Filter                                                  | Heated monolithic hyperbolic quadrupole                                                                                                                     |
| Ion Source – Mass Filter Interface                           | Dynamically rampable entrance lens                                                                                                                          |
| Mass Range                                                   | 0.6 to 1,091 u                                                                                                                                              |
| Mass Resolution                                              | Unit mass                                                                                                                                                   |
| Mass Accuracy                                                | 1 $\mu$ L injection of a 100 pg/ $\mu$ L OFN standard scanning from 50 to 300 u will give its monoisotope at m/z 271.987 $\pm$ 0.005 <sup>a</sup>           |
| Spectral Accuracy                                            | 1 $\mu$ L injection of a 100 pg/ $\mu$ L OFN standard scanning from 50 to 300 u will give 99.0% spectral accuracy <sup>a</sup>                              |
| Mass Axis Stability                                          | Better than 0.10 u/48 hours                                                                                                                                 |
| Detector                                                     | Series II triple-axis detector with high energy dynode and long-life electron multiplier (EM)                                                               |
| Dynamic Range (Electronic)                                   | 10 <sup>4</sup>                                                                                                                                             |
| Scan Rate <sup>b</sup>                                       | Agilent 5977C Inert Plus (extractor source and HydroInert source) and Agilent 5977C HES up to 20,000 u/sec;<br>Agilent 5977C (SS source) up to 12,500 u/sec |
| SIM                                                          | 60 ions $\times$ 100 groups                                                                                                                                 |
| Pumping System (Helium)                                      | 65 L/s diffusion pump (available only with the 5977C EI MSD) and 255 L/s turbo pump with 2.5 m <sup>3</sup> /hr mechanical pump                             |
| Maximum Recommended Analytical Gas Flow                      | 1.5 mL/min (diffusion pump)<br>4 mL/min (turbo pump)                                                                                                        |
| Recommended Maximum Sustained Column Flow to MS <sup>c</sup> | 3 mL/min (diffusion pump)<br>50 mL/min (turbo pump)                                                                                                         |
| Instrument Control                                           | Agilent MassHunter data system or OpenLab CDS                                                                                                               |
| Maintenance Accessibility                                    | Source (including filaments, lenses), mass filter <sup>d</sup> , and detector on removable plate for easy access                                            |
| Maintenance Scheduling                                       | Early maintenance feedback (EMF) for GC and MSD, user-defined maintenance schedule, with display of current status                                          |
| Source cleaning                                              | Automated and vent-free with proprietary JetClean option                                                                                                    |
| Direct/Realtime sample analysis or probe                     | QuickProbe when added to the GC/MSD, enables direct analysis in real time of samples and liquids with minimal-to-no sample preparation, in under 1 minute.  |
| Support Life                                                 | Guaranteed 10 years useable life with support for seven years                                                                                               |

<sup>a</sup> Only applicable with optional Accurate Mass software package. Scan mode only. Not verified during installation.

<sup>b</sup> As scan rate increases, sensitivity will decrease, and resolution may degrade.

<sup>c</sup> A high flow rate into a fixed ion source will cause a loss in sensitivity.

<sup>d</sup> The heated quadrupole mass filter should not require maintenance, but if maintenance is required, it should be performed by an Agilent service engineer.

| GC (Agilent 8890, 8860 and Intuvo 9000 GC) |                                                                                                                                                                                                                  |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GC                                         | Intuvo 9000 GC, 8890 GC and 8860 GC – see <a href="http://www.agilent.com">www.agilent.com</a> for details.                                                                                                      |
| Sample Introduction                        | Agilent 7693A automatic liquid sampler, 7650A automatic liquid sampler, CTC PAL3, 8697A headspace sampler, 7697A headspace sampler, thermal desorption, headspace, purge and trap, and other third party devices |
| Liner Replacement                          | Compatible with turn-top system                                                                                                                                                                                  |
| Inlet (Up to Two)                          | Split-splitless inlet (standard), multimode inlet (MMI) (on the 8890 and Intuvo GC), cool on column (COC) inlet, and others (optional)                                                                           |
| Oven Temperature                           | 8890 and Intuvo GC: Ambient +4 to 450 °C<br>8860 GC: Ambient +8 to 425 °C                                                                                                                                        |
| Oven Ramps/Plateaus                        | 20/21 with negative ramps allowed<br>Max Heating Ramp:<br>8890 GC: 120 C/min<br>8860 GC: 75 C/min<br>Intuvo 9000 GC: 250 C/min                                                                                   |
| Carrier Gases                              | helium, hydrogen, nitrogen                                                                                                                                                                                       |
| Electronic Pneumatic Control (EPC)         | EPC split/splitless, septum purge and auxiliary EPC modules                                                                                                                                                      |
| Carrier Gas Control Modes                  | Constant flow, constant pressure, programmable flow and programmable pressure                                                                                                                                    |
| Pressure Range                             | 8890 GC and Intuvo 9000 GC: 0 to 100 psi (standard), 0 to 150 psi (optional) with 0.001 psi resolution<br>8860 GC: 0 to 100 psi with 0.01 psi resolution                                                         |
| Flow Control                               | 8890 GC and Intuvo 9000 GC: Compatible with optional capillary flow device controller (not supported with 8860 GC)                                                                                               |
| Retention-Time Locking                     | RTL-ready                                                                                                                                                                                                        |

| Ease of Maintenance                                                                                                                                          |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Turn top inlet sealing system is built in standard with each 8890 and 8860 GC S/SL inlet (and 8890 multimode inlet) for quick, easy injector liner changes.* |  |
| A glass window shows ion source type, filament operation, and ion source connections.                                                                        |  |
| The source (including filaments and lenses) and electron multiplier can be removed from the instrument in less than one minute after venting.                |  |
| The optional micro ion gauge <sup>b</sup> can be replaced without removal of the mass spectrometer covers.                                                   |  |

\* Inlet temperature should be cool enough to touch when performing maintenance.

<sup>b</sup> A micro ion gauge is shipped standard for the CI system, and is available optionally for EI systems.

| Data System                                                      |                                                                                                                                                                                                                     |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acquisition Software                                             | Agilent MassHunter GC/MS Acquisition and OpenLab CDS Acquisition                                                                                                                                                    |
| Simultaneous MS and GC Signals                                   | Up to two MSD signals (SIM/scan) and four GC detector signals per instrument                                                                                                                                        |
| Instrument Connections (Agilent MassHunter Acquisition)          | Four instruments total: up to two GC/MSDs or four GCs                                                                                                                                                               |
| SIM/scan                                                         | Automated SIM setup and synchronous SIM/scan operation, CI optimization in both PCI and NCI modes for common reagent gases                                                                                          |
| Chemical ionization Setup                                        | Electronic mass flow control of reagent gases                                                                                                                                                                       |
| High-Mass Confirmation                                           | Verification test kit (optional)                                                                                                                                                                                    |
| Tune Options                                                     | Autotune (Atune.U), Extraction source tune (Etune.U), BFB Autotune (BFB_Atune.U), Standard Spectra Tune (Stune.U), DFTPP (target tune for USEPA semivolatile method 8270), BFB (target tune for VOC analysis)       |
| Data Analysis Software                                           | Agilent MassHunter and classic Agilent MSD ChemStation or Agilent OpenLab CDS (version 2.0 or greater)                                                                                                              |
| Application Reports                                              | Environmental, drugs-of-abuse, aromatics in gasoline                                                                                                                                                                |
| Custom Reporting                                                 | Agilent MassHunter: Microsoft Excel, classic Agilent MSD ChemStation: custom reporting                                                                                                                              |
| Spectral Libraries (optional)                                    | NIST, Wiley/NIST, Maurer/Pfleger/Weber Drug                                                                                                                                                                         |
| Agilent Retention Time Locked Mass Spectral Libraries (Optional) | Pesticides and endocrine disrupter databases, volatiles, PCBs, toxicology, hazardous chemicals, indoor air toxics, Japan Positive List, forensic toxicology, environment semivolatiles, metabolomics (Fiehn method) |
| Target Deconvolution                                             | Integrated deconvolution and spectral matching for identification and quantitation of low-level targets in complex matrices                                                                                         |
| Security                                                         | Data and result security and tamper detection                                                                                                                                                                       |
| 21CFR11 Compliance                                               | Agilent MassHunter Quantitative Analysis and Agilent MassHunter GC/MS Acquisition tools or Agilent OpenLab CDS (version 2.0 or greater)                                                                             |
| Multivariate Analysis (Optional)                                 | Agilent Mass Profiler Professional                                                                                                                                                                                  |
| Sample Class Prediction (Optional)                               | Sample Class Predictor or Agilent Mass Profiler Professional                                                                                                                                                        |
| Other Capabilities (Optional)                                    | Deconvolution reporting software linked with RTL database for classic MSD ChemStation Accurate mass data with Cerno MassWorks Software                                                                              |

| Safety, Regulatory Compliance, and Operational Conditions                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| This instrument is manufactured and distributed under a quality system certified to ISO9001. It complies with international regulatory, safety, and electromagnetic compatibility requirements. In addition, further testing was performed according to Agilent standards, to ensure operation after delivery and long-term usage. |                                                                                                                                                                                                                       |
| Safety                                                                                                                                                                                                                                                                                                                             | Canadian Standards Association (CSA): CAN/CSA-C22.2<br>No. 61010-1<br>CSA/Nationally Recognized Test Laboratory (NRTL): UL 61010-1 International Electrotechnical Commission (IEC): 61010-1<br>EuroNorm (EN): 61010-1 |
| Electromagnetic Compatibility                                                                                                                                                                                                                                                                                                      | CISPR11/EN55011: Group1, Class A<br>EN61326-1                                                                                                                                                                         |
| Sound Emission                                                                                                                                                                                                                                                                                                                     | ISO 7779 and ISO 3744: sound pressure Lp<br>For noisy lab space: L <sub>eq</sub> max. = 65 dB operator, 70 dB bystander                                                                                               |
| Power                                                                                                                                                                                                                                                                                                                              | 120 V, 50/60 Hz, 1,100 VA,<br>200 V, 50/60 Hz, 1,100 VA,<br>220 to 240 V, 50/60 Hz, 1,100 VA                                                                                                                          |
| Operating Environment                                                                                                                                                                                                                                                                                                              | Operational: 15 to 35 °C, 20 to 80% relative humidity – noncondensing<br>Storage: -40 °C to +70 °C, 0 to 95% relative humidity – noncondensing                                                                        |
| Operating Altitude                                                                                                                                                                                                                                                                                                                 | Turbo models: to 15,000 ft (4,572 m)<br>Diffusion pump models: 12,000 ft (3,658 m)                                                                                                                                    |
| Nonoperating Storage                                                                                                                                                                                                                                                                                                               | Turbo and diffusion pump models: 30,000 ft (9,144 m)                                                                                                                                                                  |
| Physical Requirements with the 8890 and 8860 GC                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                       |
| Dimensions (GC/MS)                                                                                                                                                                                                                                                                                                                 | 88 cm (w), 56 cm (d), 50 cm (h) Additional space should be added for the auto injector, sample tray, data system, and printer.                                                                                        |
| Weight (GC/MS)                                                                                                                                                                                                                                                                                                                     | 81 to 112 kg (depending on configuration)                                                                                                                                                                             |

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## 5. Technický list Unity

**MARKES**  
international

L-0016 (140721-16)



### UNITY-xr™

#### Specification sheet

The UNITY-xr is an analytical thermal desorption instrument for the simultaneous analysis of VOCs, SVOCs and thermally labile compounds collected onto sorbent tubes.

UNITY-xr Thermal Desorbers are compatible with most GC and GC-MS applications and accommodate any workflows with the choice of manual or electronic control of gases: helium, nitrogen, and hydrogen (H<sub>2</sub> available with the Multi-Gas enabled range only).



#### 1. System features

- **'Universal' TD platform** allowing analysis of compounds over a wide volatility range AND the ability to select low flow path temperatures for compatibility with labile compounds:
  - Highly effective retention of ultra-volatiles.
  - Quantitative recovery up to n-C<sub>44</sub>.
  - Quantitative recovery of labile compounds.
  - Simultaneous analysis of volatiles and semi-volatiles.
- **Quantitative re-collection** of both tube and trap desorption split flow to allow repeat analysis.
- **Compatible with 3½" sorbent tubes:** Stainless steel, inert-coated stainless steel, and glass. Also 4½" sorbent tubes (optional).
- **Electrically-cooled focusing trap** cools rapidly and is easy to maintain.
- **Stringent, method-compliant leak test** (no-flow/ambient-temperature) is carried out on every sample. Failed tubes are retained intact.
- **Splitless, single-split and double-split options** ensure compatibility with samples over a wide concentration range (ppt to percent).
- **Trap heating rates up to 100°C/s** and backflush desorption combine to facilitate splitless operation at column flows ≥2 mL/min, therefore maximising sensitivity.
- **Pre-purge of air to vent and selective elimination of water and solvents** minimise analytical interference.
- **Overlap mode** (desorption of a subsequent sample while a previous sample is still running) optimises productivity.
- **Stand-alone injector** that can be connected to any make of GC(-MS) and does not interfere with other GC accessories.
- **Interface to the GC** typically via a direct coupling to the analytical column. Part of a GC inlet may be required for back-pressure-regulated electronic pneumatic control. This can be used to provide electronic carrier gas control (ECC) through the entire TD-GC(-MS) analyser, and stabilise retention times independent of split flow and other analytical settings.
- **Extended standby mode** reduces instrument power consumption when not in use.
- **Small footprint** for operation in mobile labs or other confined environments.
- **Flexible upgrade routes include:**
  - One or two integrated mass flow controllers (MFCs) for electronic control of split and/or desorb flows.
  - ULTRA-xr for 100-tube automation, or ULTRA-xr + ULTRA-xr Pro for 199-tube automation, allowing unattended operation all weekend.
  - Options for automated, multi-channel canister/bag analysis or round-the-clock on-line air monitoring (with Kori-xr water-management accessory).

Markes International Ltd  
T: +44 (0)1443 230935 F: +44 (0)1443 231531 E: enquiries@markes.com  
www.markes.com



A subsidiary of the SCHAEFFLER Group

## 2. System controls

### 2.1 Control software

- **Markes Instrument Control (MIC)** allows:
  - Automated, unattended sequencing of tube, on-line or canister/bag samples.
  - Addition, insertion or skipping of samples in active sequences.
  - Rapid set-up of methods using pre-programmed parameters for: (a) standard methods including VDA 278, US EPA TO-17, US EPA 325 and PAH analysis; (b) conditioning methods for popular sorbent tubes and focusing traps.
  - Automated, intelligent system self-checking diagnostics, including leak isolation.
  - Preventative maintenance feedback with usage counter – indicates when parts could be replaced to avoid instrument downtime.
  - Export of sequence history to .csv and .pdf file.
  - Set-up in English, Chinese, French, or Japanese language.

### 2.2 Desorption modes

- **Two- (or three-) stage desorption** – Normal two-stage desorption of a sample, with the additional option of an elevated-temperature purge.
- **Tube conditioning** – Desorption of the sample tube for cleaning purposes with all the effluent directed to vent, i.e. away from the focusing trap and other important components of the sample flow path
- **Trap conditioning:** Desorption of focusing trap for cleaning purposes, or for obtaining a system blank.
- Other modes including on-line monitoring, direct sampling, sample stacking and automation are available when the system is configured with the appropriate module.

### 2.3 Primary (tube) desorption oven

- **Temperature:**
  - Range: 35°C to 425°C.
  - Adjustable in 1°C increments.
  - Temperature limits are user-settable within the stated range.

*N.B.* The tube oven heats from ambient to the selected temperature at the start of tube desorption in order to minimise risk of flash-vaporisation and split discrimination when analysing samples with unknown water/solvent content.

- **Desorption time:**
  - Range: 0 to 600.0 min.
  - Adjustable in 0.1 min increments.

### 2.4 Focusing trap

- **Quartz focusing trap:** 2 mm i.d. where packed and 0.9 mm i.d. at the sample input/output end. Collar at non-sampling end makes trap easy to change.
- **Trap can be packed with** between one and four sorbents.
- **Backflush desorption** ensures quantitative retention and release of wide boiling range samples.
- **Trap low temperature:**
  - Range: -30°C to 50°C.
  - Adjustable in 1°C increments.
  - Temperature limits are user-settable within the stated range.
  - Uniform electrical cooling applied over full 60 mm length of sorbent bed.
- **Trap desorption:**
  - Default setting is ballistic heating, which reaches rates of 100°C/s during the first critical stages of secondary (trap) desorption.
  - Alternatively, programmed trap heating rates from 1°C/s to 40°C/s can be selected.
- **Trap high temperature:**
  - Range: 35°C to 425°C.
  - Adjustable in 1°C increments.
  - Temperature limits are user-settable within the stated range.
  - Uniform heating applied over full length of sorbent bed.
- **Hold time at trap high temperature:**
  - Range: 0-60 min.
  - Adjustable in 0.1 min increments.

## 2.5 Sample flow path

- **Temperature range:**
  - Valve: 50°C to 210°C.
  - Transfer line: 50°C to 250°C.
  - Both adjustable in 1°C increments.
  - Temperature limits are user-settable within the stated range.
  - Uniform heating.
- **Constructed entirely of inert materials:** PTFE, quartz, inert-coated stainless steel and uncoated, deactivated fused silica.

## 2.6 Pneumatics

- Requires a pressure-controlled 0–60 psig (0–415 kPa) supply of helium, hydrogen or nitrogen carrier gas under manual or electronic control.
- Electronic mass flow control (option) is settable between 2–500 mL/min (helium and hydrogen), and 2–250 mL/min (nitrogen).
- Requires a pressurised supply of dry air or nitrogen (dewpoint below –50°C) at 50–60 psig (340–415 kPa). The dry gas is used for both pneumatic actuation of the valve and for purging the focusing trap box.  
*N.B.* Helium or hydrogen cannot be used as the dry gas supply.
- Carrier gas and dry air or nitrogen pressure control must be regulated by the pneumatic control accessory (U-GAS01 or U-GAS01-H).

## 2.7 Pre-desorption checks and controls

- **Leak test:** Each tube is pressurised and subjected to a stringent, ambient-temperature leak test without carrier gas flow. Failed tubes are not desorbed, but are preserved intact for operator attention.
- **Pre-purge:** Each tube can be optionally purged with carrier gas (in the desorption direction) at ambient temperature to remove oxygen before desorption. The air is purged to vent and none of it is allowed to reach the analyser (e.g. GC-MS).
- **Pre-purge time:**
  - Range: 0–60.0 min.
  - Adjustable in 0.1 min increments.
- **Pre-purge flow rate (when MFC is fitted):**
  - Range: 2–500 mL/min.
  - Adjustable in 1 mL/min increments.

- Range: 2–500 mL/min.
- Adjustable in 1 mL/min increments.
- An additional carrier gas pre-purge can be carried out at elevated temperature to remove water or other interfering solvent if required.
- The focusing trap can be selected to be in or out of line during either of the pre-purge stages.
- The split can be selected to be open or closed during either of the pre-purge stages.
- **Tube dry-purge:** This is an alternative to pre-purge. The sample tube is purged with dry carrier gas in the sampling direction to eliminate water and oxygen from the back of the tube. The purged air is directed away from the analytical column and is sent to vent.
- **Tube dry-purge time:**
  - Range: 0–60.0 min.
  - Adjustable in 0.1 min increments.
- **Tube dry-purge flow rate (when MFC is fitted):**
  - Range: 2–500 mL/min.
  - Adjustable in 1 mL/min increments.
- **Trap dry-purge:** The focusing trap can be optionally purged with dry carrier gas after primary (tube) desorption and before the trap is desorbed. The purge flow is then directed through the focusing trap, in the trapping (sampling) direction, to sweep any remaining interferences to vent.
- **Trap dry-purge time:**
  - Range: 0 to 60.0 min.
  - Adjustable in 0.1 min increments.
- **Trap dry-purge flow (when MFC is fitted):**
  - Range: 2–500 mL/min.
  - Adjustable in 1 mL/min increments.
- **Trap dry-purge temperature:**
  - Range: –30°C to 50°C.
  - Adjustable in 1°C increments.
  - Temperature limits are user-settable within the stated range.

## 2.8 Sample splitting and quantitative re-collection for repeat analysis

- The UNITY-xr split can be operated in the following ways:

- During primary (tube) desorption only (inlet split).
- During secondary (trap) desorption only (outlet split).
- During both desorption stages, i.e. double-split operation (inlet and outlet split).
- During neither desorption stage, i.e. splitless operation.
- The split can be turned on or off during system standby.
- Split and desorb/trap flows are controlled by needle and solenoid valves downstream of the sample flow path.
  - Optional mass flow controllers provide electronic control of split and desorb/trap flows.
  - Configurations including Air Server-xr or CIA Advantage-xr modules have mass flow controllers configured as standard for controlling both split and trap flows.
- The split vent line contains a charcoal filter in front of the control valves (and MFC) to prevent contamination of the valves/MFC and laboratory atmosphere. The charcoal filter has the same external dimensions as a standard sorbent tube. The charcoal filter is connected to the main heated valve via a short, inert, heated flow path.
- When required, the charcoal filter can be replaced with a conditioned sorbent tube to quantitatively re-collect the split effluent from tube and trap desorption (inlet and outlet split). This capability allows repeat analysis, method/data validation and archiving of critical samples.
- Note: Maximum split ratios and flows may not be achievable in all configurations with all carrier gas types.

### 3. System specification

#### 3.1 Dimensions and weight

- Height: 46 cm (18.1").
- Width: 16 cm (6.3").
- Depth: 54 cm (21.3").
- Weight: 16 kg (35 lb).

#### 3.2 Tubes accommodated

- 3½" (89 mm) long × ¼" (6.4 mm) o.d. tubes.

- 4½" (114 mm) long × 6 mm o.d. tubes (optional).  
N.B. Kits are available to allow users to interchange between the 3½" and 4½" versions.
- Constructed of stainless steel, inert-coated stainless steel or glass.
- With or without sorbent packing.
- With or without TubeTAG RFID tags.

#### 3.3 Ambient operating conditions

- Temperature: 15°C to 30°C.
- Relative humidity: 5–95% RH (non-condensing).

#### 3.4 Power requirements

- 100–240 V, 50/60 Hz, 650 W (UNITY-xr self-adjusts to local voltage input).

#### 3.5 Gas consumption

- Dry air or nitrogen: ~100 mL/min.
- Carrier gas consumption is method-dependent (typically 5–200 mL/min).

#### 3.6 Minimum PC specification

For TD control:

- CPU: 1 GHz 64-bit dual-core or better.
- RAM: 4 GB.
- Hard disk space: 2 GB.
- Graphics card: DirectX 9 or later.
- Display: 1024 × 768 display.
- Operating system: Windows 7, 8.1 or 10, 64-bit, English.
- Other requirements: Windows-compatible keyboard and mouse; one free USB connection for UNITY-xr communication with PC.

#### 3.7 Safety and regulatory certifications

- The instrument is designed and manufactured under a quality system registered to ISO 9001.
- The instrument complies with the essential requirements of the following applicable European Directives, and carries the CE mark accordingly:
  - Low Voltage Directive 2014/35/EU
  - EMC Directive 2014/30/EU
  - ROHS Directive 2011/65/EU

- The instrument conforms to the following product safety standards:
  - IEC 61010-1:2010/EN 61010-1:2010.
  - IEC 61010-2-010/EN 61010-2-010:2014.
  - IEC 61010-2-081/EN 61010-2-081:2015.
  - Canada: CSA C22.2 No.61010-1:2012.
  - USA: ANSI/UL 61010-1:2012.
- The instrument conforms to the following regulation on electromagnetic compatibility (EMC):
  - IEC 61326-1/EN 61326-1:2013.

### 3.8 GC remote cable connections

- UNITY-xr includes a GC interface cable that connects to the 'ready' output and 'start' input of the GC(-MS) and data-handling systems.
- The cable supports automatic start of the entire analytical system when the UNITY-xr focusing trap desorbs, and allows UNITY-xr to check the 'ready' status of the analyser and associated data handling.
- The UNITY-xr focusing trap will not desorb unless and until it receives a 'ready' signal from the GC(-MS) system.

## 4. System options

- Standard models configured for use with helium and nitrogen carrier gas
- Multi-Gas enabled models configured for use with helium, hydrogen and nitrogen carrier gas

Accessory and upgrade options include:

- Integrated electronic mass flow control of split and/or desorb flow. MFCs available with flow range between 2–500 mL/min (helium and hydrogen), and 2–250 mL/min (nitrogen). Allows split ratios from zero to 125,000:1 to be used with standard (60 m × 0.25 mm i.d.) capillary columns.
- ULTRA-xr 100-tube autosampler and automated outlet split re-collection.
- ULTRA-xr plus ULTRA-xr Pro 199-tube automation and automated inlet and outlet split re-collection.
- Air Server-xr options (3- or 8-channel) for continuous on-line air/gas monitoring or analysis of multiple canisters/bags.

- CIA Advantage-xr options (T or HL models) for method-compliant analysis from whole-air/gas samples, collected using multiple canisters/bags or on-line monitoring.

**For more information about our products and services, please visit [www.markes.com](http://www.markes.com).**

### Trademarks

UNITY-xr™, Air Server-xr™, CIA Advantage-xr™, TubeTAG™, ULTRA-xr™ and ULTRA-xr Pro™ are trademarks of Markes International.

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## 6. Technický list CIA

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### UNITY-CIA Advantage-xr™

#### Specification sheet

The **CIA Advantage-xr** is a multi-channel module that connects to the **UNITY-xr**, and which allows analysis of whole-air and gas samples collected using canisters and Tedlar bags, as well as continuous monitoring of air or gas streams.

UNITY-xr Thermal Desorbers are compatible with most GC and GC-MS applications and accommodate any workflows with the choice of manual or electronic control of gases: helium, nitrogen, and hydrogen (H<sub>2</sub> available with the Multi-Gas enabled range only).



#### 1. System features

- **Two models are available**, the **CIA Advantage T-xr** and **CIA Advantage HL-xr**.
- **The UNITY-CIA Advantage T-xr** is a dedicated system for analysis of trace-level components.
  - Sample volumes: 5 mL upwards.
  - Sample channels: 4.
  - Upgradeable to 17 channels with CIA Satellite-xr.
- **The UNITY-CIA Advantage HL-xr** is a versatile system for the analysis of both high- and low-concentration samples and for screening unknowns.
  - Sample volumes: 0.5 mL upwards (using sample gas loop), and 5 mL upwards (using MFC).
  - Sample channels: 14.
  - Upgradeable to 27 channels with CIA Satellite-xr.
- **Method-compliant:** Complies with US EPA Method TO-15 and Chinese EPA Method HJ 759 for canister-based analysis of air.
- **Cryogen-free operation and low gas consumption** for robust operation and high uptime.
- **Internal standard capability** allows either a precise aliquot (via a 1 mL loop) or a metered volume (5–500 mL) of gaseous standard to be added to the focusing trap prior to sampling.
- **Electronic mass flow control** is used for sample and split flows. Set and actual sampling flows are displayed and continuously updated in the software.
- **Heated, inert internal sample flow paths** eliminate risk of condensation and carryover.
- **Compatible with gas-phase samples** ranging in pressure from below atmospheric to 50 psig.
- **Sample stacking:** Combine multiple samples, channels and standards onto the focusing trap before injection into the GC column.
- **Tube desorption capability** in compliance with US EPA Method TO-17 and other standard methods. Single-tube desorption is performed manually on the UNITY-xr, or desorption of up to 100 tubes can be automated with the addition of an ULTRA-xr.

Markes International Ltd  
T: +44 (0)1443 230935 F: +44 (0)1443 231531 E: enquiry@markes.com

[www.markes.com](http://www.markes.com)



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## 2. System controls

### 2.1 Control software

- **Markes Instrument Control (MIC)** allows:
  - Automated, unattended sequencing of tube, on-line and canister/bag samples\*.
  - Addition, insertion or skipping of samples in active sequences.
  - Rapid set-up of methods using pre-programmed parameters for: (a) standard methods including US EPA TO-15, PAMS, US EPA TO-17, VDA 278, US EPA 325, PAMS + TO-15 + OVOCs, and PAH analysis; (b) conditioning methods for popular sorbent tubes and focusing traps.
  - Automated, intelligent system self-checking diagnostics, including leak isolation.
  - Preventative maintenance feedback with usage counter – indicates when parts could be replaced to avoid instrument downtime.
  - Export of sequence history to .csv and .pdf files.
  - Set-up in English, French, Japanese or Chinese languages.

### 2.2 Pre-desorption checks and controls

- **Selection of carrier gas type:** Three carrier gas options (helium, hydrogen (Multi-Gas models), and nitrogen) are available and user-defined in the software.
- **Electronic mass flow control** is used for all sampling and split flows, which are settable between 2–500 mL/min (helium and hydrogen) and 2–250 mL/min (nitrogen).
- **Leak test:** Leak test of the entire UNITY-CIA Advantage-xr internal flow path run as part of a sample method.
- **Sample purge:** This ensures that individual sample lines leading up to the CIA Advantage-xr, as well as the entire flow path inside the system, are swept with the current sample before the beginning of sample collection. The sample purge flow is all directed to the split line.
- **Sample purge flow:**
  - Range: 2–500 mL/min.
  - Adjustable in 1 mL/min increments.
- **Sample purge time:**
  - Range: 0–60.0 min.
  - Adjustable in 0.1 min increments.
- **Internal standard addition:** Gaseous internal standard can be added automatically via a 1 mL inert sample loop or metered between 5–500 mL using the MFC.
- **Sample gas selection:** Air, helium, hydrogen (Multi-Gas models), or nitrogen sample gas can be selected.
- **Sample volume/time:** After the leak test (if selected) and sample purge, the flow of sample air/gas is directed to the electrically-cooled focusing trap of the UNITY-xr until the desired volume is collected, or for a defined sample time.
  - Sample volume range (HL model): 0.5–15,000 mL, adjustable in 0.1 mL increments.
  - Sample volume range (T model): 5–15,000 mL, adjustable in 0.1 mL increments.
  - Sample time range (both models): 0–99.9 min, adjustable in 0.1 min increments.
- **Sample flow:** This determines the flow rate of sample air/gas into the focusing trap for the sampling time. It is controlled by the mass flow controller and is independent of the pressure of the sample.
  - Range: 2–250 mL/min (nitrogen or air)  
2–500 mL/min (helium and hydrogen).†
  - Adjustable in 1 mL/min increments.
- **Post-sampling purge:** The flow path of the UNITY-CIA Advantage-xr is purged with clean gas (humidified or carrier) to eliminate any remaining sample, thereby preventing carryover into subsequent analyses.
- **Post-sampling purge time:**
  - Range: 0–99.9 min.
  - Adjustable in 0.1 min increments.

\* Not available if installing on a UNITY 2. Automated sequencing between tubes and on-line/canister samples also requires the ULTRA-xr to be configured.

† Sampling flow rates  $\geq 250$  mL/min may not be attainable under all operational conditions. Factors affecting the maximum sampling flow rate will include the type of focusing trap and any sampling accessories connected to the sample inlet.

- **Post-sampling purge flow:**
  - Range: 2-500 mL/min.
  - Adjustable in 1 mL/min increments.
- **Trap dry-purge:** The UNITY-xr focusing trap is purged with dry carrier gas after sample collection and before the trap is desorbed. The purge flow is directed through the focusing trap, in the trapping (sampling) direction, to sweep any remaining oxygen, water and/or other residual sample matrix gas from the trap to vent. This step is part of the Dry-Focus3 process.
- **Trap dry-purge time:**
  - Range: 0 to 99.9 min.
  - Settable in 0.1 min increments.
- **Trap dry-purge flow:**
  - Range: 2-500 mL/min.
  - Settable in 1 mL/min increments.
- **Trap dry-purge temperature:**
  - Range: -30°C to 50°C.
  - Adjustable in 1°C increments.
  - Temperature limits are user-settable within the stated range.
- **Trap desorption:**
  - Default setting is ballistic heating, which reaches rates of 100°C/s during the first critical stages of secondary (trap) desorption.
  - Alternatively, a range of programmed trap heating rates from 1°C/s to 40°C/s can be selected.
- **Flow path:** The entire inert sample flow path is heated to eliminate risk of contamination or carryover.
  - Range: 50-200°C.
  - Settable in 1°C increments.
  - Temperature limits are user-settable within the stated range.
- **Cycle time (overlap):** The start of collection of another sample onto the focusing trap can overlap with analysis of the previous sample, to optimise the overall cycle time.

## 2.3 Inlet sampling options

- **Inlet selection:** 4 or 14 sample inlet options are available depending on the model chosen. Each can be extended to 17 or 27 respectively, by adding a CIA Satellite-xr.
- The start of each new sample collection time can be programmed to begin:
  - as soon as the trap has re-cooled to its trapping temperature (250°C to -30°C in <5 min);
  - at a fixed time interval;
  - at an absolute time, e.g. 12:00, 13:00, 14:00.

## 2.4 Automatic sequencing of inlets

- A sequence of samples can be entered by the user into the sequence table on the PC user interface.
- An entire sequence can be repeated any number of times.
- Individual samples can be identified as 'calibrant', 'blank', 'sample' or as a user-defined name.
- A log file is produced as a sequence progresses and is automatically maintained and saved. Any sequence deviations are recorded in the log file.
- If any deviations occur in a sequence, the GC run is initiated to keep the analytical system 'in sync' with the desorber.
- Sequences can be stored and recalled for re-use if necessary.
- No manual change-over is needed between CIA Advantage-xr samples and ULTRA-xr tube desorption. Both sample types can be sequenced without user intervention.

## 3. System specification

The CIA Advantage-xr mounts on the right-hand side of the UNITY-xr and connects through either the 'tube' or 'split' side of the UNITY-xr flow path.

### 3.1 Dimensions and weight

CIA Advantage-xr:

- Height: 42 cm (16.5").
- Width: 24 cm (9.4").
- Depth: 54 cm (21.3").

- Weight: 21 kg (46 lb).

#### UNITY-CIA Advantage-xr:

- Height: 46 cm (18.1")
- Width: 40 cm (15.7")
- Depth: 54 cm (21.3")
- Weight: 37 kg (81 lb).
- UNITY-CIA Advantage-CIA Satellite-xr:
- Height: 46 cm (18.1")
- Width: 64 cm (25.2")
- Depth: 54 cm (21.3")
- Weight: 58 kg (128 lb).

#### 3.2 Recommended ambient operating conditions

- Temperature: 15°C to 30°C.
- Relative humidity: 5–95% RH (non-condensing).

#### 3.3 Power requirements

- 100–240 V, 50/60 Hz, 900 W (CIA Advantage-xr self-adjusts to local voltage input).

#### 3.4 Pneumatic requirements

- Pressure-controlled 0–60 psig (0–415 kPa) supply of helium, hydrogen or nitrogen carrier gas under manual or electronic control. (This is in addition to the UNITY-xr carrier gas supply).
- Pressurised supply of dry air/nitrogen at 50–60 psig (340–415 kPa). The gas is used for pneumatic actuation of valves. (This is in addition to the UNITY-xr dry gas supply).

#### 3.5 Minimum PC specification

For TD control:

- CPU: 1 GHz 64-bit dual-core or better.
- RAM: 4 GB.
- Hard disk space: 2 GB.
- Graphics card: DirectX 9 or later.
- Display: 1024 × 768 display.
- Operating system: Windows 7, 8.1 or 10, 64-bit, English.
- Other requirements: Windows-compatible keyboard and mouse; one free USB per CIA Advantage-xr module (in addition to the port requirements for the UNITY-xr).

#### 3.6 Safety and regulatory certifications (for UNITY-CIA Advantage-xr)

- The instrument is designed and manufactured under a quality system registered to ISO 9001.
- The instrument complies with the essential requirements of the following applicable European Directives, and carries the CE mark accordingly:
  - Low Voltage Directive 2014/35/EU.
  - EMC Directive 2014/30/EU.
  - ROHS Directive 2011/65/EU.
- The instrument conforms to the following product safety standards:
  - IEC 61010-1:2010/EN 61010-1:2010.
  - IEC 61010-2-010/EN 61010-010:2014.
  - IEC 61010-2-081/EN 61010-2-081:2015.
  - Canada: CSA C22.2 No.61010-1:2012.
  - USA: ANSI/UL 61010-1:2012.
- The instrument conforms to the following regulation on electromagnetic compatibility (EMC):
  - IEC 61326-1/EN 61326-1:2013.

#### 4. System options

- **CIA Satellite-xr** (U-CIASAT-2S or U-CIASAT-H-XR): The CIA Satellite-xr provides capacity for an additional 13 channels.
  - CIA Advantage T-xr with CIA Satellite-xr provides 17 channels.
  - CIA Advantage HL-xr with CIA Satellite-xr provides 27 channels.
- **Kori-xr water management option** (U-KORI-XR or U-KORI-H-XR): Uses an empty trap to remove water from humid air streams prior to analyte focusing, allowing simultaneous analysis of ultra-volatiles, polar species, oxygenates and pinenes.
- **In-line Nafion dryer** (U-ASDRY) for monitoring ultra-volatile, non-polar compounds in humid atmospheres (not suitable for polar species): Requires a pressure-regulated (~15 psig) supply of 150–200 mL/min dry air or nitrogen with a dew point below –50°C (as required for UNITY-xr).

- **ULTRA-xr 100-tube autosampler** (U-ULTRA-XR or U-ULTRA-H-XR): Both CIA Advantage-xr and ULTRA-xr can be installed onto the same UNITY-xr, allowing automated re-collection of the outlet split from both tube and canister/on-line samples.
- **Pump** (U-ASPM1/U-ASPM2/U-ASPM3 or U-ASPM1-H/U-ASPM2-H (for Multi-Gas models)): If the sample/standard gas is pressurised (>10 psig), the controlled flow through the entire system is driven by this pressure.<sup>†</sup> If the sample is at low (<10 psig) pressure, a pump is required to draw the gas-phase sample through the system. The pump includes a power cord to connect to the mains supply, silicone rubber tubing and a copper tube adaptor.
- **Heated sample lines** (U-HTLNKT or U-HTLNKT-T): Recommended for the analysis of compounds that can condense at room temperature.
- **Humidifier** (U-HUMID): Supplies humidified carrier gas to flush the flow path, thereby reducing carryover.
- **Canister rack** (U-RACK02): Markes' floor-mounted Maxi Rack holds up to 15 canisters (14 samples and one internal standard) up to 6 L in size. See separate specification sheet.

For more information about our products and services, please visit [www.markes.com](http://www.markes.com).

#### Trademarks

CIA Advantage-xr™, CIA Satellite-xr™, Dry-Focus3™, Kori-xr™, ULTRA-xr™ and UNITY-xr™ are trademarks of Markes International.

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*Kori-xr was developed in collaboration with the National Centre for Atmospheric Science (NCAS) at the University of York. It was co-funded by the UK's innovation agency (Innovate UK), the Natural Environment Research Council (NERC) and the Welsh Government under the Knowledge Transfer Partnership program.*

## 7. Technický list Ultra

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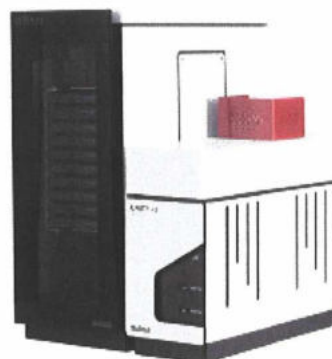


### UNITY-ULTRA-xr™

#### Specification sheet

The **ULTRA-xr** is a high-throughput autosampler, which adds to the **UNITY-xr** thermal desorption unit, for the rapid and unattended analysis of **VOCs and SVOCs** from up to **100** sample sorbent tubes in a single sequence.

UNITY-ULTRA-xr Thermal Desorbers are compatible with most GC and GC-MS applications and accommodate any workflows with the choice of manual or electronic control of gases: helium, nitrogen, and hydrogen (H<sub>2</sub> available with the Multi-Gas enabled range only).



#### 1. System features

- **100-tube capacity** offers unattended, unsupervised operation over an entire weekend.
- **Compatible with 3½" sorbent tubes:** Stainless steel, inert-coated stainless steel, and glass.
- **Quantitative re-collection** of both tube and trap desorption split flows to allow repeat analysis, with selectable automated outlet split re-collection.
- **Sample stacking:** Combine multiple tube samples onto the focusing trap before injection onto the GC column.
- **Internal standard (optional):** Allows gas-phase standard to be loaded onto the focusing trap or a sample tube via a 1 mL loop.
- **Integrated TubeTAG read/write capability** for enhanced tracking of tube history.
- **Overlap mode** (desorption of a subsequent sample while a previous sample is still running) optimises productivity.
- **Sealing of tubes with DiffLok caps** prevents entry of contaminants and loss of volatiles before, during and after analysis.
- **Minimal linear robotic movements** required for operation increases reliability.
- **Tube cooling fan:** Rapidly cools sample tubes after desorption for increased sample throughput.
- **Versatility and throughput:** Software allows multiple sets of tubes, requiring different TD methods, to be linked together in a single automated sequence.

- **Integrates with:** All UNITY-xr configurations, with or without any other module(s).\*

#### 2. System controls

##### 2.1 Control software

- **Markes Instrument Control (MIC)** allows:
  - Automated, unattended sequencing of tube, on-line and canister/bag samples.†
  - Addition, insertion or skipping of samples in active sequences.
  - Rapid set-up of TD methods using pre-programmed parameters for (a) standard methods including VDA 278, US EPA TO-17, US EPA 325 and PAH analysis; (b) conditioning methods for popular sorbent tubes and focusing traps.
  - Pre-loading of an internal standard on a tube or trap.

\* Installation of an ULTRA-xr onto a UNITY 2 system: (a) requires a software update, (b) requires disconnection of existing Air Server 2 or CIA Advantage modules; (c) has limited functionality.

Installation of an ULTRA-xr Multi-Gas to the UNITY 2 is possible however configuration is not compatible with hydrogen.

† Not available if installing on a UNITY 2. Automated sequencing between tubes and on-line/canister samples also requires the Air Server-xr or CIA Advantage-xr to be configured.



- Automated, intelligent system self-checking diagnostics, including leak isolation.
- Preventative maintenance feedback with usage counter – indicates when parts could be replaced to avoid instrument downtime.
- Integrated pressure ratio calculation for monitoring of tube packing integrity.
- Export of sequence history to .csv and .pdf file.
- Set-up in English, Chinese, French, and Japanese language.

## 2.2 Desorption modes

Please refer to the UNITY-xr specification sheet for details of desorption modes.

### 2.3 Primary (tube) desorption oven

#### • Temperature:

- Range: 35°C to 425°C.
- Adjustable in 1°C increments.
- Temperature limits are user-settable within the stated range.

*N.B.* The tube oven heats from ambient to the selected temperature at the start of tube desorption in order to minimise risk of flash vaporisation and split discrimination when analysing samples with unknown water/solvent content.

#### • Desorption time:

- Range: 0–600.0 min.
- Adjustable in 0.1 min increments.

### 2.4 Pre-desorption checks and controls

- The pre-desorption checks and controls are as for the UNITY-xr. However, the leak test is automated so that if a tube fails, it is not desorbed and replaced in its position in the tray.
- The position of the tube that failed the leak test is added to the sequence history/log, which is automatically maintained and saved.
- The number of consecutive leak test failures before sequence stop is user-settable.

### 2.5 Automatic sequencing of tubes

- A tube sequence of multiple methods can be entered into the sequence table via the PC user interface.

- An entire sequence can be repeated any number of times.
- Individual tubes can be identified as 'calibrant', 'blank', 'sample' or as a user-defined name.
- A sequence history/log file is produced as a sequence progresses, and is automatically maintained and saved.
- Sequence deviations, e.g. leak test failure or missing tube, are recorded in the log file. If any occur, the GC run is initiated to keep the analytical system synchronised with the desorber.
- An automated tube-conditioning mode is available on UNITY-ULTRA-xr configurations, allowing automated, sequential tube conditioning without risk of trap contamination.
- Automated re-collection of trap desorption (outlet) split flow for up to 100 tubes using a single ULTRA-xr autosampler when re-collected onto original tube. Not available with UNITY 2.
- ULTRA-xr systems also facilitate automated dry-purging of tubes. If configured with UNITY 2 this feature is only available when the ISDP accessory is installed.
- No manual change-over needed between ULTRA-xr and on-line/canister systems.

### 2.6 Sample splitting and quantitative re-collection for repeat analysis

- The UNITY-ULTRA-xr split can be operated in the following ways:
  - During primary (tube) desorption only (inlet split).
  - During secondary (trap) desorption only (outlet split).
  - During both desorption stages, i.e. double split operation (inlet and outlet split).
  - During neither desorption stage, i.e. splitless operation.
- The split can be turned on or off during system standby.
- Split and desorb flows are controlled by needle and solenoid valves downstream of the sample flow path.
  - Optional mass flow controllers provide electronic control of split and desorb/trap flows.

- The split vent line contains a charcoal filter in front of the control valves (and MFC) to prevent contamination of the valves/MFC and laboratory atmosphere. The charcoal filter has the same external dimensions as a standard sorbent tube. The charcoal filter is connected to the main heated valve via a short, inert, heated flow path.
- When required, the charcoal filter can be replaced with a conditioned sorbent tube to quantitatively re-collect the split effluent from tube and trap desorption (inlet and outlet split). This capability allows repeat analysis, method/data validation and archiving of critical samples.
- Note: Maximum split ratios and flows may not be achievable in all configurations

### 3. System specification

#### 3.1 Dimensions and weight

##### ULTRA-xr:

- Height: 62 cm (24.4").
- Width: 24 cm (9.4").
- Depth: 55 cm (21.7").
- Weight: 23 kg (51 lb) unloaded, 28 kg (62 lb) fully loaded.

##### UNITY-ULTRA-xr:

- Height: 62 cm (24.4").
- Width: 40 cm (15.7").
- Depth: 55 cm (21.7").
- Weight: 39 kg (86 lb) unloaded, 44 kg (97 lb) fully loaded.

#### 3.2 Tubes accommodated

- 3/4" (89 mm) long x 1/4" (6.4 mm) o.d. tubes.
- Constructed of stainless steel, inert-coated stainless steel or glass.
- With or without sorbent packing.
- With or without TubeTAG RFID tags.

#### 3.3 Ambient operating conditions

- Temperature: 15°C to 30°C.
- Relative humidity: 5-95% RH (non-condensing).

#### 3.4 Power requirements

- 100-240 V, 50/60 Hz, 400 W (ULTRA-xr self-adjusts to local voltage input).

#### 3.5 Minimum PC specification

##### For TD control:

- CPU: 1 GHz 64-bit dual-core or better.
- RAM: 4 GB.
- Hard disk space: 2 GB.
- Graphics card: DirectX 9 or later.
- Display: 1024 x 768 display.
- Operating system: Windows 7, 8.1 or 10, 64-bit, English.
- Other requirements: Windows-compatible keyboard and mouse; one free USB (in addition to the port required for the UNITY-xr).

#### 3.6 Safety and regulatory certifications

- The instrument is designed and manufactured under a quality system registered to ISO 9001.
- The instrument complies with the essential requirements of the following applicable European Directives, and carries the CE mark accordingly:
  - Low Voltage Directive 2014/35/EU.
  - EMC Directive 2014/30/EU.
  - ROHS Directive 2011/65/EU.
- The instrument conforms to the following product safety standards:
  - IEC 61010-1:2010/EN 61010-1:2010.
  - IEC 61010-2-010/EN 61010-2-010:2014.
  - IEC 61010-2-081/EN 61010-2-081:2015.
  - Canada: CSA C22.2 No.61010-1:2012.
  - USA: ANSI/UL 61010-1:2012.
- The instrument conforms to the following regulation on electromagnetic compatibility (EMC):
  - IEC 61326-1/EN 61326-1:2013.

#### 4. System options

- Standard model configured for use with helium and nitrogen carrier gas
- Multi-Gas enabled model configured for use with helium, hydrogen and nitrogen carrier gas

Accessory and upgrade options include:

- **Internal standard accessory:** Contains a 1 mL loop for introducing a gas-phase internal standard onto the focusing trap or inlet end of a blank or sampled tube.
- **The addition of a second autosampler** (ULTRA-xr Pro) to the UNITY-xr fully automates the quantitative re-collection of inlet and outlet splits for up to 199 tube samples back onto the same tubes (or for up to 99 tube samples onto separate, conditioned, sample tubes).
- **The addition of a canister/on-line module** (CIA Advantage-xr or Air Server-xr) to the UNITY-xr enables the analysis of whole-air samples, gas/air streams, canisters or bags. Sequencing between these samples and tubes is fully automated.

For more information about our products and services, please visit [www.markes.com](http://www.markes.com).

#### Trademarks

ULTRA-xr™, ULTRA-xr Pro™, Air Server-xr™, CIA Advantage-xr™, TubeTAG™ and UNITY-xr™ are trademarks of Markes International.

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## 8. Technický list KORI

**MARKES**  
international

L-0050 (220319-6)

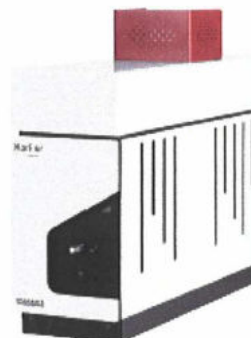


### Kori-xr™

#### Specification sheet

Kori-xr aids the analysis of humid air using Markes' TD equipment, by removing water from on-line and canister samples and allowing the simultaneous analysis of ultra-volatiles, polar species, oxygenates and pinenes.

All of Markes' TD instruments are compatible with most GC and GC-MS applications and accommodate any workflows with the choice of manual or electronic control of gases: helium, nitrogen, and hydrogen (H<sub>2</sub> available with the Multi-Gas enabled range only).



#### 1. System features

- **Electrically cooled water-removal trap** selectively removes water from the sample stream without affecting target analytes and without extending the overall cycle time.
- **Trap heated and flushed** with carrier gas between samples to remove water collected.
- **Compatible with gas-phase samples** ranging in pressure from below atmospheric pressure to 50 psig.
- **Integrates with:** UNITY-Air Server-xr and UNITY-CIA Advantage-xr systems, with or without ULTRA-xr. Also compatible with UNITY 2-Air Server and UNITY 2-CIA Advantage. Multi-Gas model only compatible with Multi-Gas range.

#### 2. System controls

##### 2.1 Control software

- **Markes Instrument Control (MIC):**
  - Please refer to the UNITY-Air Server-xr or UNITY-CIA Advantage-xr specification sheets for software features.
  - When installing Kori-xr on a UNITY 2-Air Server or UNITY 2-CIA Advantage, the instrument controls must be upgraded to the included MIC software.

##### 2.2 Modes of operation for analysis

- Please refer to the UNITY-Air Server-xr or UNITY-CIA Advantage-xr specification sheets for desorption modes.

##### 2.3 Water removal trap

- Constructed from quartz (3 mm i.d.).
- Trap low temperature:
  - Range: -30°C to 50°C.
  - Adjustable in 1°C increments.
  - Uniform electrical cooling applied over full length of ice deposit zone.
- Trap high temperature:
  - Range: 35°C to 425°C.
  - Adjustable in 1°C increments.
  - Uniform heating applied over full length of ice deposit zone.

##### 2.4 Sample flow path

- Temperature range: 50°C to 210°C.
- Adjustable in 1°C increments.
- Uniform heating.
- Constructed entirely of inert materials: PTFE, quartz, inert-coated stainless steel.
- Flow capabilities: Independent, manual flow control between 25–100 mL/min.



## 2.5 Pneumatics

- Requires a pressurised supply of dry air or nitrogen (dewpoint below  $-50^{\circ}\text{C}$ ) at 50–60 psig (340–415 kPa). The dry gas is used for both pneumatic actuation of the valve and for purging the focusing trap box.
  - Supplied with a fitting to attach to the pneumatic control accessory (U-GAS01) on UNITY-xr or UNITY 2.
- Note that helium and hydrogen cannot be used as the dry gas supply.

## 3. System specification

### 3.1 Dimensions and weight

- Height: 46 cm (18.1").
- Width: 16 cm (6.3").
- Depth: 54 cm (21.3").
- Weight: 16 kg (35 lb).

### 3.2 Ambient operating conditions

- Temperature:  $15^{\circ}\text{C}$  to  $30^{\circ}\text{C}$ .
- Relative humidity: 5–95% RH (non-condensing).

### 3.3 Power requirements

- 100–240 V, 50/60 Hz, 650 W (Kori-xr self-adjusts to local voltage input).

### 3.4 Gas consumption

- Dry air or nitrogen:  $\sim 100$  mL/min.

### 3.5 Minimum PC specification

For TD control:

- CPU: 1 GHz 64-bit dual-core or better.
- RAM: 4 GB.
- Hard disk space: 2 GB.
- Graphics card: DirectX 9 or later.
- Display: 1024 × 768 display.
- Operating system: Windows 7, 8.1 or 10, 64-bit, English.
- Other requirements: Windows-compatible keyboard and mouse; one free USB connection (in addition to those required for the UNITY-xr).

## 3.6 Safety and regulatory certifications

- The instrument is designed and manufactured under a quality system registered to ISO 9001.
- The instrument complies with the essential requirements of the following applicable European Directives, and carries the CE mark accordingly:
  - Low Voltage Directive 2014/35/EU.
  - EMC Directive 2014/30/EU.
  - RoHS Directive 2011/65/EU.
- The instrument conforms to the following product safety standards:
  - IEC 61010-1:2010/EN 61010-1:2010.
  - IEC 61010-2-010/EN 61010-2-010:2014.
  - IEC 61010-2-081/EN 61010-2-081:2015.
  - Canada: CSA C22.2 No.61010-1-12:2012.
  - USA: ANSI/UL 61010-1:2012.
- The instrument conforms to the following regulation on electromagnetic compatibility (EMC):
  - IEC 61326-1/EN 61326-1:2013.

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## Trademarks

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*Kori-xr was developed in collaboration with the National Centre for Atmospheric Science (NCAS) at the University of York. It was co-funded by the UK's innovation agency (Innovate UK), the Natural Environment Research Council (NERC) and the Welsh Government under the Knowledge Transfer Partnership program.*

## 9. Technický list TC-20 TAG

**MARKES**  
international

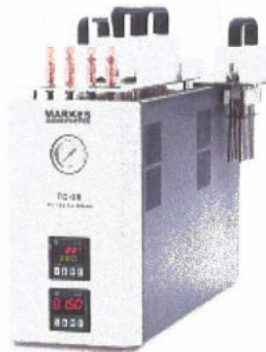
L-0037 (030517-4)



### TC-20 TAG

#### Specification sheet

The **TC-20 TAG™** is a compact, stand-alone device for the simultaneous conditioning and dry-purging of up to 20 thermal desorption sorbent tubes fitted with **TubeTAG™** RFID tags.



#### 1. System features

- Conditioning of up to 20 single-bed TD sorbent tubes simultaneously, to remove contamination from sorbent tubes prior to sampling.
- Dry-purging of up to 20 TD sorbent tubes after sampling and before analysis – especially important when hydrophilic sorbents have been used.
- Four manifolds (optional) for conditioning or dry-purging 20 tubes while an additional 20 tubes are cooling.

#### 2. System specification

##### 2.1 Dimensions and weight

- Height: 30 cm (11.8").  
41 cm (16.1") with gas manifold blocks.
- Width: 16 cm (6.3").
- Depth: 51 cm (20.1").
- Weight: 14 kg (30 lb).

##### 2.2 Ambient operating conditions

- Temperature: 15°C to 30°C.
- Relative humidity: 5–95% RH (non-condensing).

##### 2.3 Operational temperature

- Range: 50°C to 400°C
- Adjustable in 1°C increments.

##### 2.4 Time

- Range: 1 min to 99 h 59 min.
- Settable in 1 min increments.

##### 2.5 Carrier gas

- Gas: Helium or nitrogen.
- Pressure range: 0–60 psi.
- Purity: 5 N recommended.

##### 2.6 Power requirements

- Voltage: 100–120 V or 220–240 V.
- Frequency: 50/60 Hz.
- Maximum power: 400 W.

##### 2.7 Safety and regulatory approvals

- The instrument is designed and manufactured under a quality system registered to ISO 9001.
- The instrument complies with the essential requirements of the following applicable European Directives, and carries the CE mark accordingly:
  - Low Voltage Directive 2014/35/EU.
  - EMC Directive 2014/30/EU.
- The instrument conforms to the following product safety standards:
  - IEC 61010-1:2001/EN 61010-1:2001.
  - IEC 61010-2-010/EN 61010-2-010:2003.
  - Canada: CSA C22.2 No.61010-1-12:2005.
  - USA: ANSI/UL 61010-1:2005.
- The instrument conforms to the following regulation on electromagnetic compatibility (EMC):
  - IEC 61326-1:2012/EN 61326-1:2013.

Markes International Ltd  
T: +44 (0)1443 230935 F: +44 (0)1443 231531 E: [enquiries@markes.com](mailto:enquiries@markes.com)  
[www.markes.com](http://www.markes.com)



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## 10. Technický list vodíkový generátor

### Precision Hydrogen Trace 1200 GC Carrier Gas

Application: Precision

Part number: 3301768



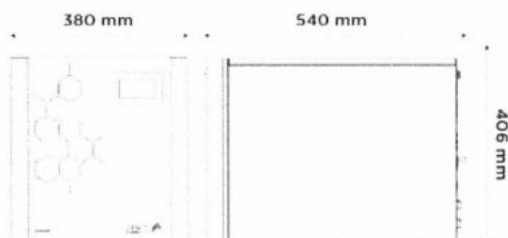
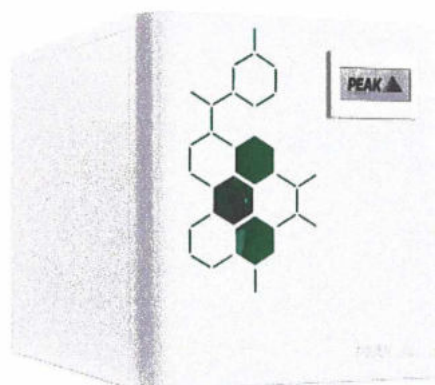
#### Description

The Precision Hydrogen Trace 1200 generator is designed primarily for GC carrier gas use, and can also be used for detectors requiring hydrogen fuel gas such as FID and FPD. One generator is capable of supplying multiple GC instruments.

This generator offers a safe, reliable and convenient solution for those using hydrogen for GC carrier gas, producing the highest purity of hydrogen from the Precision series by utilising a Proton Exchange Membrane to create the hydrogen gas from deionized water, as well as Pressure Swing Absorption and molecular sieve technology to remove moisture content down to trace levels. The Precision Hydrogen Trace generators are also suitable for providing collision gas for ICP-MS.

The Precision Hydrogen Trace 1200 generator also comes with many highly robust safety features as standard, allowing for peace of mind in the laboratory and a far safer, dependable and more convenient alternative to cylinder gas.

- **Gas types** Hydrogen
- **Integrated compressor:** No
- **Application Types:** GC & GC-MS Carrier & Detector Gas, ICP-MS Reaction Gas



#### Key Features

- Suitable for flame gas and carrier gas at trace detection limits
- 99.99999%\* purity
- Internal leak detection with automatic shutdown features
- Proven PEM technology to generate hydrogen safely and reliably
- Regenerative PSA dryers to ensure highest level of purity
- Automatic loading pump as standard
- Maintenance limited to replacing de-ionizer cartridge
- Compact, space-saving modular design
- Creates hydrogen on demand, minimal storage of hydrogen in the system
- Short and easy start-up and shutdown procedures
- Combine multiple units for higher flow requirements
- GC in-oven hydrogen leak detector available as an optional extra
- 12 month comprehensive on-site warranty
- Peak also offers a 3 year cell warranty with this generator as standard

## Technical Specifications

| Precision Hydrogen Trace 1259 GC Carrier Gas |                                       |
|----------------------------------------------|---------------------------------------|
| Gas Type                                     | Hydrogen                              |
| Max Gas Flow:                                | 1200cc/min                            |
| Max Output Pressure:                         | 100psi/6.9bar                         |
| Max Output Pressure:                         | 100psi/6.9bar                         |
| Max Purity:                                  | 99.99999                              |
| Gas Outlets Fitting:                         | 1 x 1/8" Swagelok compression fitting |
| Water Purity Requirements:                   | ASTM Type II (<1 µS/cm / >1 MQ-cm)    |
| Water Consumption:                           | up to 2.1 L/Day                       |
| Power Consumption:                           | 787 Watts                             |
| Voltage:                                     | 110 / 230                             |
| Frequency:                                   | 50 / 60                               |
| Current:                                     | 2.3 ~ 4.8 Amps                        |
| Heat output:                                 | 1000                                  |
| Max Operating Temp:                          | 35°C / 95°F                           |
| Accreditations:                              | CE, FCC, CGA                          |
| Size (HxWxD) mm                              | 406 x 380 x 540 mm                    |
| Size (HxWxD) inches                          | 16 x 15 x 21.3 inches                 |
| Generator Weight                             | 38kg / 83.6 lbs                       |

## [PEAK Protected]<sup>TM</sup>

Peak Scientific gas generators define the benchmark in reliability, convenience and performance in laboratories around the world, and come backed with a 12 month warranty. Beyond this period however you can ensure that your investment continues to be **[Protected]** by our comprehensive generator care cover.

Our world-class aftercare support packages deliver a program of scheduled preventative maintenance whilst giving you the reassurance of instant access to worldwide technical support and priority on-site response in the untimely event of a breakdown.

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Tel: +44 (0)141 812 8100  
Fax: +44 (0)141 812 8200

Peak Scientific North America  
Tel: +1-800-767-6532  
Fax: +1-978-608-9503

Peak Scientific China  
Tel: +86 21 5079 1190  
Fax: +86 21 5079 1191  
For a full list of our worldwide office locations, please visit:  
Web: [www.peakscientific.com](http://www.peakscientific.com)  
Email: [discover@peakscientific.com](mailto:discover@peakscientific.com)

Peak Scientific's Quality Management System conforms to: ISO 9001



## 11. Technický list směřovače plynů

### GasMixers

# SONIMIX 2106

Best in class Gas Mixer with the unique sonic nozzle technology

The Sonimix 2106 is a gas mixer mainly used to calibrate and linearize gas monitors and to generate specific gas mixtures.

The Sonimix 2106 is based on the principle of gas flow through sonic nozzles and is built according to the ISO 6145/6 standard. The sonic nozzle principle makes it the most accurate and stable device on the market. It generates binary mixtures from 0 to 100% in fixed steps in a pure mechanical process without electronic regulation and without any influence from ambient pressure or temperature.

The touch-screen LCD interface provides simple and user-friendly management of all functions on the unit.

Optional Auto Diagnostic functions for quick check of the instrument performances (patented) is available.

Optional Nox converter tester.

Proven metrological performances – Optional ISO 17025 calibration reports will be delivered from our accredited laboratory. In this way the device can be easily linked with National Standards (NIST, METAS, UKA, etc)

#### Main applications

- Fulfilment of ISO 14481 norm CEM (QUAL 1 to QUAL 3)
- Quality control of gas monitors in the laboratory
- Gas analysers production
- To generate accurate gas standards and mixtures for R&D purpose
- Automotive industry for engine test benches

#### Main advantages

- ✓ Accuracy - (0.5% rel.)/ stability (0.2% rel.)
- ✓ Range - Up to 1024 programmable calibration points. Rare calibrations need.
- ✓ Return on investment – Reduce gas cylinders costs, less components
- ✓ Compatibility for corrosive gases (% range) with gold nozzles
- ✓ Safe - Smart purge routine
- ✓ Ergonomic with LCD display



**R Evolution**  
in Gas Calibration Systems



## Specifications

| Models: Sonimix 2106            | 2106-10                                                                                                   | 2106-16 | 2106-64 | 2106-128                                  | 2106-256 | 2106-1024 |
|---------------------------------|-----------------------------------------------------------------------------------------------------------|---------|---------|-------------------------------------------|----------|-----------|
| General data                    |                                                                                                           |         |         |                                           |          |           |
| Dilution points                 | 10                                                                                                        | 16      | 64      | 128                                       | 256      | 1024      |
| Dilution principle              | Sonic nozzles (according ISO 6145-6) and high precision pressure regulators                               |         |         |                                           |          |           |
| Dilution gas line flow accuracy | < 0.25 % of set point                                                                                     |         |         |                                           |          |           |
| Source gas line flow accuracy   | < 0.25 %                                                                                                  |         |         |                                           |          |           |
| Repeatability on flow           | < 0.1 %                                                                                                   |         |         |                                           |          |           |
| Accuracy on concentration (rel) | < 0.5 % on the highest dilution ratio                                                                     |         |         |                                           |          |           |
| Repeatability on concentration  | Better than 0.14% relative                                                                                |         |         |                                           |          |           |
| Response time                   | < 15 sec                                                                                                  |         |         |                                           |          |           |
| Auto Diagnostic                 | Diagnostic of pressure regulator, valve opening, nozzle functioning, drift                                |         |         |                                           |          |           |
| Factory calibration             | By laminar flow with uncertainty < 0.2% of reading                                                        |         |         |                                           |          |           |
| Warm up time                    | none                                                                                                      |         |         |                                           |          |           |
| Operating temperature           | 15°C - 40°C                                                                                               |         |         |                                           |          |           |
| Dimensions                      | 19" 3HE/84 TE , 500mm deep<br>portable casing in option                                                   |         |         |                                           |          |           |
| Net weight                      | 15 - 20 Kg                                                                                                |         |         |                                           |          |           |
| Gas inlet requirments           |                                                                                                           |         |         |                                           |          |           |
| Dilution gas:                   | Requires dry Air, Nitrogen or other gas, 2 ports                                                          |         |         |                                           |          |           |
| Dew point                       | -40°C                                                                                                     |         |         |                                           |          |           |
| Source gas:                     | compatible with corrosive gases up to 10% (if option installed), up to 12 ports                           |         |         |                                           |          |           |
| Pressure                        | 3 ± 0.3 bar rel                                                                                           |         |         |                                           |          |           |
| Fittings                        | 3 x Swagelok 1/4" (Air, Nitrogen, Span gas), optional up to 3x 4Swagelok 1/4" per instrument              |         |         |                                           |          |           |
| Gas outlet requirments          |                                                                                                           |         |         |                                           |          |           |
| Flow:                           | 2.5 ± 0.25 L/min (other flow rate upon request)<br>adjustable by by-pass valve in front of the instrument |         |         |                                           |          |           |
| Pressure                        | up to 1 bar rel (other pressure upon request)                                                             |         |         |                                           |          |           |
| Fittings                        | 4 x Swagelok 1/4" (Mixture, Waste, Purge)                                                                 |         |         |                                           |          |           |
| Communication                   |                                                                                                           |         |         |                                           |          |           |
| RS 232                          |                                                                                                           |         |         | Standard                                  |          |           |
| Ethernet TCP/IP                 |                                                                                                           |         |         | Standard                                  |          |           |
| USB                             |                                                                                                           |         |         | Standard                                  |          |           |
| WiFi                            |                                                                                                           |         |         | Optional                                  |          |           |
| Electrical data                 |                                                                                                           |         |         |                                           |          |           |
| Power supply voltage            |                                                                                                           |         |         | 230V/50-60Hz<br>115V/60Hz<br>100V/50-60Hz |          |           |
| Installed power (Max)           |                                                                                                           |         |         | 150W                                      |          |           |
| NOx converter tester (option)   |                                                                                                           |         |         |                                           |          |           |
| NO2 range                       | 15 to 50 ppm / 30 to 100 ppm / 300 to 1000 ppm, all at 2.2 NL/min                                         |         |         |                                           |          |           |
| Stabilization time              | Less than 1 min (once the device has warmed up)                                                           |         |         |                                           |          |           |
| Inlet fittings                  | 2 x Swagelok (NO, air) 1/4"                                                                               |         |         |                                           |          |           |
| Outlet fittings                 | 2 x Swagelok (outlet, purge) 1/4"                                                                         |         |         |                                           |          |           |



**LNI SWISSGAS**  
www.lni-swissgas.eu

## 12. Technický list záložního zdroje (UPS)

**UPS Eaton 5PX**  
Jednofázový UPS

# UPS Eaton 5PX Gen2

1000/1500/2200/3000 VA



Montáž rack/tower



Intuitivní LCD displej pro snadnou konfiguraci a správu

### Pokročilá ochrana pro:

- servery
- switche
- routery
- datová úložiště



### Výjimečná efektivita, ovladatelnost a možnost měření energie pro IT manažery

#### Výkonnost a účinnost

- Eaton 5PX Gen 2 poskytuje jednotkový účinník ( $W=VA$ ). S výkonem vyšším o 11% v porovnání s jinými UPS dokáže zálohovat více serverů.
- 5PX Gen2, nyní s certifikací Energy Star 2.0, nabízí nejlepší výkon ve své třídě, díky nižší spotřebě a nákladům na chlazení.
- Při provozu v bateriovém režimu poskytuje 5PX vysoce kvalitní výstupní signál pro všechna připojená citlivá zařízení, jako jsou servery s aktivními PFC zdroji.
- Všechny konfigurace UPS a EBM 5PX Gen2 poskytují nejlepší poměr rozměrů a doby zálohy.

#### Správa a kybernetická bezpečnost

- Inovativní grafický LCD displej poskytuje všechny provozní informace hned na první pohled. Zvyšuje komfort uvedení do provozu a konfigurace.
- Modely 5PX Gen2 Netpack se dodávají se síťovou kartou Eaton Gigabit, která nabízí dvojitou certifikaci kybernetické bezpečnosti (UL 29000-1 a IEC 62443-4-2) a umožňuje kyberneticky zabezpečený dohled společnosti Eaton.
- Spolu s 5PX Gen2 umožňuje síťová karta Eaton Gigabit jak vzdálené nastavení UPS, tak vzdálený upgrade firmwaru, což zajišťuje snadné nastavení (správu zařízení) a snížení nákladů na údržbu.
- 5PX Gen2 dokáže měřit spotřebu energie na úrovni skupin zásuvek. Hodnoty kWh lze zobrazovat na LCD displeji nebo pomocí Eaton Intelligent Power Software.
- Eaton Intelligent Power Software se bez problémů integruje do předních virtualizačních prostředí a automatizovaných nástrojů pro využití cloudů.

#### Dostupnost a flexibilita

- 5PX Gen2 2200 VA a 3000 VA jsou k dispozici ve formátu RT2U (optimalizované pro montáž do datového rozváděče) nebo RT3U (optimalizované pro samostatně stojící montáž nebo montáž do datových rozváděčů s malou hloubkou). Podpěry a lyžiny jsou součástí všech modelů.
- Ovládání segmentů 5PX Gen2 umožňuje prioritizaci odstavení nekritických zátěží a maximalizaci doby zálohy pro zátěže kritické.
- Technologie správy baterií Eaton ABM<sup>®</sup> využívá třístupňovou metodu nabíjení, která optimalizuje stav baterií a prodlužuje jejich životnost až o 50%.
- Pro delší dobu zálohy lze přidat až 4 externí bateriové moduly vyměnitelné za provozu.

**EATON**

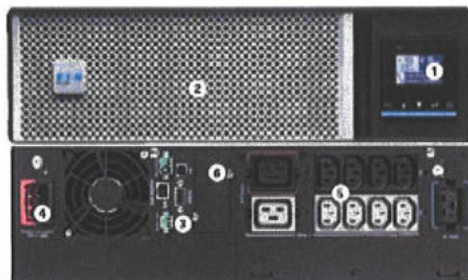
Powering Business Worldwide

## UPS Eaton 5PX Gen2

### 1 Grafický LCD displej:

- Zřetelné informace o stavu UPS a měřených veličinách
- Vylepšené možnosti konfigurace
- K dispozici v 7 jazycích

### 2 Knyt baterií pro jejich výměnu za provozu (Hot swap)



- 3 1 USB port, 1 sériový port, dálkové zapnutí/vypnutí (ROO), dálkové vypnutí napájení (RPO) a reléový výstup
- 4 Konektor pro externí baterii (EBM)
- 5 8 zásuvek IEC 10A + 2 IEC 16A s měřením energie (včetně 6 zásuvek pro dálkové ovládání)
- 6 Slot pro komunikační kartu

Eaton 5PX Gen2 2200i RT3U

### Technická specifikace

|                                                      | 1000                                                                                                                                                                                        | 1500                           | 2200                                                                                 | 3000                                      |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------|
| Výkon (VA / W)                                       | 1000 VA / 1000 W                                                                                                                                                                            | 1500 VA / 1500 W               | 2200 VA / 2200 W                                                                     | 3000 VA / 3000 W                          |
| Formát (IT, rack/tower)                              | RT2U                                                                                                                                                                                        | RT2U                           | RT2U a RT3U                                                                          | RT2U a RT3U                               |
| <b>Elektrické parametry</b>                          |                                                                                                                                                                                             |                                |                                                                                      |                                           |
| Topologie                                            | Line Interactive vysokofrekvenční (čistá sinusoida, vyvážení i ztlumování napětí)                                                                                                           |                                |                                                                                      |                                           |
| Rozebratelnost napájecího kabelu bez použití baterií | 160V/284V (nastavitelné na 150V/284V)                                                                                                                                                       |                                |                                                                                      |                                           |
| Rozebratelnost frekvence bez použití baterií         | 47 až 70 Hz (soustava 50 Hz), 56,5 až 70 Hz (soustava 60 Hz), 40 Hz v režimu nízké citlivosti                                                                                               |                                |                                                                                      |                                           |
| Výstupní napětí                                      | 230 V (+6 / -10 %) (nastavitelné na 200V* / 208V / 220V / 230V / 240V), 50/60 Hz +/- 0,1 Hz (automatická detekce)                                                                           |                                |                                                                                      |                                           |
| <b>Zapojení</b>                                      |                                                                                                                                                                                             |                                |                                                                                      |                                           |
| Vstup                                                | IEC C14 (10A)                                                                                                                                                                               | IEC C14 (10A)                  | IEC C20 (16A)                                                                        | IEC C20 (16A)                             |
| Výstup                                               | 8 x IEC C13 (10A)                                                                                                                                                                           | 8 x IEC C13 (10A)              | 8 x IEC C13 (10A)<br>2 x IEC C19 (16A)                                               | 8 x IEC C13 (10A)<br>2 x IEC C19 (16A)    |
| Dálkové ovládané zásuvky                             | 2 skupiny po 2 x IEC C13 (10A)                                                                                                                                                              | 2 skupiny po 2 x IEC C13 (10A) | 1 skupina po 2 x IEC C13 (10A)<br>1 skupina po 2 x IEC C13 (10A) + 1 x IEC C19 (16A) |                                           |
| Další výstupy s Hot Swap MEP                         | 4 zásuvky FR / Schuko nebo 6 IEC zásuvek IEC nebo zverňovnice (verze FW)                                                                                                                    |                                |                                                                                      |                                           |
| Další výstupy s FlexPOU                              | 8 zásuvek FR / Schuko nebo 12 zásuvek IEC 10A                                                                                                                                               |                                |                                                                                      |                                           |
| <b>Baterie</b>                                       |                                                                                                                                                                                             |                                |                                                                                      |                                           |
| Batná záložní doba **                                | 300 W                                                                                                                                                                                       | 500 W                          | 900 W                                                                                | 1200 W                                    |
| 5PX 1000                                             | 30                                                                                                                                                                                          | 17                             | 8                                                                                    |                                           |
| 5PX 1000 + 1 EBM / + 4 EBM                           | 148 / 551                                                                                                                                                                                   | 89 / 332                       | 48 / 192                                                                             |                                           |
| 5PX 1500                                             | 44                                                                                                                                                                                          | 24                             | 13                                                                                   | 7                                         |
| 5PX 1500 + 1 EBM / + 4 EBM                           | 164/611                                                                                                                                                                                     | 92 / 340                       | 53 / 199                                                                             | 23 / 123                                  |
| 5PX 2200                                             | 50                                                                                                                                                                                          | 28                             | 16                                                                                   | 9                                         |
| 5PX 2200 + 1 EBM / + 4 EBM                           | 242 / 950                                                                                                                                                                                   | 139 / 551                      | 80 / 319                                                                             | 49 / 197                                  |
| 5PX 3000                                             | 68                                                                                                                                                                                          | 39                             | 23                                                                                   | 13                                        |
| 5PX 3000 + 1 EBM / + 4 EBM                           | 255 / 950                                                                                                                                                                                   | 148 / 548                      | 86 / 323                                                                             | 54 / 201                                  |
| Správa baterií                                       | ABM** a teplotně kompenzovaná metoda nabíjení (volitelná uživatelsky), automatické testování baterií, ochrana proti hlubokému vybíjení, automatické rozpoznání externích bateriových modulů |                                |                                                                                      |                                           |
| <b>Rozhraní</b>                                      |                                                                                                                                                                                             |                                |                                                                                      |                                           |
| Komunikační porty                                    | 1 USB port + 1 sériový port RS232 + 1 minisverňovnice pro dálkové zapnutí/vypnutí + 1 minisverňovnice pro dálkové vypnutí + 1 minisverňovnice vstupního napětí                              |                                |                                                                                      |                                           |
| Slot pro komunikační kartu                           | 1 slot pro kartu Network M2 (součástí verze Netpack) nebo INDCW M2 nebo Relay M2                                                                                                            |                                |                                                                                      |                                           |
| <b>Provozní podmínky, normy a homologace</b>         |                                                                                                                                                                                             |                                |                                                                                      |                                           |
| Provozní teplota                                     | od 0 do 40°C                                                                                                                                                                                |                                |                                                                                      |                                           |
| Hlučnost                                             | < 40 dB při typickém zatížení                                                                                                                                                               |                                |                                                                                      |                                           |
| Bezpečnost                                           | IEC/EN 62040-1, UL1778, CSA22-2                                                                                                                                                             |                                |                                                                                      |                                           |
| EMC, výkonost                                        | IEC/EN 62040-2, FCC třída B, CISPR22 třída B                                                                                                                                                |                                |                                                                                      |                                           |
| Homologace a značení                                 | CE / CB report (TUV) / cTUVus / EAC / UKCA / Ukr / Cm                                                                                                                                       |                                |                                                                                      |                                           |
| <b>Rozměry V x Š x H / Hmotnost</b>                  |                                                                                                                                                                                             |                                |                                                                                      |                                           |
| Normální UPS (mm)                                    | 438x448x85,5                                                                                                                                                                                | 438x448x85,5                   | 438x603x85,5 (RT2U)<br>438x483x129 (RT3U)                                            | 438x603x85,5 (RT2U)<br>438x483x129 (RT3U) |
| Hmotnost UPS (kg)                                    | 19,6                                                                                                                                                                                        | 22,4                           | 28,2 (RT2U) / 27,5 (RT3U)                                                            | 31,7 (RT2U) / 31,1 (RT3U)                 |
| Normální EBM (mm)                                    | 438x448x85,5                                                                                                                                                                                | 438x448x85,5                   | 438x603x85,5 (RT2U)<br>438x483x129 (RT3U)                                            | 438x603x85,5 (RT2U)<br>438x483x129 (RT3U) |
| Hmotnost EBM (kg)                                    | 27,8                                                                                                                                                                                        | 27,8                           | 40,4 (RT2U) / 39,7 (RT3U)                                                            | 40,4 (RT2U) / 39,7 (RT3U)                 |
| <b>Základní servis a podpora</b>                     |                                                                                                                                                                                             |                                |                                                                                      |                                           |
| Záruka                                               | 3 roky na elektroniku, 2 roky na baterii (3 roky plná záruka při registraci)                                                                                                                |                                |                                                                                      |                                           |

\* sebitní výstup 0-5-10-16-200 V

\*\* Doba zálohy je zhruba a může se lišit podle vybavení, konfigurace, stáří baterií, napětí atd.

| Typová čísla*                | 1000           | 1500           | 2200                                          | 3000           |
|------------------------------|----------------|----------------|-----------------------------------------------|----------------|
| UPS RT2U                     | 5PX1000IRT2UG2 | 5PX1500IRT2UG2 | 5PX2200IRT2UG2                                | 5PX3000IRT2UG2 |
| UPS RT2U se síťovou kartou** | 5PX1000IRTNG2  | 5PX1500IRTNG2  | 5PX2200IRTNG2                                 | 5PX3000IRTNG2  |
| UPS RT3U                     |                |                | 5PX2200IRT3UG2                                | 5PX3000IRT3UG2 |
| EBM                          | 5PXEBM48RT2UG2 | 5PXEBM48RT2UG2 | 5PXEBM72RT2UG2 (RT2U) / 5PXEBM72RT3UG2 (RT3U) |                |
| 2m kabel pro připojení       | EBMCL48RT      | EBMCL48RT      | EBMCL72                                       | EBMCL72        |

\* Součástí všech UPS 5PX a 3 UIM je sada pro montáž do racku

\*\* Síťová karta je standardně součástí verze Netpack

Eaton Elektrotechnika, s.r.o.  
Elektrický sektor EMEA  
Kondrovská 2406  
193 00 Praha 9, Česká republika  
Eaton.eu

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