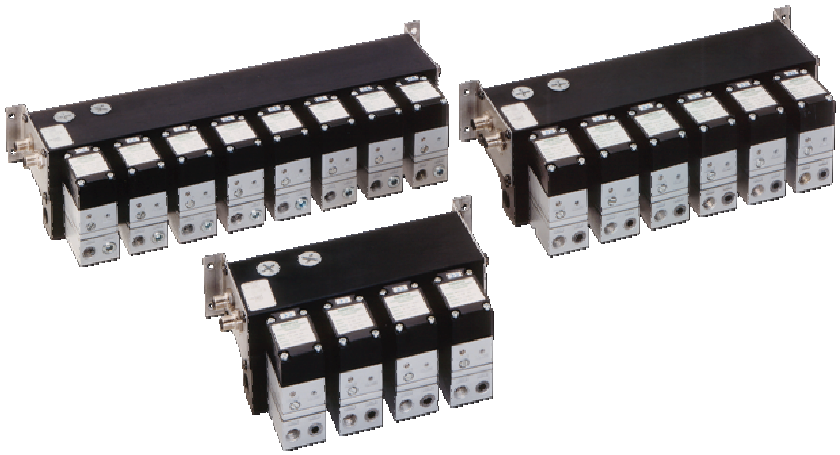
MPCR Series
Profibus-DP
Technical Manual



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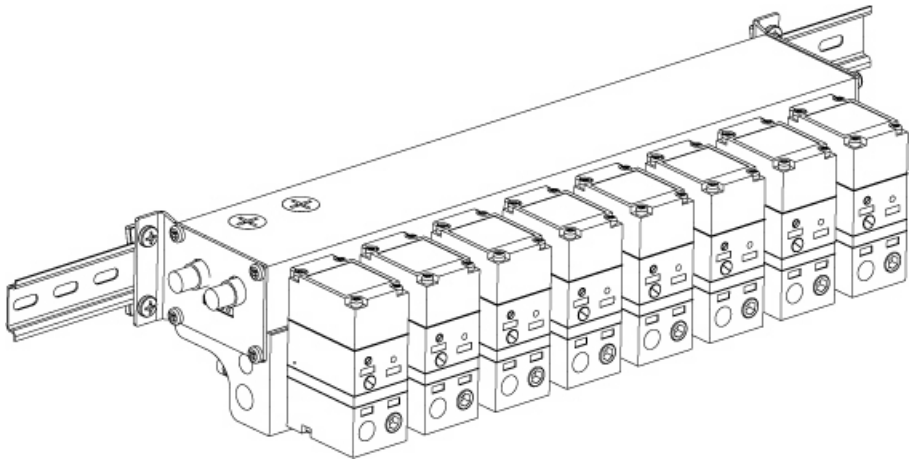
MPCR Series Introduction

Product Overview

The MPCR Series is a manifold proportional control regulator that utilizes one fieldbus node to control up to eight miniature electropneumatic regulators, which will eliminate multiple nodes and costly wiring. Optional feedback provides an additional input to the PLC indicating the output pressure of each regulator.

This manual addresses the specifics of configuring and commissioning the Numatics MPCR Series product configured with the Profibus-DP communication interface. For more information relating to MPCR, please refer to the latest Numatics MPCR Series catalog.



About Profibus

Overview

Profibus-DP is a communication protocol used to network industrial devices to eliminate labor intensive and expensive point to point wiring schemes. Siemens originally developed Profibus DP, but it is now supported by a multitude of manufacturers and the protocol standard governed by the Profibus Trade Organization (PTO).

Profibus-DP uses a 2-wire (plus shield) network and can have up to 124 nodes. The protocol can transfer a maximum of 244 bytes of data per node cycle with nine selectable communication (baud) rates of 9.6 Kbps, 19.2 Kbps, 93.75 Kbps, 187.5 Kbps, 500 Kbps, 1.5Mbps, 3 Mbps, 6 Mbps and 12 Mbps. Maximum distance depends upon baud rate and cable media type. Refer to the section below for details.

More information about Profibus can be obtained from the Profibus web site
http://www.profibus.com

MPCR Profibus Features

Features	*Description*
Bus Topology	Linear bus, active bus termination on both ends. Stub lines permitted only for <= 1.5Mbit/sec baud rates.
Baud Rates Supported	9.6 Kbps, 19.2 Kbps, 93.75 Kbps, 187.5 Kbps, 500 Kbps, 1.5Mbps, 3 Mbps, 6 Mbps and 12 Mbps
Duplicate address detection	Node address must match address in Master configuration software, before node will enter the data exchange mode
Error Correction	Yes, if error detected, sender is requested to repeat the message
Address Setting options	Done by internal switches

Cabling and Drop Line Lengths (as defined by Profibus specification)

Maximum Cable Length

Baud Rate	9.6Kbps	19.2Kbps	93.75Kbps	187.5Kbps	500Kbps	1.5Mbps	12Mbps
Range/ Segment	1200M	1200M	1200M	1000M	400M	200M	100M

MPCR Series

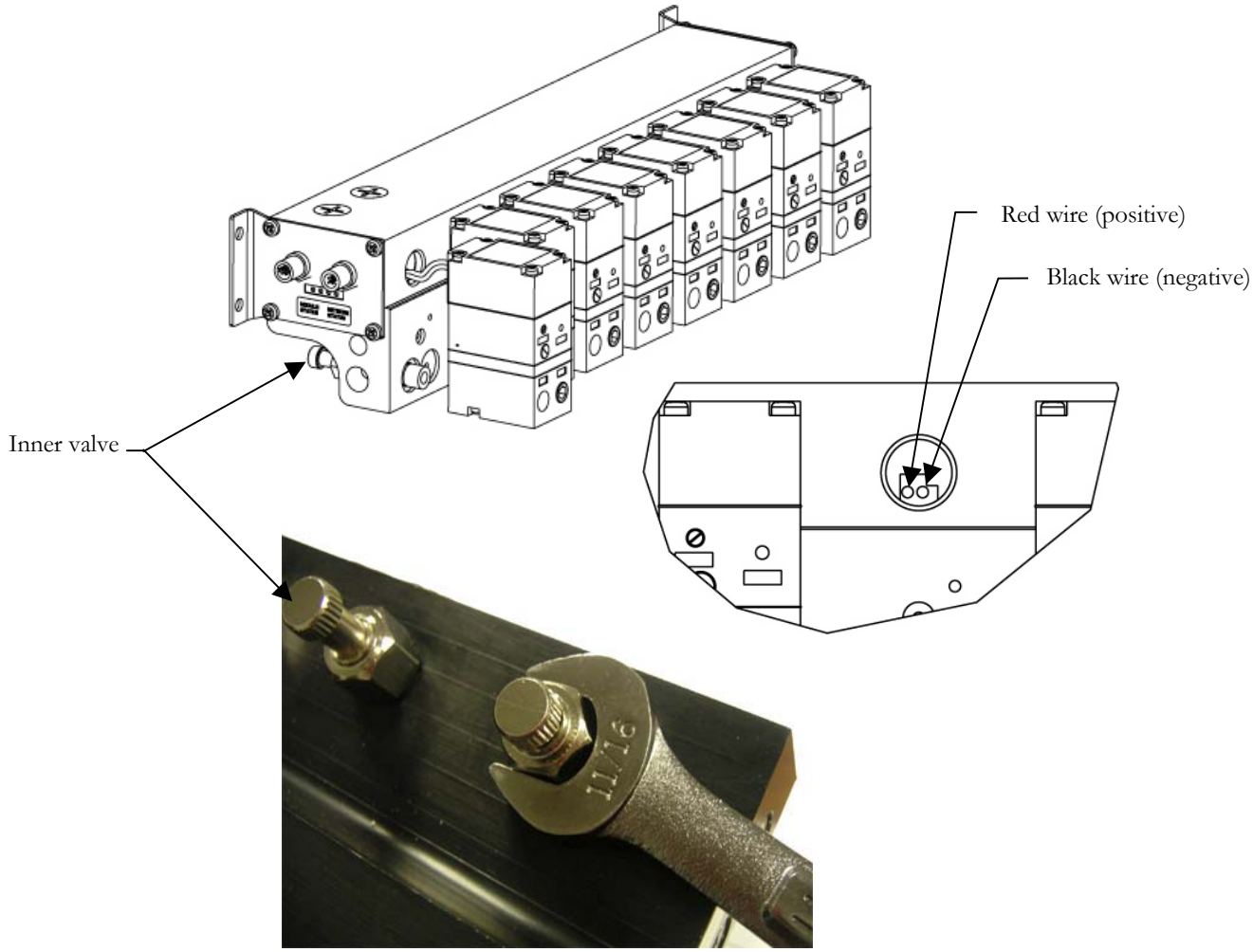
Removable Miniature Electropneumatic Regulators

The MPCR Series uses individual shutoffs on each station, which allows the users to service regulators while the rest of the manifold remains functional. This is possible due to the backplane electronics.

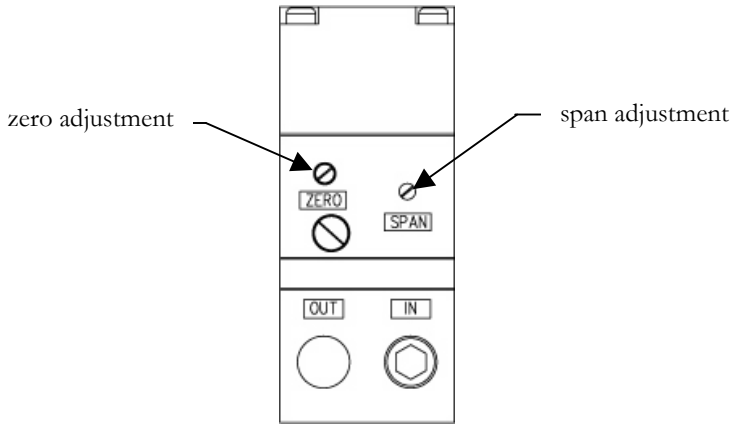
The steps involved to remove the miniature electropneumatic regulators are as follows:

1. **Rotate inner valve to shutoff air supply to individual regulator.**
2. **Turn large 11/16th Hex to remove regulator.**
3. **Lift orange spring clips to remove wires from the backplane circuit board.**

Reverse steps in order to install regulators. When connecting regulators to the backplane circuit board, be aware that the red wire from the regulator must be inserted on the left and the black wire must be inserted on the right while facing the front of the manifold.



Calibrating Miniature Electropneumatic Regulators



Calibration

All units are shipped from the factory calibrated, it is suggested that the user check the calibration once the manifold is installed.

The unit is calibrated so that minimum input signal corresponds to minimum output pressure and increasing input signal results in increase output pressure, where maximum input signal results in maximum output pressure.

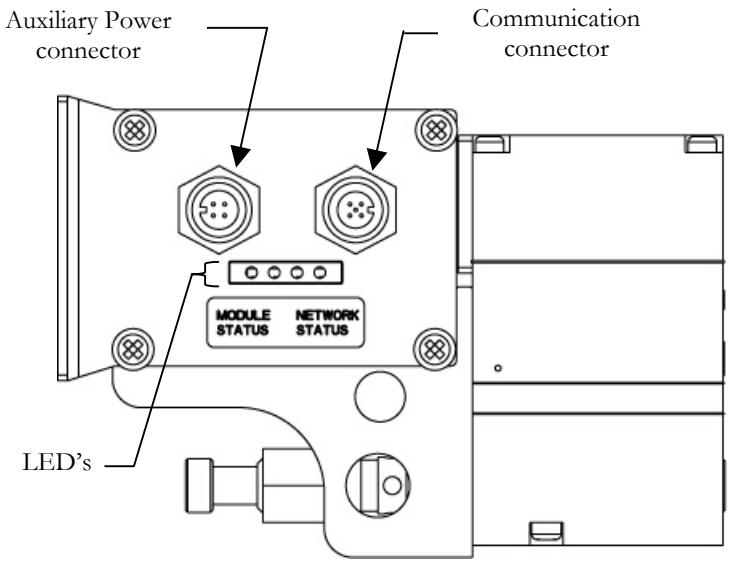
1. **Apply the minimum input signal from the controller.**
2. **Observe the output pressure. If necessary, adjust the zero screw until reaching the minimum output pressure setting. Turn zero screw clockwise to decrease and counter-clockwise to increase.**
3. **Apply the maximum input signal from the controller.**
4. **Observe the output pressure. If necessary, adjust the span screw until reaching maximum output pressure setting. Turn span screw clockwise to decrease and counter-clockwise to increase.**
5. **After setting the span it will be necessary to recheck the zero. Repeat steps 1-4 until both end points are at required values.**

Module Configurations and Pinouts

Factory Default Settings

Type	Value	Description
Node Address	126	Node address
Diagnostics	Disabled	Diagnostic Reporting is turned off
Diagnostic Mask	0	Determines which outputs are enabled for diagnostic reporting
Fail Safe Mode	Disabled	Fail Safe Mode Disabled
Fail Safe Data	0	Determines if Fail Safe Data is 1 or 0 for an output.

LED Display



Connector Types

Industry standard connectors are used for communication and auxiliary power. The Profibus-DP 12 Mbps communication connector is a reverse keyway 5- pin female 12mm micro type connector and the Aux. Power connector type is a single keyway 4 pin male "micro" connector.

Profibus DP Communication Connector Pinout

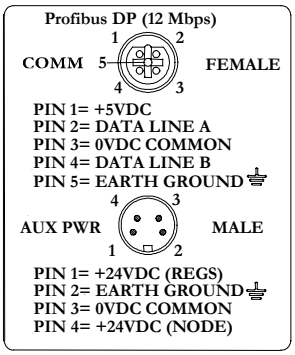
Pin #	Function	*Description*
1	+5 VDC	+5 volt output from node, used for termination of network.
2	Data Line A	Profibus-DP Communication Line A (Green)
3	0VDC Common	Common for +5V output and Data Lines A & B
4	Data Line B	Profibus-DP Communication Line B (Red)
5	Earth Ground	Internally connected to earth ground (case). Connect to shield of Profibus-DP cable.

Auxiliary Power Connector Pinout

Pin #	Function	Description
1	+24VDC (Regulators)	Voltage used to power outputs (regulators)
2	Earth Ground	Protective Earth (case)
3	0VDC Common	0VDC Common, for regulators
4	+24VDC (Node)	Voltage used to power node electronics

12 Mbps Connectors

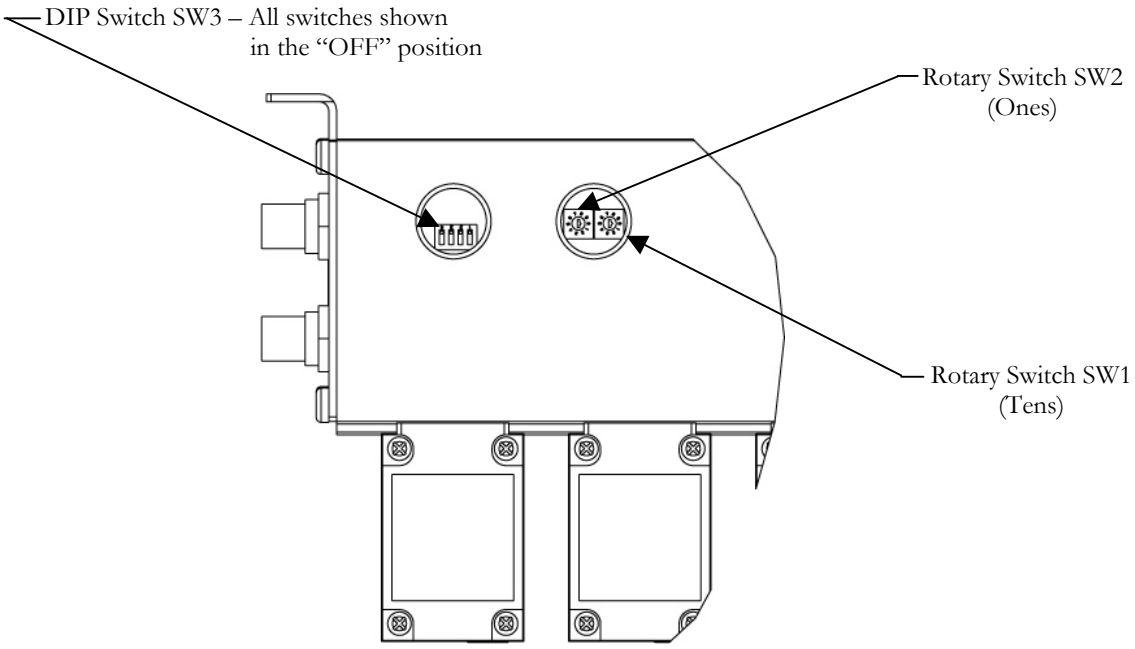
Comm. - 12mm (reverse key)
Aux. Power - Mini



ATTENTION

- ***Maximum pin capacity on pin #3 (0VDC common) of auxiliary power connector is 4 Amps. The combined draw of Pin #1 (Regulators) and pin #4 (Node) cannot exceed 4 Amps, at any given moment in time.***
- ***Auxiliary power connector Pin #4 supplies power to node electronics. This pin must be powered at all times for communication node to be functional***

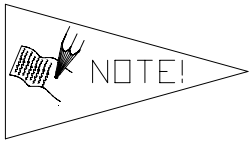
Network Address



Rotary Switch Settings (SW1 & SW2)

Network Address:

Switch	Description
SW1	Sets the Tens Digit (MSD)
SW2	Sets the Ones Digit (LSD)



- **All DIP and rotary switch settings do not take effect until power is cycled (turned OFF and ON).**
- **Address is set to a default setting of 126 prior to shipment**
- **Node address may only be assigned once per network.**
- **GSD files may be downloaded from our web site at www.numatics.com.**

DIP Switch Settings (SW3)

Switch	Function
SW3-1	Adds 100 to the address indicated on Rotary Switches (SW1 & SW2)
SW3-2	Use Flash Address
SW3-3	Not Used
SW3-4	Not Used

Settings Example

The example below shows the correct settings for the following requirements:

Address = 23

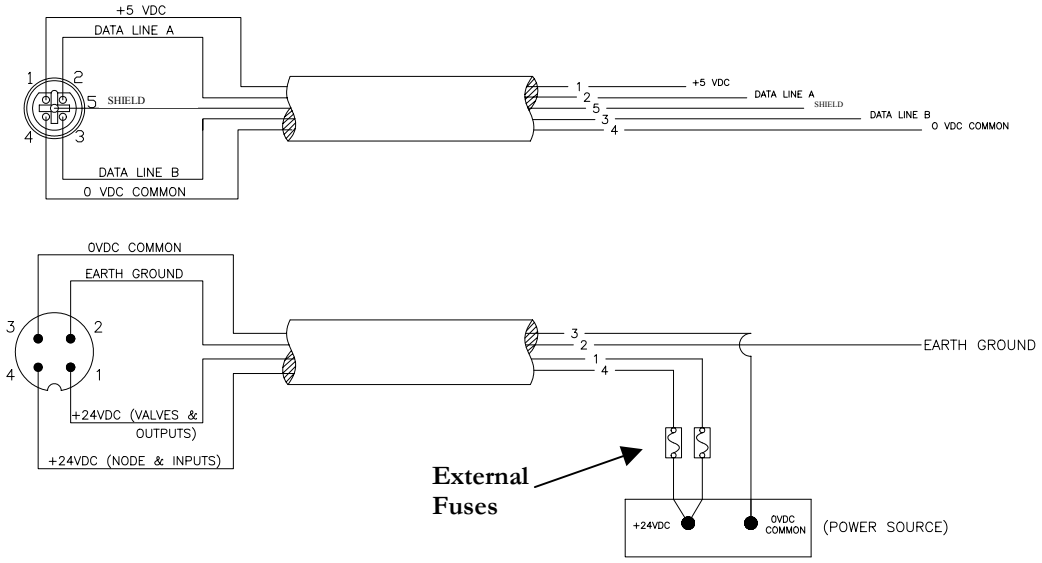
Switch Settings:

Switch	Setting	Description
SW1	2	Sets the Tens Digit of Network Address to Two (2)
SW2	3	Sets the Ones Digit of Network Address to Three (3)

Electrical Connections

Power Supply Wiring Diagram

12 Mbps Communication Connector (Female connector view on module)



ATTENTION

- ***Please see page 13 for external fuse sizing guideline chart.***
- ***When using molded connector power cables, do not rely on wire colors for Pin-Out. Always use pin number references.***

Power Consumption

Auxiliary Power Connector – Power Pins

Aux. Power Connector Pin #	Description
1	Powers Outputs (Valves)
4	Powers Discrete I/O and Node Electronics

Power Ratings

- Maximum system current capability is 4 amps. Care should be taken not to exceed 4-amps draw through pin #3, 0VDC common (pin #1 and pin #4 combined).

Auxiliary Power Connector	*Volts*	*Tolerances*	*Current*	*Power*
Pin 1 +24VDC (Valves)				
MR84 Series Regulator (Each)	24VDC	+10%/-15%	0.020 A	0.50 Watts
MR85 Series Regulator (Each)	24VDC	+10%/-15%	0.020 A	0.50 Watts
Pin 4 +24VDC (Node & I/O)				
Node	24VDC	+/- 10%	0.015 A	0.36 Watts
Communication Connector	*Volts*	*Tolerances*	*Current*	*Power*
Pins 2 & 3 Bus Power (V+ and V-)	24VDC	11-25 VDC	0.025 A	0.6 Watts

Recommended External Fuses:

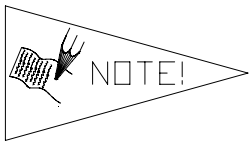
External fuses should be chosen based upon the physical manifold configuration. Please refer to the following page for the fuse sizing guide.

Power Consumption and External Fuse Sizing Guide

Power Consumption - Aux. Power Connector Pin #1 – (Regulators)		
Description		*Current*
Number of MR84 Series Regulators ___ X 0.020 A	=	_____Amps
		+
Number of MR85 Series Regulators ___ X 0.020 A	=	_____Amps
Total Regulator Current*:		_____Amps
Surge Compensation:	X	1.25
Suggested External Pin #1 Fuse Value:		_____Amps

Power Consumption - Aux. Power Connector Pin #4 – (Node)		
Description		*Current*
Communication Node Power Consumption	=	0.070 Amps
Surge Compensation:	X	1.25
Suggested External Pin #4 Fuse Value:		0.250 Amps

***The combination of total regulator current must not exceed 4 Amperes.**



At any given moment in time, the combined current draw through pin #1 (Regulators) and pin #4 (Node) cannot exceed 4 amperes. Therefore, the combined value of the two fuses on pin #1 and pin #4 should not exceed 5 amperes (4 amperes max by 1.25 surge compensation).

Profibus-DP Configuration and Mapping

GSD File

The GSD file contains configuration information required to establish communication to a node on a Profibus DP network. The GSD file is available on the Numatics, Inc., website at www.numatics.com or on the Profibus website at www.profibus.com.

I/O Setup

Outputs

Outputs are defined as any miniature electropneumatic regulator. The output byte size depends upon the physical configuration of the manifold. Please reference the following table for the output byte size.

Inputs

The inputs are only applicable if the manifold has a feedback option. The input byte size will include a byte for each station. Please reference the following table for the input byte size.

Manifold I/O Sizing Table

Part No.	Description	Rx (Input Bytes)	Tx (Output Bytes)
MPCR-04PTCF	4 Station Profibus NPTF Manifold with Common Exhaust and Feedback	4	8
MPCR-04PTCN	4 Station Profibus NPTF Manifold with Common Exhaust	4	0
MPCR-04PTIF	4 Station Profibus NPTF Manifold with Individual Exhaust and Feedback	4	8
MPCR-04PTIN	4 Station Profibus NPTF Manifold with Individual Exhaust	4	0
MPCR-06PTCF	6 Station Profibus NPTF Manifold with Common Exhaust and Feedback	6	12
MPCR-06PTCN	6 Station Profibus NPTF Manifold with Common Exhaust	6	0
MPCR-06PTIF	6 Station Profibus NPTF Manifold with Individual Exhaust and Feedback	6	12
MPCR-06PTIN	6 Station Profibus NPTF Manifold with Individual Exhaust	6	0
MPCR-08PTCF	8 Station Profibus NPTF Manifold with Common Exhaust and Feedback	8	16
MPCR-08PTCN	8 Station Profibus NPTF Manifold with Common Exhaust	8	0
MPCR-08PTIF	8 Station Profibus NPTF Manifold with Individual Exhaust and Feedback	8	16
MPCR-08PTIN	8 Station Profibus NPTF Manifold with Individual Exhaust	8	0
MPCRG04PTCF	4 Station Profibus G-tap Manifold with Common Exhaust and Feedback	4	8
MPCRG04PTCN	4 Station Profibus G-tap Manifold with Common Exhaust	4	0
MPCRG04PTIF	4 Station Profibus G-tap Manifold with Individual Exhaust and Feedback	4	8
MPCRG04PTIN	4 Station Profibus G-tap Manifold with Individual Exhaust	4	0
MPCRG06PTCF	6 Station Profibus G-tap Manifold with Common Exhaust and Feedback	6	12
MPCRG06PTCN	6 Station Profibus G-tap Manifold with Common Exhaust	6	0
MPCRG06PTIF	6 Station Profibus G-tap Manifold with Individual Exhaust and Feedback	6	12
MPCRG06PTIN	6 Station Profibus G-tap Manifold with Individual Exhaust	6	0
MPCRG08PTCF	8 Station Profibus G-tap Manifold with Common Exhaust and Feedback	8	16
MPCRG08PTCN	8 Station Profibus G-tap Manifold with Common Exhaust	8	0
MPCRG08PTIF	8 Station Profibus G-tap Manifold with Individual Exhaust and Feedback	8	16
MPCRG08PTIN	8 Station Profibus G-tap Manifold with Individual Exhaust	8	0

Bit Mapping Rules

Bit mapping for the MPCR Series varies with the physical configuration of the manifold. The following is a breakdown of the bit mapping rules associated with the MPCR Series manifold.

Regulators

Outputs

1. **The number of output bytes corresponds directly to the number of stations on the manifold assembly. One byte for each station.**

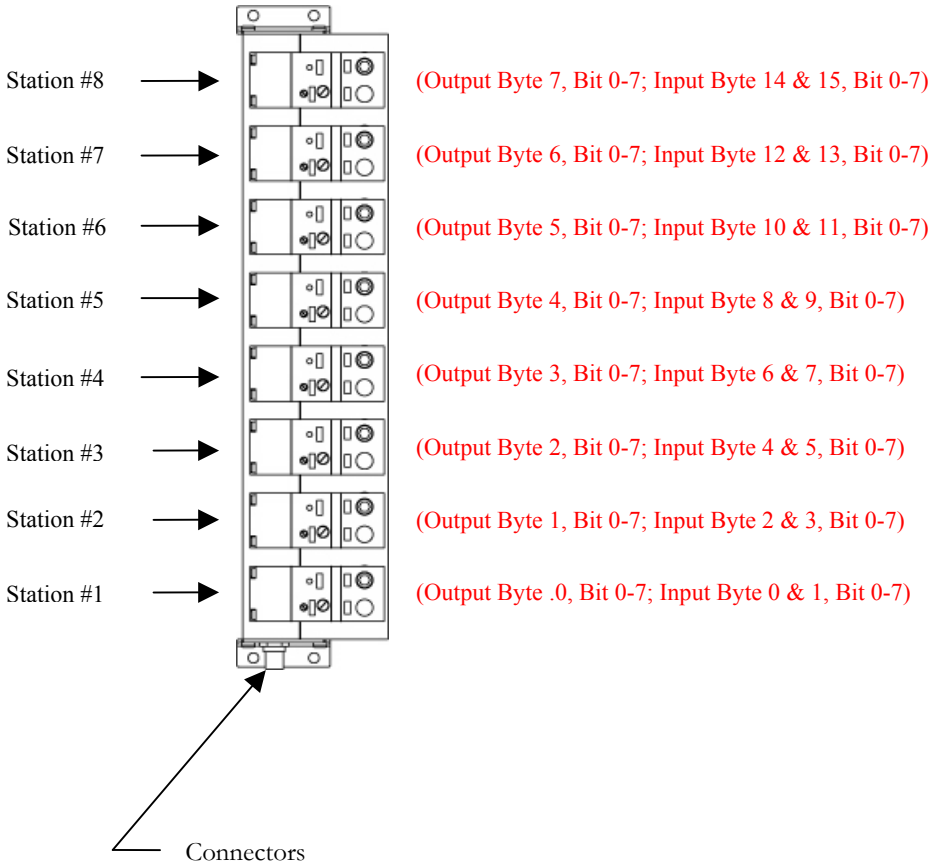
Inputs

1. **Input bits are on dependent on the manifold configuration.**
2. **If the feedback manifold is selected, then the number of output bytes corresponds directly to the number of stations on the manifold assembly.**

I/O Mapping

Example

MPCR-08PTFC



Example #1 I/O Table

Output Table								
BYTE	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Regulator #1	Regulator #1	Regulator #1	Regulator #1	Regulator #1	Regulator #1	Regulator #1	Regulator #1
1	Regulator #2	Regulator #2	Regulator #2	Regulator #2	Regulator #2	Regulator #2	Regulator #2	Regulator #2
2	Regulator #3	Regulator #3	Regulator #3	Regulator #3	Regulator #3	Regulator #3	Regulator #3	Regulator #3
3	Regulator #4	Regulator #4	Regulator #4	Regulator #4	Regulator #4	Regulator #4	Regulator #4	Regulator #4
4	Regulator #5	Regulator #5	Regulator #5	Regulator #5	Regulator #5	Regulator #5	Regulator #5	Regulator #5
5	Regulator #6	Regulator #6	Regulator #6	Regulator #6	Regulator #6	Regulator #6	Regulator #6	Regulator #6
6	Regulator #7	Regulator #7	Regulator #7	Regulator #7	Regulator #7	Regulator #7	Regulator #7	Regulator #7
7	Regulator #8	Regulator #8	Regulator #8	Regulator #8	Regulator #8	Regulator #8	Regulator #8	Regulator #8

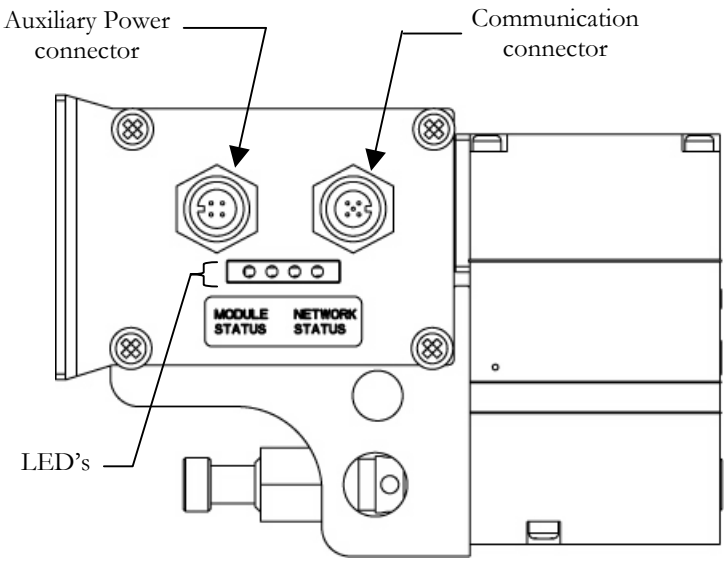
Input Table *								
BYTE	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Station #1 Input	Station #1 Input	Station #1 Input	Station #1 Input	Station #1 Input	Station #1 Input	Station #1 Input	Station #1 Input
1	Station #1 Input	Station #1 Input	Station #1 Input	Station #1 Input	Station #1 Input	Station #1 Input	Station #1 Input	Station #1 Input
2	Station #2 Input	Station #2 Input	Station #2 Input	Station #2 Input	Station #2 Input	Station #2 Input	Station #2 Input	Station #2 Input
3	Station #2 Input	Station #2 Input	Station #2 Input	Station #2 Input	Station #2 Input	Station #2 Input	Station #2 Input	Station #2 Input
4	Station #3 Input	Station #3 Input	Station #3 Input	Station #3 Input	Station #3 Input	Station #3 Input	Station #3 Input	Station #3 Input
5	Station #3 Input	Station #3 Input	Station #3 Input	Station #3 Input	Station #3 Input	Station #3 Input	Station #3 Input	Station #3 Input
6	Station #4 Input	Station #4 Input	Station #4 Input	Station #4 Input	Station #4 Input	Station #4 Input	Station #4 Input	Station #4 Input
7	Station #4 Input	Station #4 Input	Station #4 Input	Station #4 Input	Station #4 Input	Station #4 Input	Station #4 Input	Station #4 Input
8	Station #5 Input	Station #5 Input	Station #5 Input	Station #5 Input	Station #5 Input	Station #5 Input	Station #5 Input	Station #5 Input
9	Station #5 Input	Station #5 Input	Station #5 Input	Station #5 Input	Station #5 Input	Station #5 Input	Station #5 Input	Station #5 Input
10	Station #6 Input	Station #6 Input	Station #6 Input	Station #6 Input	Station #6 Input	Station #6 Input	Station #6 Input	Station #6 Input
11	Station #6 Input	Station #6 Input	Station #6 Input	Station #6 Input	Station #6 Input	Station #6 Input	Station #6 Input	Station #6 Input
12	Station #7 Input	Station #7 Input	Station #7 Input	Station #7 Input	Station #7 Input	Station #7 Input	Station #7 Input	Station #7 Input
13	Station #7 Input	Station #7 Input	Station #7 Input	Station #7 Input	Station #7 Input	Station #7 Input	Station #7 Input	Station #7 Input
14	Station #8 Input	Station #8 Input	Station #8 Input	Station #8 Input	Station #8 Input	Station #8 Input	Station #8 Input	Station #8 Input
15	Station #8 Input	Station #8 Input	Station #8 Input	Station #8 Input	Station #8 Input	Station #8 Input	Station #8 Input	Station #8 Input

***Inputs from feedback option when ordered**

Diagnostics

LED Functions

Upon power up, the LED's indicate the status of the unit. There are two sets of LED's on the MPCR: network status and auxiliary power.



LED Name	Color	Status	Description
Network	Green	ON	Normal operation. Device is on-line and has established a connection.
	Red	ON	Device is not on-line. Bus power not applied. The device has detected a bus error that has rendered it incapable of communicating on the network; Duplicate Network Address; "Bus Off" condition; Physical problem with network.
Module	Green	ON	Normal operation. The device status is okay.
	Red	ON	Critical fault in communication electronics

Appendix

System Specifications

Electrical	
Supply Voltage	Regulators: 24 VDC + 10%, -15% Bus: 24 VDC +/- 10%
Current	Total current on the Aux. Power Connector (Pin 1 - "Regulators" and Pin 4 - "Node") must not exceed 8 amperes.
Recommended External Fuse	External fuses should be chosen depending upon manifold configuration. Please refer to power consumption chart for additional fuse sizing information. See page 13
Spike Suppression	Output spike suppression is internally provided for regulator outputs.
Operating Temperature for Electronic Components	23 to 114°F (-5 to 46°C)

Factory Default Settings

Description	*Default*
Node Address	126
Diagnostic Messaging	0
Fail Safe Mode	0
Fail Safe Data	0

Troubleshooting

Symptom	Possible Cause	Solution
Won't go on-line. Network Status LED is Red & Module Status LED is Green	Parameterization Problem or invalid or duplicate network address	Check configuration and Parameterization setting on Profibus configuration software. Check network addressing Check network cabling and connections.
All LED's off	Power not properly applied	Power must be applied to pin #4 on the auxiliary power connector for the node to function properly. Pin #4 of the auxiliary power connector must have power
Regulator outputs do not energize. All node LEDs normal.	Output power not present or connected improperly on Aux. Power connector.	Check for 24VDC on pin #1 of Aux. Power connector.

Glossary of Terms

The following is a list and description of common terms and symbols used throughout this document:

Bit	**Smallest unit of digital information either a "0" or "1"**
Bit mapping	**Chart showing which bit is connected to which physical input or output point**
Byte	**8 bits (1/2 word)**
Ground	**This term is used to indicate an earth ground**
GSD file	**A text file, which contains specific product information, definitions of product capabilities and configurable parameters.**
I/O	**Any combination of Inputs and Outputs**
Word	**2 Bytes (16 bits)**

Technical Support

For technical support, contact your local Numatics distributor. Additional assistance is available from Numatics Inc. at (810) 667-3900 and ask for Technical Support.

Issues relating to network set-up, PLC programming, sequencing, software related functions, etc… should be handled with the appropriate product vendor.

Information on GSD files, local distributors, and other Numatics, Inc. products and support issues can be found on the Numatics, Inc. WEB site at: http://www.numatics.com