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Millar Worldwide Distribution

Millar, LLC has a network of Authorized Distributors in most countries around the world. For information on the Millar distributor in your country, please contact the Millar Customer Service Department at our headquarters in Houston, Texas.

For your convenience, Millar provides translated IFUs in other languages. Please visit our website at eifu.millar.com (go to 'Manuals and Guides') to sign up for an account and follow the registration process to access the IFUs in additional languages. Documents are in PDF format and require free Adobe Acrobat Reader software to view. System requirements for Adobe Acrobat Reader software are Windows operating system (Windows 8 or later) or macOS (v10.14 or later).



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Models referred to herein are protected by USA and International patents.

M.I. P/N: 004-2204 Rev. C



Making the
improbable possible.

MODEL MPS-2000

Millar Pressure System

Instructions for Use (IFU)

[illegible]

Environmental	
Operating	50° to 104°F (10 to 40°C),
	30 to 75 % RH
Transport and Storage	-4° to 149°F (-20 to 65°C),
	30 to 75% RH
Safety Protection	
Fuse	Re-settable, 0.4A

Note: Specifications subject to change without notice.

Factory Repair

If repair or return is needed, contact your distributor. If you purchased the MPS-2000 or accessory directly from Millar, LLC contact Millar's Customer Service Department to obtain a Return Material Authorization (RMA) number and specific instructions regarding the return of the MPS-2000 or accessory. All returns must have a RMA number. Millar contact information may be found on the back cover of this IFU.

Millar Limited Warranty

Millar, LLC warrants that at the time of sale to the original purchaser, the device was free from defects in both materials and workmanship. For a period of 365 days (1-year) from the date of original shipment to the original purchaser, Millar will, at no charge and at its option, either repair or replace this product if found to have been shipped with defects in either materials or workmanship. Our warranty does not cover damage to the product from alterations, misuse, abuse, negligence, or accident.

Millar hereby excludes all warranties not herein stated, whether express or implied by operation of law or course of dealing or trade usage or otherwise, including but not limited to any implied warranties of fitness or merchantability.

Since handling, storage, cleaning and sterilization of the product, as well as factors relating to catheterization procedures, and other matters beyond Millar's control, may directly affect the product and the results obtained from its use, Millar shall not be liable for any incidental or consequential loss, damage, or expense arising directly or indirectly from the use of this product.

The user shall determine suitability for use of these devices for any research procedure. Therefore, the user accepts these devices subject to all the terms hereof.

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Definition of Symbols	
	Attention, consult accompanying documents
	Date of Manufacture
	Manufacture Location
REF	Catalog Number
SN	Serial Number
	Batch Code
	Type CF Applied Part
	Double Insulated
	Electrostatic Sensitive Device
	EU Declaration of Conformity
	Waste Electrical and Electronic Equipment

Definitions	
DC	Direct Current
IFU	Instructions for use
AC	Alternating Current
Transducer	Pressure tip catheter
AC Mains	Hospital Alternating Current Supply
RMA	Return Material Authorization
M.I.	Millar, LLC
RF	Radio Frequency
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference

**READ ALL INSTRUCTIONS, WARNINGS AND PRECAUTIONS
PRIOR TO USE**

MPS-2000 Specifications

Ingress Protection	IP20
Type	CF
Pressure Transducer Characteristics	
Transducer Sensitivity	5 μ V/V/mmHg, nominal
Resistance	Bridge Excitation Load
	1000 ohms, nominal 350 ohms, minimum
Transducer Bridge Excitation	5.0 V _{DC} , nominal
Signal Input Resistance	50 megohm, nominal
Pressure Outputs	
Sensitivity	1 V/100 mmHg, nominal.
Accuracy Error Band	$\leq \pm 1$ mmHg or 1 % of reading, whichever is greater
Frequency Response	DC to 1000 Hz (-3 Db), minimum
Output Resistance	1000 ohms, nominal
Noise	< 0.3 mmHg peak-to-peak
Zero-Offset Temperature	< 0.15 mmHg/ $^{\circ}$ C
Gain Temperature	< 0.1 %/ $^{\circ}$ C
Balance Adjustment Range	± 140 mmHg, nominal
Standby-Calibration Mode	
Zero Offset	$\leq \pm 1$ mmHg
Calibration Steps	0, 25, 100 and 125 mmHg
Calibration Accuracy	$\leq \pm 0.5$ mmHg
LED Bar Graphs	
Range	-25 to 200 mmHg in 10 steps
Resolution	25 mmHg
Out of Range	Top light stays on at high pressures
	Bottom light turns off at low pressures
Power Supply	External AC/DC desktop style
Input (Universal)	100 to 240 V _{AC} , 0.3A, 50/60 Hz
Output	5 V _{DC} /2.0 A, regulated ($\pm 5\%$)
Safety Approvals	EN 60601-1
Mechanical	
Size	2.6 in. H x 6.1 in. W x 5.3 in. D
	6.6 cm H x 15.5 cm W x 13.5 cm D
Weight	1.1 lbs. (0.5kg)

Recommended separation distances between portable and mobile RF communications equipment and the MPS-2000			
The MPS-2000 is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the MPS-2000 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the MPS-2000 as recommended below, according to the maximum output power of the communications equipment			
Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 MHz in ISM bands $d = 1.17\sqrt{P}$	80 MHz to 800 MHz in ISM bands $d = 1.17\sqrt{P}$	800 MHz to 6 GHz $d = 2.3\sqrt{P}$
0.01	0.117	0.117	0.23
0.1	0.37	0.37	0.73
1	1.17	1.17	2.3
10	3.7	3.7	7.3
100	11.7	11.7	23
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.			
NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
NOTE 3 An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 6 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into test subject areas.			
NOTE 4 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

Electrical equipment such as the MPS-2000 needs special precautions regarding electromagnetic compatibility (EMC) and needs to be installed and put into service according to the EMC information provided in this document.

Portable and mobile radio frequency (RF) communications equipment can affect electrical equipment such as the MPS-2000.

The MPS-2000 should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the MPS-2000 should be observed to verify normal operation in the configuration in which it will be used.

Device Description

The following information will provide data relating to the safe operation of the MPS-2000. The two-channel MPS-2000, M.I. P/N 880-0185, is an essential interface between one dual-pressure or two single-pressure Mikro-Tip™ catheters and a data acquisition system or monitor. The unit is powered by a Millar-supplied external AC/DC power supply.

The MPS-2000 pressure inputs (input channel 1 and input channel 2) are electrically isolated.

The pressure outputs have a sensitivity of 1V/100mmHg, which is ideally compatible with most monitors and computer data acquisition systems. The amplifier provides bridge excitation voltage, separate balance (zero) controls and lighted push buttons for electronic calibrations of 0, 25, 100 or 125 mmHg for both channels.

The MPS-2000 allows selection of standby mode to verify zero and calibration. The output connectors are standard ¼-inch phone jacks. Output cables are not provided. See Output Connector Wiring section in this IFU for additional information.

Intended Use/Indications

The MPS-2000 Pressure Control Unit is intended for use with Millar Mikro-Tip pressure catheters that have the standard sensitivity of 5 µV/V/mmHg. It is intended for use in monitoring pressures in laboratory animals. It is NOT intended for human use. It is intended for use by trained research personnel.

Warnings

EXPLOSION HAZARD! Do not operate this unit in the presence of flammable anesthetic mixtures with air or with oxygen or nitrous oxide.
ELECTRIC SHOCK HAZARD! Use only those power supplies and power cables recommended and approved by Millar, LLC. In addition, use only Millar catheters. See the RECOMMENDED ACCESSORIES section for replacement parts.
ELECTRIC SHOCK HAZARD! The MPS-2000 is not to be used in wet environments. Discontinue use of the MPS-2000 if it is suspected that liquid has entered the case. Contact Millar customer service immediately.
 No modification of this equipment is allowed.

Precautions

DO NOT remove the cover. Refer servicing to qualified personnel.
 DO NOT use the MPS-2000 and transducers with or near high-frequency surgical equipment.
 DO NOT use the MPS-2000 in close proximity to high electrical noise-generating equipment, as this may cause interference with the signal. If interference occurs, move the MPS-2000 system away from the noise-generating device. Electrical equipment such as the MPS-2000 needs special precautions regarding electromagnetic compatibility (EMC) and needs to be installed and put into service according to the EMC information provided in this document. Portable and mobile radio frequency (RF) communications equipment can affect electrical equipment such as the MPS-2000.

Contraindications

Results obtained by using non-Millar catheters have not been validated.

Environmental protection

Disposal of this ME Equipment (MPS-2000 and all accessories) is to be performed following all governmental standards that may be applicable to your country and / or origin of use. There are no inherent risks to the user with the disposal of this ME Equipment.

Guidance and manufacturer's declaration – electromagnetic immunity			
The MPS-2000 is intended for use in the electromagnetic environment specified below. The customer or the user of the MPS-2000 should assure that it is used in such an environment.			
Immunity test	IEC 61326-1 test level	Compliance level	Electromagnetic environment – guidance
Conducted RF IEC 61000-4-6 Radiated RF IEC 61000-4-3	3 Vrms 150 kHz to 80 MHz 3 V/m 80 MHz to 1 GHz; 1.4 GHz to 6 GHz	3 V 3 V/m	Portable and mobile RF communications equipment should be used no closer to any part of the [EQUIPMENT or SYSTEM], including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.17\sqrt{P}$ $d = 1.17\sqrt{P} \text{ , 80 MHz to 800 MHz}$ $d = 2.3\sqrt{P} \text{ , 800 MHz to 6 GHz}$ Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, ^a should be less than the compliance level in each frequency range. ^b Interference may occur in the vicinity of equipment marked with the following symbol: 
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the MPS-2000 is used exceeds the applicable RF compliance level above, the MPS-2000 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the MPS-2000. ^b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [V _i] V/m.			

Guidance and manufacturer's declaration – electromagnetic immunity			
The MPS-2000 is intended for use in the electromagnetic environment specified below. The customer or the user of the MPS-2000 should assure that it is used in such an environment.			
Immunity test	IEC 61326-1 test level	Compliance level	Electromagnetic environment – guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±4 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±1 kV for power supply lines ±0.5 kV for input/output Lines	±2 kV for power supply lines ±1 kV for input/output Lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±0.5 kV differential mode ±1 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	0% <i>UT</i> (100% dip in <i>UT</i>) during half cycle 0% <i>UT</i> (100% dip in <i>UT</i>) during 1 cycle 70% <i>UT</i> (30% dip in <i>UT</i>) during 25/30 cycles 0% <i>UT</i> (100% dip in <i>UT</i>) during 250/300 cycles	0% <i>UT</i> (100% dip in <i>UT</i>) during half cycle 0% <i>UT</i> (100% dip in <i>UT</i>) during 1 cycle 70% <i>UT</i> (30% dip in <i>UT</i>) during 25/30 cycles 0% <i>UT</i> (100% dip in <i>UT</i>) during 250/300 cycles	Mains power quality should be that of a typical commercial or hospital environment. If the user of the MPS-2000 requires continued operation during power mains interruptions, it is recommended that the MPS-2000 be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	Not applicable	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE <i>UT</i> is the a.c. mains voltage prior to application of the test level.			

Normal Use Operating Instructions

To minimize drift, presoak the catheter pressure sensor in sterile water or saline for 30 minutes prior to balancing.

Connect the MPS-2000 Control Unit to the monitor and insert the DC power plug into the DC IN jack on the rear panel. Plug the other end of the power cord into the AC mains connection. Refer to Fig. 2. Connect the power cord to the external power supply

Set the MPS-2000 mode switch to STANDBY and the power switch to ON. Ensure power switch LED is illuminated on the back panel. If power LED does not illuminate, see troubleshooting section for additional help.

Adjust the monitor for a zero baseline. Ensure the 25 and 100 mmHg calibration buttons are in the off position.

Press the 25 mmHg CALIBRATION button, the 100 mmHg CALIBRATION button, or both buttons to get a 125 mmHg calibration signal, according to the desired range, and then adjust the monitor sensitivity. Connect the catheter and extension cable to the MPS-2000 pressure input(s) on back of unit; channel 1 or 2 or both (Fig. 2). Turn the MPS-2000 function switch located on the front panel (Fig. 1) to TRANSDUCER and, with the pressure sensor just below the surface of water or saline and shielded from ambient light, adjust the TRANSDUCER BALANCE control to the same zero baseline as in step 3. Place the catheter balance locking mechanism in the LOCK position.

The catheter is now ready for use. Refer to the catheter IFU for additional information. During sustained use, calibration can be checked without removal of the catheter from the test subject by switching the MPS-2000 function switch to STANDBY, reproducing the original zero baseline. Subsequently, calibration signals equivalent to 25 mmHg, 100 mmHg, or 125 mmHg (using both switches) can be obtained by selecting the corresponding buttons.

To remove the transducer connections after use, simply hold the outside collar of the connector and pull out. The Power Input Connection and the Output Monitor Connection can be removed by holding the connector body and pulling out. Do not pull the cable of any connection to remove it from the back panel. Always use the connector body.

Figures



Fig. 1.MPS-2000 Front Panel Controls



Fig. 2. MPS-2000 Rear Panel

EMC Testing Standards

Electromagnetic Compatibility (EMC)

This device was tested for electromagnetic compatibility (EMC) under the IEC 61326-1:2020 standard.

Guidance and manufacturer's declaration – electromagnetic emissions		
The MPS-2000 is intended for use in the electromagnetic environment specified below. The customer or the user of the MPS-2000 should assure that it is used in such an environment.		
Emissions Test	Compliance	Electromagnetic environment – guidance
RF emissions CISPR 11	Group 1	The MPS-2000 uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The MPS-2000 is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Recommended Accessories

Only Millar accessories are to be used with the MPS-2000. All accessories are sold separately. The use of accessories, transducers, and cables other than those specified or supplied by Millar, LLC may result in increased EMI emissions or decreased immunity to EMC.

MPS-2000 Interface Cables

Cable Model	M. I. Part Number	Cable Length	Catheter End Connector Type
PEC-4D	850-5103	4 ft. (122 cm)	Low Profile
PEC-10D	850-5090	10 ft. (305 cm)	Low Profile

Note: Viking connectors are round with 4 pins. Low Profile connectors are flat with 4 pins.

Note: The maximum length of interface cables is 10ft. EMC testing has not been performed with longer cables.

Power Supply Information

Item	M.I. Part Number	Description	Connectors
Power Supply	249-2365 GlobTek GTM21089-1305-T3	Power Supply	C14
North American Power Cord	850-5117	Power Cord	Hospital Grade NEMA 5/15 and C13
European Power Cord	850-5118	Power Cord	Type CEE 7/7 and C13

* This unit must be purchased from Millar, LLC. The separate power supply is considered part of this ME Equipment.

Power cords for locations other than North America and continental Europe may be acquired directly from Feller GmbH. Cords used in other regions will require a C13 connector for the power supply connection and the appropriate regional plug for connection to the power source. The cord must be SJT, 18AWG, and rated for at least 10 amperes at the appropriate regional voltage. The maximum power cord length is 8.2 feet or 2.5m.

You may contact Feller directly at the numbers listed below.

Web: www.feller-at.com

Feller GmbH	Austria	(+43) 256/6232
Feller (UK) Ltd.	Great Britain	(+44) (191) 455 1048
Feller KFT	Hungary	(+36) (94) 512 730
Feller-Neumayer LTD	Hong Kong	(+852)/280 68166
Feller US Corp.	USA	(732) 247-7333

Interface and Adapter Cables

To purchase interface and adapter cables to connect pressure transducers and monitors, please contact Fogg System Company, Inc.

Fogg System Company, Inc
15592 East Batavia Drive
Aurora, CO 80011 USA
Phone: 303-344-1883
Fax: 303-344-1780
Email: sales@foggsystem.com
Web site: www.foggsystem.com

Since monitors have different input wiring requirements, a control unit with a specified monitor input cable should be used only with same make and model of monitor for which it is supplied, even if the connector fits another monitor.

Millar does not assume responsibility for calibration of external monitors.

CAUTION: The bar graph pressure displays in Fig. 1 are intended for use in set-up and operation of the unit. The displays are intended to show a presence of signal. They are NOT intended to supply quantitative or qualitative signal information for use in diagnosis of test subject condition.

Repair, Cleaning, Preventative Maintenance and Inspection

There are no user-serviceable parts inside the MPS-2000 or its accessories. If the unit or accessory is found to be defective, it MUST be returned to Millar for repair or replacement. The user must call Millar Customer Service to obtain a Return Material Authorization (RMA) number and specific instructions regarding the return of the MPS-2000 or accessory. All returns must have a RMA number.

The MPS-2000 should be cleaned periodically with a damp cloth and mild detergent, if needed. Disconnect the power connection from the unit before cleaning. Care should be taken to prevent excessive water from entering the case during cleaning. A 70/30 alcohol wipe may be used to disinfect the case; however, repeated use of alcohol may damage the case or labels. A diluted solution of bleach in water (<5 % bleach) may be used to disinfect the case exterior by wiping with a dampened cloth.

The following items should be periodically checked as part of a yearly preventative inspection program. Check the plastic nuts on the PRESSURE INPUT connectors to ensure that they are secure. Hand-tighten, if needed.

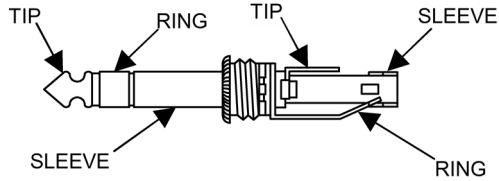
Check all switches to ensure that they are fully seated into the case.

Verify that the plastic feet are securely attached to the bottom of the case. Replace any missing feet. Check the enclosure to ensure that the cover is securely installed on the base. Inspect the horizontal seam to verify that it does not have a visible clearance that can be pulled apart. To secure the top to the bottom, place the unit on a flat surface and press firmly down on each side to snap the top to the bottom.

Output Connector Wiring

Pressure Output Connection

The customer is to supply a 1/4" phone plug which mates with the model MPS-2000 PRESSURE OUTPUT connector. An example plug is the Switchcraft® #267, which is a 1/4" 3-conductor phone plug or equivalent. The input and output are isolated from ground but they are connected to each other. See accessories section.



DC Amplifier with Differential Input Circuitry

Tip	+ Signal
Ring	- Signal
Sleeve	Cable Shield

DC Amplifier with Single-ended Input Circuitry

Tip	Signal Input Lead
Ring and Sleeve	Cable Shield

Reverse Polarity

Ring	Signal Input Lead
Tip and Sleeve	Cable Shield

CAUTION:

Millar, LLC cannot assume responsibility for the performance of the MPS-2000 if the plug is incorrectly wired.
Use shielded wire $\leq$ 3 feet in length for the output cable. Using longer cable could result in noise pickup to your monitor.

Troubleshooting

Effect	Cause	Solution
No power light illuminated on power switch	No AC mains power to external power supply	Check to be sure that the AC power cord is securely plugged into power supply
		Ensure that the DC input power cable is securely attached to back of MPS-2000 unit
		Ensure that the circuit breaker supplying AC mains power to the system has not been tripped
No light(s) illuminated on LED bar graph	No AC Mains power to external power supply	Check to be sure that the AC power cord is securely plugged into power supply
	No transducer is plugged into MPS-2000	Plug transducer into MPS-2000
	Faulty Transducer	Replace with known good transducer
	MPS-2000 is defective	Contact Millar Customer Service for RMA to return unit