PCR-2 Pneumatically Controlled Remote Oxygen Regulator

Conveniently connects directly to your cylinder by hand

**Audience & Purpose of this Manual**
This manual is intended to allow one to become familiar with the purpose, operating aspects & application potential of the PCR-2 adaptive remote controlled oxygen regulator system.

**General Description**
The PCR-2 system is a completely integrated, pneumatic powered and remotley operated oxygen regulator, designed to provide you with unmatched remote control, safety, comfort, and convenience at an affordable price.
**Usage**
The PCR-2 can be used with any off-the-shelf industry standard CGA-540 cylinder valve (optionally DIN-477-9), providing the ability to remove the PCR-2 from the cylinder for easy refilling or exchanging purposes with industry standard CGA-540 adapters. If removing the cylinder is not convenient, an SAE-4 high pressure access port is provided on the back of the PCR-2 to allow for an optional remote fill port and/or a remote pressure gauge. This SAE-4 port provides you with a variety of options for your installation application needs. (see pages xx and on for diagrams of installation suggestions).

**Main inlet service port**
The PCR-2 is designed to be conveniently attached to the screw threads, by hand, of the service port of an industry standard CGA-540 oxygen cylinder. Optionally, the PCR-2 can be ordered with a DIN-477-9 screw-on fitting for use with most European oxygen cylinders.

The PCR-2 is not intended to be used as the main high pressure shut off, rather for providing the ability to remotely turn on & off the main regulated low pressure oxygen supply to your delivery system.

The valve of the cylinder should be turned off during times of aircraft storage as to mitigate any oxygen system drainage. It is not necessary to close the cylinder valve during refueling, lunch stops, leg stretches or for other brief periods.

**Auxiliary HP Inlet ports**
In addition to the main screw-on port there are three additional SAE-4 HP ports for auxiliary (optional) utility applications. These ports can be used for a remote filler station, gauge and for cascading to additional cylinders. These auxiliary SAE14 HP ports come standard with plugs installed. A number of HP AN and Swageloc® style fittings are comparable with these ports. The main 'screw-on' inlet port is internally pneumatically connected to these auxiliary SAE-4 ports.

**Main Service L.P. Outlet Port**
The low pressure regulated outlet has one O-ring face seal style port (G 1/8 BSPP). This comes standard with a swivel elbow push-in style QD fitting compatible with 6mm OD polyurethane tubing.

**LPRD Port**
For long-term connected and pressurised applications, this SAE-2 port accommodates an optional Low Pressure Relief Device. It reliefs, vents, oxygen to mitigate possible damage to the system in the event the main regulator creates an over-pressure of about 65~75 psig. This LPRD can be applied to an optional over-board relieving system if the installation requires such.

**Pneumatic control ports A, B & C**
There are three 10-32 threaded ports where the remote control toggle switch pneumatically connects via o-ring face seal banjo type fittings. These ports are labeled A, B & C and have a matching set of labeled ports on the pneumatic toggle control switch.

There are three small 1/8" O.D. Color coded kink resistant 1/8” dia. polyurethane pneumatic lines that connect the remote ON/OFF toggle pneumatic switch/valve to the PCR-2. The pressure through these lines is the same low pressure that is supplied to the outlet and is flow restricted to a mere 1/64 liter-per-minute. This helps to prevent against the low pressure oxygen supply contributing to any fires in the event these lines should become severed.

**Pop-up valve indicator**
There is a small red pop-up button on the top of the PCR-2 that can be observed popping-up or down as the valve is pneumatically opened or shut off. While the button is down, the low pressure outlet port is shut off.
BSPP Low Pressure oxygen outlet service port with 6 mm. Swivel Elbow for easy hook-up of 6mm OD polyurethane tubing

SAE-2 port for optional Low-Pressure-Relief-Device port for over-board relief in near air-tight or contained small volume installations

Main ‘Screw-On’ inlet port. CGA-540 (USA) or DIN-477-9 (Euro)

Two of three (3) HP utility SAE-4 ports for optional configurations

Three of three (3) HP utility SAE-4 ports for optional configurations

One of three (3) HP utility SAE-4 ports for optional configurations

Static vent port hole

DO NOT COVER OR BLOCK

Pop-Up indicator for Pneumatic ON/Off valve up = on down = off

Pneumatic control ports A, B & C

Pneumatic port fittings to Remote control switch for desmodromically (push-pull) actions for extreme-temperature operations

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Performance Features

Desmodromically remote operating on/off outlet ‘pop-up’ valve for operating in extended temperature ranges -40 through +60 °C

Optional Low-Pressure-Relief-Device connects to this SAE-2 port for over-pressure situations that may occur in long-term connected and pressurized applications.

An optional over-board system can be fitted for near air-tight or contained small volume installations.

Precision Sapphire embedded brass orifices control the rate and flow of oxygen in the lengths of the remote controlled switch

Regulator outlet plenum for improved output flow transient stability while using constant flow and EDS pulse demand regulators together

Precision formulated wave spring provides a stable and repeatable regulator reference without transient resonance.

SAE-4 HP utility ports for optional supply, fill and gauge configurations

Main inlet fittings all have an o-ring seal for simple hand-tight connections. Unlike sintered brass we use dual-mesh stainless screen filters that are serviceable for long-life operations

Our regulator designs have a virtually flat outlet pressure regulation curve for both lock-up (static) and flowing (dynamic) with inlet pressures from 300 to 3,000 psig. In open and closed-loop instantaneous flow tests, they have very well dampened, oscillation free flows. Flows of 55 to 60 liters/minute are measured through a controlled pneumatic resistance with inlet pressures of 1,000 to 3,000 psig. Target flows are 22 ±2 liters/minute throughout the inlet pressure range of 500 to 3,000 psig. EDS units only need to have the regulator that instantaneously delivers ~10 liters/minute to complement the needed amount of oxygen for pressure altitudes up to 18,000 ft.

Regulator Features Include:

Very constant lock-up and flowing pressure range and large flow reserve throughout the pressure life of the cylinder. Light weight aluminum body with oxygen compatible brass and seat materials in the critical wetted regulating/throttling high-pressure areas.

Wide operating temperature range. -20 to +50 °C. Special flat-wire double-helix spring design complements the gas dynamics and aging characteristics of the inlet seat to provide lock-up to dynamic pressures that are unusually tightly matched for a piston type regulator designs throughout it’s service life. Our unique ball-and-flat-seat design provides very fast response times to lock-up with an oscillation free high flow factor specifically designed for use with pulse demand systems.

Testing & Verification:

All of our regulators are 100% tested during assembly for multiple parameters before they are packaged and made ready for sale. Dynamic flow testing is performed with the regulator feeding through a mass-flow meter at the end of 20 feet of 6mm O.D. 4mm ID tubing to guarantee that the regulator will operate up to four EDS units at 18,000 ft. with cylinder pressures as low as 500 psig. The typical length of tubing used in most built-in applications is about 20 feet.

Why a piston type regulator, why not a diaphragm type as seen in medical equipment? Piston-type compressed gas regulators are well known for being low-cost, rugged, light-weight and able to be serviced with standard assembly practices. Additionally, they have the ability to ingest small particles at extreme temperatures while performing well within specifications called out for their duty. Their simplicity provides the means to a quick diagnostic and repair even in the field. Diaphragm regulators are known more for their precision and high-cost but, are sensitive to harsh environments making them more suited for stationary and controlled indoor applications. Because they usually do not have suitable lock-up to flow pressure characteristics, are larger and heavier, they are usually unsuitable for pulse-demand systems.
With our high and low pressure pneumatic accessories, there are virtually hundreds of ways to configure your PCR installation application. This sections will show a few of some of the most popular applications our customers have been configuring.

**Basic Applications**

First is the most basic application using the oxygen outlet kits with self sealing CPC style fittings. We have a number of cylinder hold-down kits for aluminum and composite-fiber-wound cylinders.
A flex line with SAE to JIC fittings allows the PCR-2 to be moved on & off the cylinder many times over without disturbing your hard-line installations.

There are many fitting and accessory options that allow you to apply the PCR-2 to accommodate many of your installation needs.
We have all electric pressure gauge kits. Just two wires are needed between the gauge and sending unit.

Showing yet a more semi-permanent installation application with our new 4x bulkhead mountable CPC type outlet manifold, a remote filler station where the cylinder can easily be removed for filling, inspections and servicing.
<table>
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<th>Part Number</th>
<th>Description</th>
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<td>00ELN-012-00A</td>
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</table>

**Basic Applications**
Unless ordered special, all copper tubing will be shipped in a 12" dia. coil with the ends either capped (image right) or crimped (image left) or both ways while being cut to length as ordered.
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ARE:

- 0.00 ±0.015
- 0.00X ±0.010
- 0.00XX ±0.005

INTERPRET GD&T PER ASME 14.5

NOTES:

1. Item 7 Check-valve Body (0CV02-0257-00) may also use Revision "D"

2. DO NOT LUBE Item 2 O-ring

3. Do not assemble Item 12 Gauge - customer will install in field

4. Items 2, 3, 4, 6, 9 included in Service Kit p/n KM100-1010-01
**NOTICE**

This "ΩΩΩΩ" type cylinder hold-down mounting kit has not been tested, but has been designed to comply or exceed to the objectives of:

X axis @ approx. 2.4 G. sin.
Y axis @ approx. 6 G. sin.
Z axis @ approx. 8 G. sin.

TEMP RANGE: N/A

Material: 304 Stainless Steel

**SPECIFICATIONS:**

Diameter determined by cylinder size chart

**SUPPLIER:** Mountain High E&SCO. Redmond, OR. USA
NOTES:
1. Material: 16ga (.060) T-304 Stainless Steel
2. See document 5ICMK-0003-00 Cylinder Mounting Kit Selection Chart for information on selecting a Cylinder Mounting Kit for a particular cylinder. Cylinder Mounting Brackets (feet) and Hand Grip Knobs are included with the Cylinder Mounting Kit.
General Specifications

Service Gas: Oxygen per MIL-027210, Type 1
Operating Pressure: 0-2200 psig (152 bar)
Construction: Main Body 6061-T6 Alum. Anodize Per MIL-A-8625 Type II
Safety Factor: 4:1

Weight: 2.0 oz Max

ASSY. SCREWS: DO NOT REMOVE (2 PLCs)

WHT ON BLK

WHT TEXT ON BLK

4-40 UNC-2B (2 PLC)

Ø 0.14 2 PLC.

Mounting hole template

1/8 NPT-M

1/2" HEX-HOLD

OXYGEN
USE NO OIL
PSI X 100

USE NO OIL
PSI X 100

DO NOT SCALE DRAWINGS

SIZE A SHEET 1 OF 1

REV: C

CONTRACTOR SHEETS AND 7/16 IN. FOR 1/4" DIA.

INTERPRET GD&T DIMS AND TOLS PER ASME 14.5

UNLESS OTHERWISE SPECIFIED DIMS ARE IN INCHES.
TOLERANCES ARE:

S.S. ±0.0005

G.S. ±0.0003 ANGLES PLANOC/TIONS ±0.5° ±0.5° ±0.5° ±0.001

MOUNTAIN HIGH E&S CO.
REDMOND, OR. USA

Issued: 09-27-96
Drawn: PLM
Engineer: PLM
APPR: 09-27-96

REVISED TO SHOW CORRECT DIAL DETAIL (WAS DWG. NO. E-900105)
REVISED WITH NEW FORMAT
REVISED TO SHOW NEW DIMENSIONS

DO NOT USE FOR PRODUCTION ORDERING
FOR REFERENCE ONLY

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mhoxygen.com

Page 17
**Polyurethane Tubing**

**General Specifications**

- **MATERIAL:** POLYURETHANE
- **COLOR:** > See Table
- **MAX. OPERATING PRESSURE:** > See Chart
- **BURST PRESSURE:** > See Chart
- **Outside Diameter, O.D.:** > See Table
- **Inside Diameter, I.D.:** > See Table
- **MIN. BENDING RADIUS:** > See Table
- **TEMP RANGE:** > See Chart
- **LENGTH & PACKAGE:** By the Foot or 20 or 30' Roll

**Table:**

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<tr>
<th>Li</th>
<th>MH Item Number</th>
<th>O.D.</th>
<th>I.D.</th>
<th>COLOR</th>
<th>Durometer</th>
<th>Min. Bend Radius</th>
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<tbody>
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<td>19600-0009-00</td>
<td>(0.250) 6.35mm</td>
<td>(0.125) 3.2mm</td>
<td>CLR</td>
<td>85</td>
<td>(0.590) 15mm</td>
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<td>(0.236) 6.0mm</td>
<td>(0.157) 4mm</td>
<td>CLR Blue</td>
<td>95</td>
<td>(0.590) 15mm</td>
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<td>Orange</td>
<td>95</td>
<td>(0.394) 10mm</td>
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**Notes:**

- **ADDED IMAGES**: POLYURETHANE > See Table
- **ADDED DUROMETER COLUMN**

**Revision History**

- **A:** 04-26-96
- **B:** 04-26-96
- **C:** 04-26-96

**PLM E. C. O. / APPR.**

- **PLM:** 63

**REVISION HISTORY**

- **UNLESS OTHERWISE SPECIFIED DIMS ARE IN INCHES.**
- **TOLERANCES ARE:**
  - 0.X ±0.015
  - 0.0XX ±0.005
  - ± 0.5° ± 1/64
  - 0.XXX ±0.005

**Third Angle Projection.**

**MOUNTAIN HIGH E&S CO.**

Redmond, OR, USA
General Specifications

Regulator performance
- Inlet operating pressure range: 34.5 to 172 bar (500 to 2500 psig.)
- Absolute Max inlet pressure: 207 bar (3000 psig.)
- Gas Medium Compatibility: Oxygen, Air, Nitrogen
- Nominal lock-up static (no-flow) pressure: 1.38 – 1.86 bar (20 – 27 psig.)
- Dynamic (flowing @ ~25 liter/minute flow): 0.83 – 1.03 bar (12 – 15 psig.)
- Max free-flow through output port: ~100 liter/minute
- Operating temperature range: -20 to +50 °C
- Storage temperature range: -45 to +65 °C
- Operating Altitudes: -2K to +35K ft. SPA
- Operating Humidity: 0 to 93% RH non condensing

Pneumatic control
- Dynamic & static control pressure for desmodromic actions: 0.80 to 1.25 bar (11.6 to 18.1 psig.)
- Transitional flow requirements: < 0.0625 liter/min.
- Transient time from off to on (down/up-down) ~ 225 ms. Temperature dependant

Construction Material
- Main Body & Internal non HP wetted Parts: 6066-T6\(^2\) Machined Anodized Aluminum\(^3\)
- Internal HP wetted parts: CDA-360 Cartridge Brass
- Internal control orifices: Brass captured sapphire ruby cartridge
- Internal filters: Brass captured dual mesh stainless steel screens, 43 micron
- Seals & O-rings: PTFE, FKM, fluorocarbon, EPDM, Polyurethane & Fluoro-Silicone
- Other fittings & parts: Brass, FRP ABS & Steel

Physical Properties
- Weight: 383 grams (13.5 Oz.) Regulator Assy. only
- Height: 8.6 cm (3.38”)
- Depth: 7.8 cm (3.08”) Including fitting protrusions
- Width: 5.8 cm (2.3”) Including fitting protrusions

Endurance & Reliability Statement
- Estimated Mean Time Before Failure (EMTBF) (MTBF) ~3,650 Hours or ~2,735 full flowing on-off cycles

Environmental Testing Compliance Criteria
- RTCA DO160 section series: See next sheet
- RTCA DO178 section series: N/A

Regulatory Statement
- FCC Part 15 (unintended emissions): N/A
- FAA part 23, 25: Specific to application.

NOTES
1) Operating between 0 ~ 48 °C
2) ASTM B209 6061-T651 ALUMINUM
3) Anodized Per MIL-A-8625 TYPE II SLATE
This is a list of known RTCA DO-160 tests that will most likely applicable for FAA STC applications. This chart was derived from experiences with past certified applications and programs.

### DO-160 Sections Applicable for FAA STC

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### § DO-160G Section updates

- Sec 15: Magnetics Effects
- Sec 16: Power Input – AC & DC up to 45 kVA.
- Sec 17: Voltage spike
- Sec 18: Radio Frequency Conducted Susceptibility
- Sec 19: Induced Signal Susceptibility
- Sec 20: Radiated & Conducted RF Susceptibility
- Sec 21: Radiated & Conducted RF Emissions
- Sec 22: Lightning Induced Transient Susceptibility
- Sec 23: Lightning Direct Effects
- Sec 25: Electrostatic Discharge
The main regulator inlet seat, in time and usage, ‘will wear in such a way the regulator’s static / non-flowing ‘lock-up’ pressure may creep past the specified limits. In this case, the dynamic ‘flowing’ pressure may still be within the specified limits allowing the unit to supply the proper amount of oxygen to all stations in use. If the static pressure goes beyond ~ 55 - 65 psig. The LPRD will relieve the over pressure supply to ambient.

Servicing:
It is highly recommended that the PCR-2 be repaired and serviced by MH or an authorized service center.