

# numatics®

## G3 Series Modbus TCP Technical Manual



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## About Modbus TCP

### Overview

Modbus TCP is a communication protocol that uses the same network technology that can be found in commercial and domestic operations worldwide, but has added benefits/features toward manufacturing applications.

The Modbus Organization is an independent organization that governs the Modbus TCP specification and oversees conformance testing for products.

Modbus TCP uses industrial M12 IP67-rated connectors. The protocol can transfer data at two interface speeds of 10 Mbps and 100 Mbps. Maximum network cabling distance is limited to 100m segments at 20° C.

More information about Modbus TCP can be obtained from Modbus website [www.modbus.org](http://www.modbus.org)

### G3 Modbus TCP Features

| <i>Features</i>             | <i>Description</i>                                                                                      |
|-----------------------------|---------------------------------------------------------------------------------------------------------|
| Modbus TCP™ Spec. Supported | Designed to Modbus TCP™ Specification                                                                   |
| Bus Topology                | Star and Multi-Star                                                                                     |
| Baud Rates Supported        | 10/100 Mbps and Autobaud                                                                                |
| CE                          | CE Compliant                                                                                            |
| Duplicate Address Detection | If a duplicate address is detected on power up, duplicates will not progress to run mode                |
| Address Setting             | Via DHCP/BOOTP, Web Page Configuration, Graphical Display or optional Manual Configuration Module (MCM) |
| Duplex                      | Half and Full supported                                                                                 |

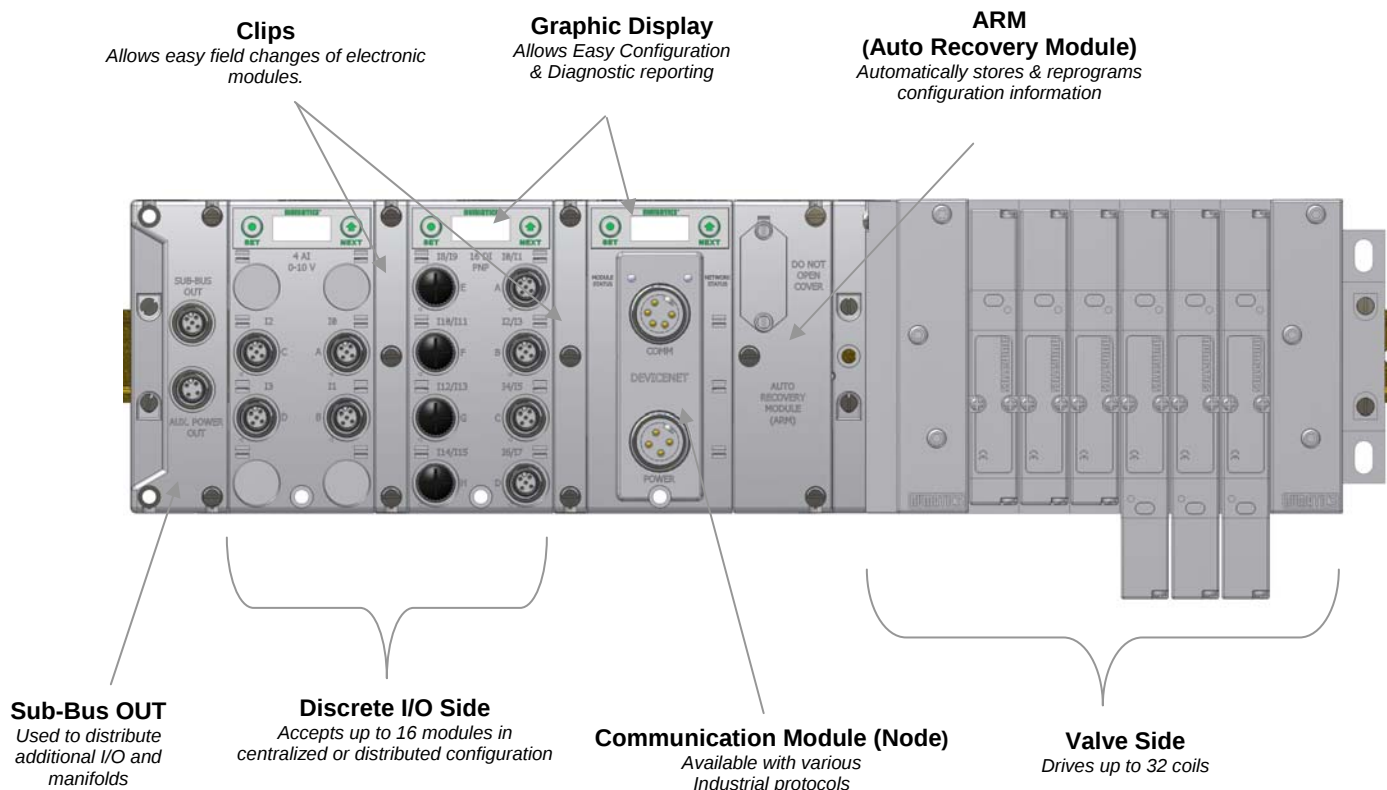
## G3 Introduction

The G3 Series is an electronic product platform that features an integrated graphic display for simple commissioning and displaying of diagnostic information. In addition it has an innovative distribution capability which allows the same I/O components that make up a centralized manifold configuration to be used as the distribution components as well, decreasing the need for duplicate components on centralized and distributed applications. The G3 platform interfaces to a variety of valve series and fieldbus interface protocols and is capable of addressing a total of 1200 I/O points (150 bytes). With proper assembly and termination the G3 modules will have an IP65 / IP67 rating.

The manifold can be viewed as having two sections to it, the *Valve Side* and the *Discrete I/O Side*. The *Valve Side* supports a maximum of 32 solenoid coils and the *Discrete I/O Side* supports a maximum of 16 modules capable of addressing up to 1200 outputs, 1200 inputs or various combinations.

Various discrete modules with integrated graphic display are available. They include digital I/O, analog I/O, and specialty modules which cover various application needs. Pin-outs for all connectors are labeled on the side of the respective modules and are also detailed in the module section of this document.

This manual details specific information for configuring and commissioning the Numatics G3 Series product line. For more information relating to pneumatic valving and valve manifold assemblies, please refer to the Numatics *In Control* Catalog at [www.numatics.com](http://www.numatics.com).

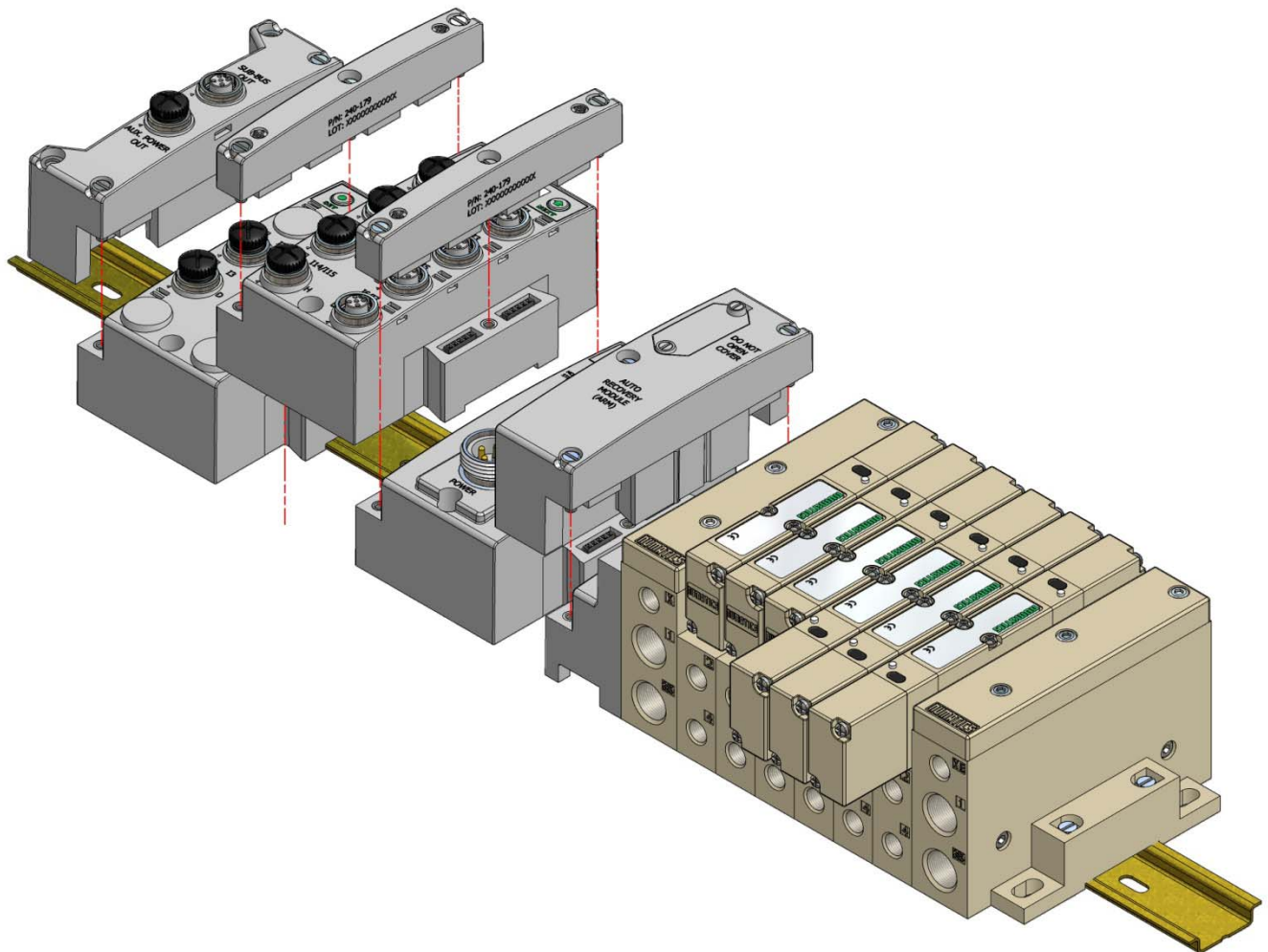


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## G3 Electronics Modularity

### Discrete I/O

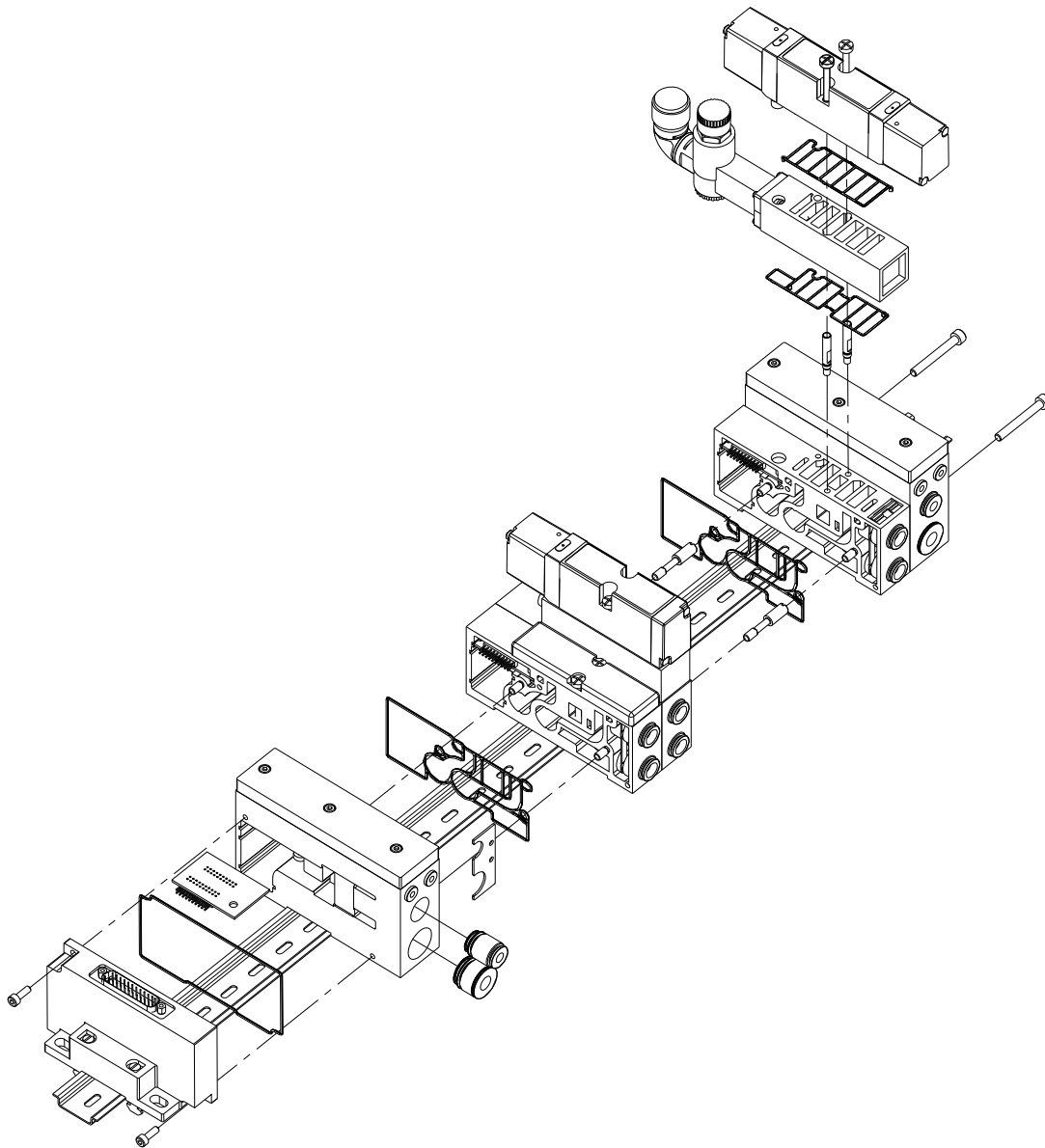
The G3 Series product line is a completely modular and scalable system. As shown below, all of the G3 electronic modules plug together, via mechanical clips, allowing easy assembly and field changes.



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## Pneumatic Valve Manifold

The pneumatic valve manifold with Internal Circuit Board Technology is also modular. The valve solenoid coil connections are automatically made using Z-Board™ technology (plug together PC boards, which allow internal connection from solenoid coils to output drivers without the use of wires). This allows easy assembly and field changes.

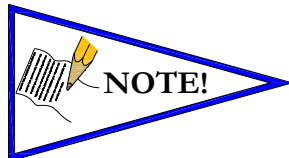
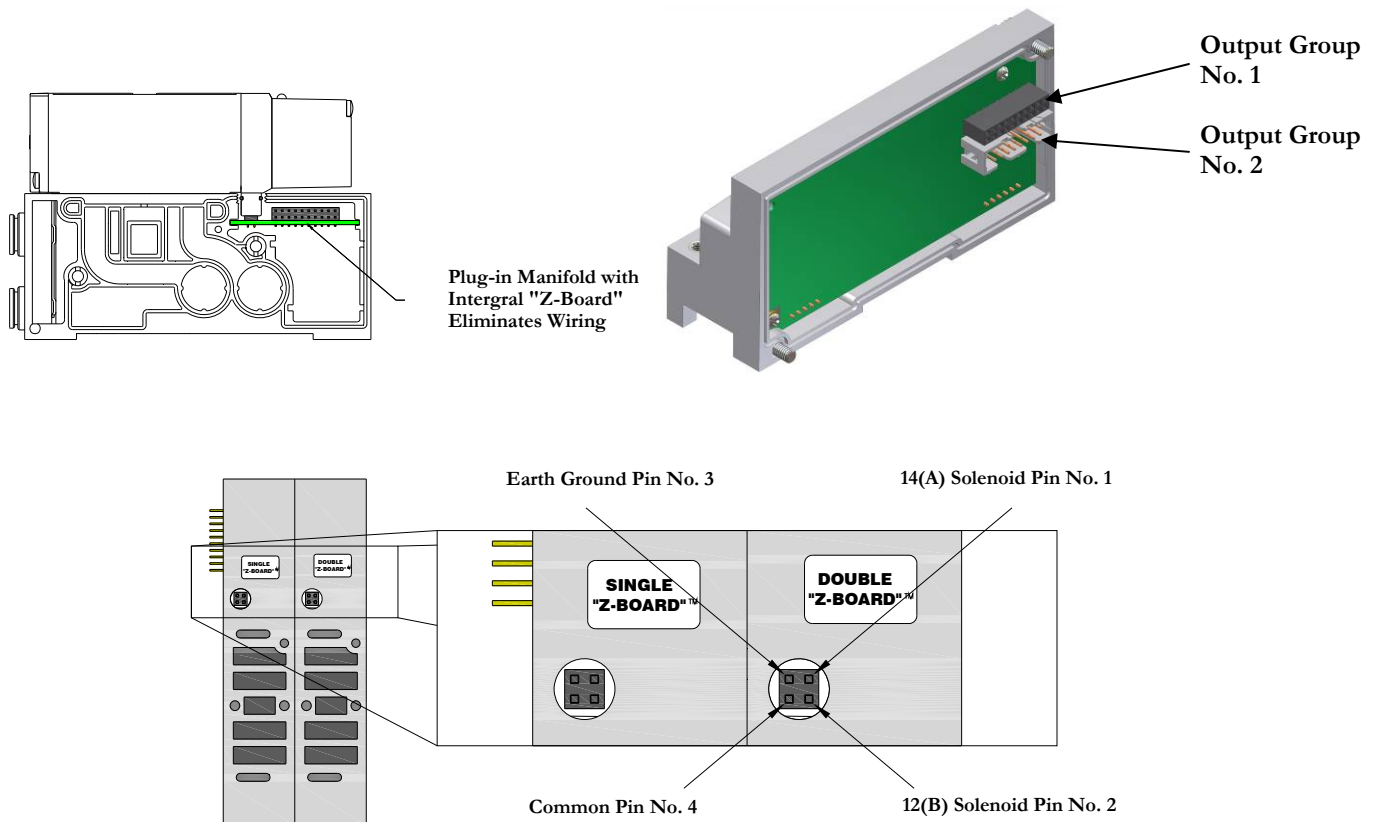


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## Manifold Connectors

### Solenoid Coil Connections using Z-Board™ technology

Z-Board™ plug together technology connects all valve solenoids to the valve coil output driver board, located in the valve adapter. The 32 available coil outputs are divided into 2 separate connector groups. Output group No. 1 is comprised of the first output word, bits 0-15, and output group No. 2 is comprised of the second output word, bits 16-31. Output group No. 1 connects directly to the Z-Boards™. Output group No. 2 is connected to the Z-Boards™ via an internal ribbon cable or valve side Sub-D. The first output (bit 0) connects to the “14” (A) solenoid on the valve closest to the communication node. The 17<sup>th</sup> – 32<sup>nd</sup> solenoids interconnect via the Z-Boards™ to output group No. 2. For the maximum capability of 32 solenoids on the same manifold, the 16<sup>th</sup> and 17<sup>th</sup> solenoid coils must NOT be on the same sub-base.

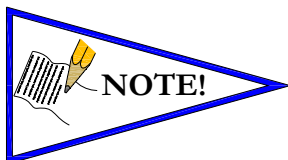
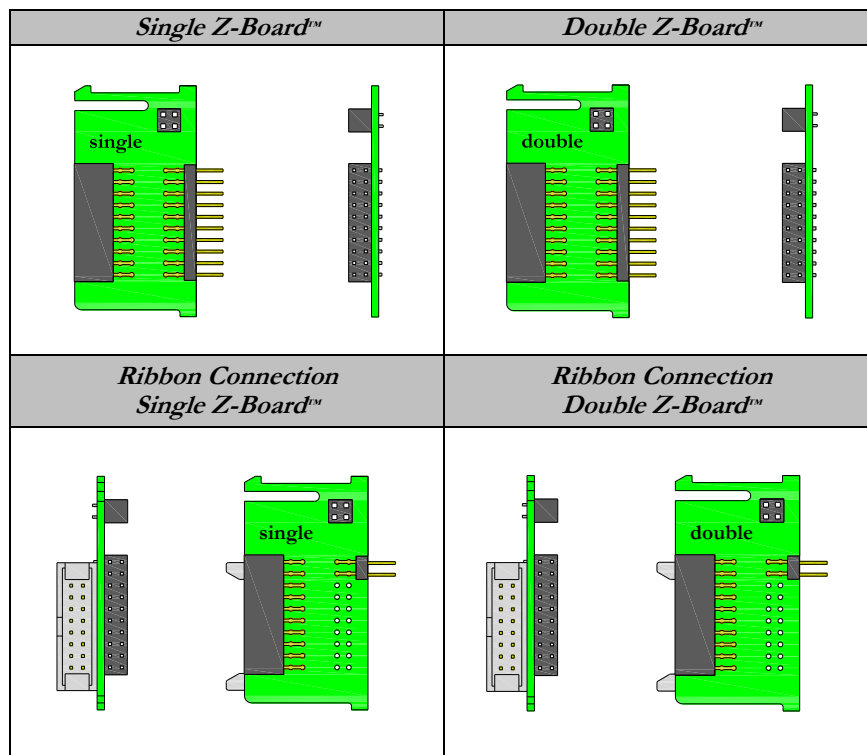


*A single solenoid valve's coil is always on the "14" end.*

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## Z-Board™ Connectors

The 2005/2012/2035 valve series utilize 2 different Z-Board™ designs to achieve the single and double solenoid output functions. This yields the possible 32 single, 16 double, or various combinations of valve coil output capabilities.



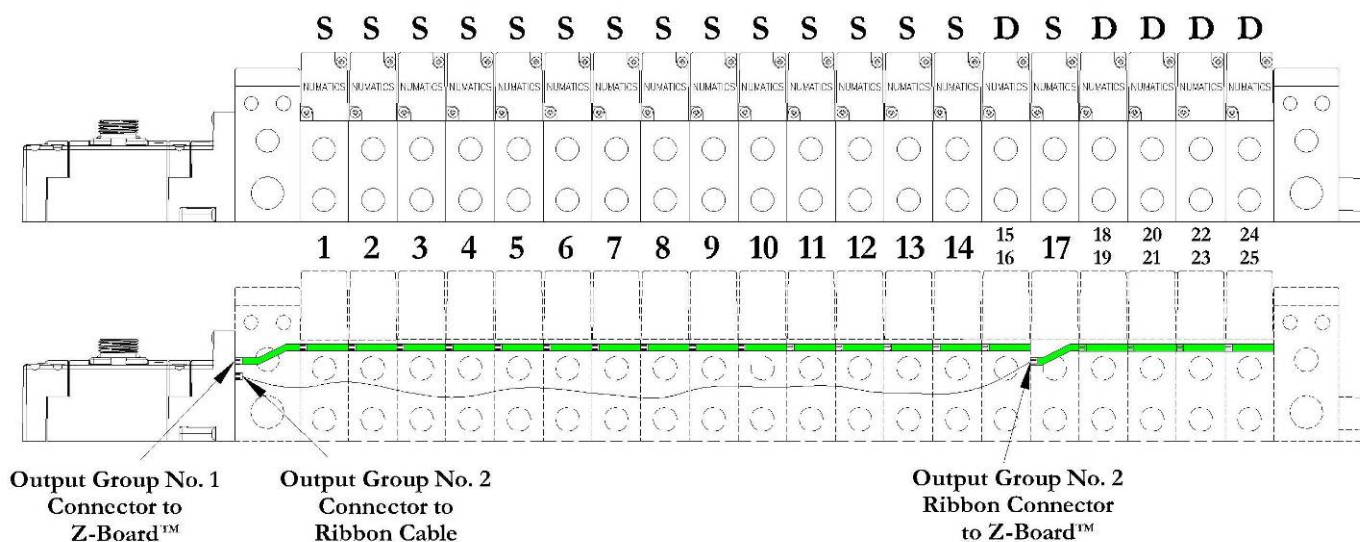
*The 17<sup>th</sup> solenoid (output group No. 2's first bit) must be accessed via either the valve side Sub-D output module or a ribbon connector type Z-board.*

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## Z-Board™ and Ribbon Cable Example

If fourteen (14) single solenoid and one (1) double solenoid valves are connected directly to the communication node via their Z-Boards™, and one (1) single solenoid and four (4) double solenoid valves are connected to the communication node via the ribbon cable, the following would be the valve side bit map:

S = Single Solenoid with Single Z-Board™  
D = Double Solenoid With Double Z-Board™



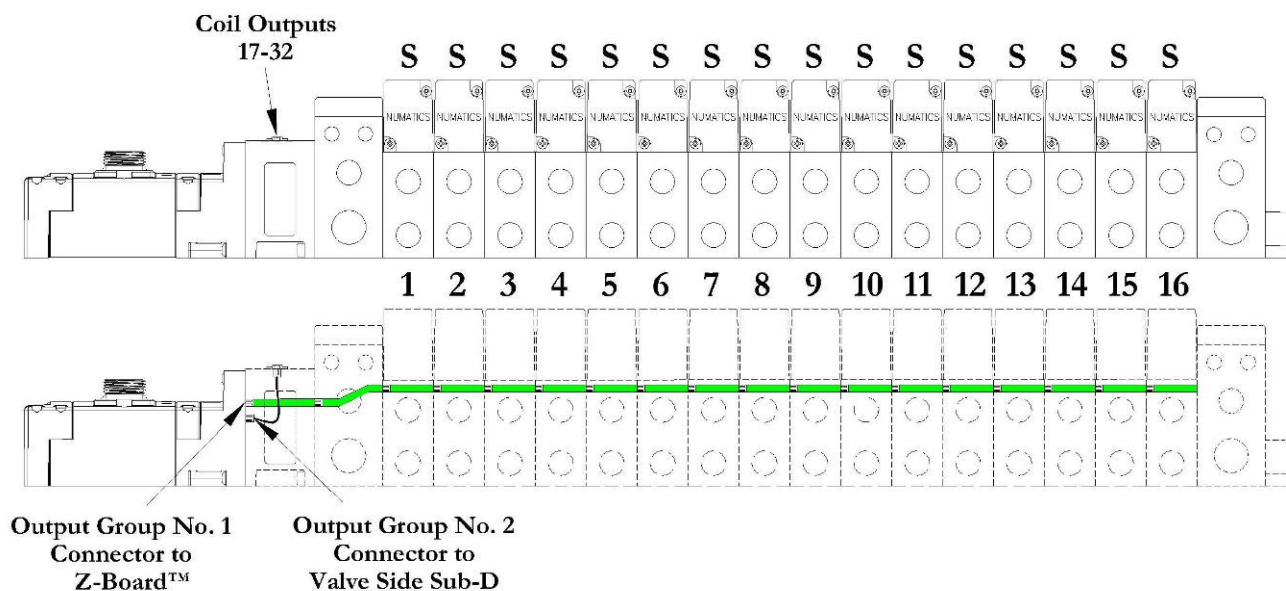
| Output Word              | 0  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 1  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|--------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Output Byte              | 0  |    |    |    |    |    |    |    | 1  |    |    |    |    |    |    |    | 2  |    |    |    |    |    |    |    | 3  |    |    |    |    |    |    |    |
| Output Bit No.           | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| Solenoid Coil Output No. | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |

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## Z-Board™ with Valve Side Sub-D Example

If sixteen (16) single solenoid valves are connected directly to the communication node via their Z-Boards™, and a valve side Sub-D connector is connected to the communication node via the output Group No. 2 connector then the following would be the valve side bit map:

S = Single Solenoid with Single Z-Board



| Output Word                 | 0  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 1  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Output Byte                 | 0  |    |    |    |    |    |    |    | 1  |    |    |    |    |    |    |    | 2  |    |    |    |    |    |    |    | 3  |    |    |    |    |    |    |    |
| Output Bit No.              | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| Solenoid Coil<br>Output No. | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |

## Communication Module

### Modbus TCP Communication Module (Node)

This module is the communication interface to the manifold. It contains communication electronics and internal short circuit protection for power. It can be configured via software, via the graphic display or manually via DIP switches through the optional Manual Configuration Module (MCM).

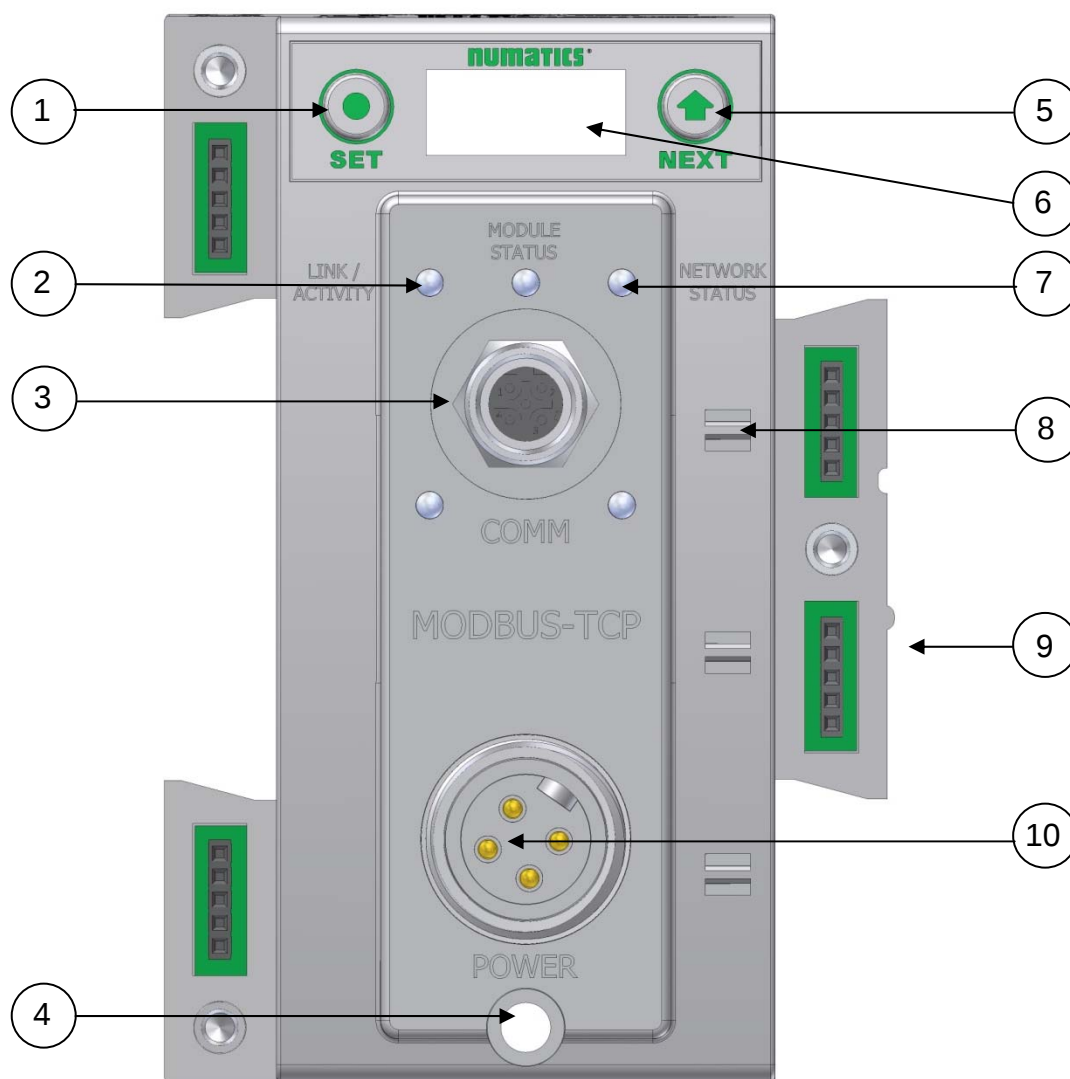
| <i>Communication Module Kit Part Number</i> |         |
|---------------------------------------------|---------|
| Modbus TCP Communication module             | 240-292 |



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## Communication Module Description

| Detail No. | Description                                                               |
|------------|---------------------------------------------------------------------------|
| 1          | “Set” Button – used to navigate through user menus and to set parameters  |
| 2          | Activity/Link Status LED                                                  |
| 3          | 4 Pin M12 D-Coded Female Communication Connector                          |
| 4          | Mounting Hole                                                             |
| 5          | “Next” Button – used to navigate through user menus and to set parameters |
| 6          | Graphic Display – used to display parameter information                   |
| 7          | Network Status LED                                                        |
| 8          | Slot for text ID tags                                                     |
| 9          | Keying for preventing I/O module insertion                                |
| 10         | 4 Pin MINI Male Power Connector                                           |



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## Connector Pin-Outs

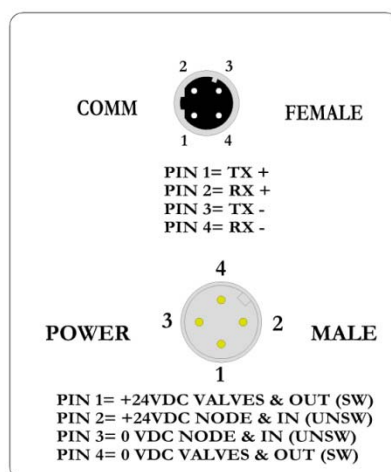
Industry standard connectors are used for communication and auxiliary power.  
 The Ethernet communication connector is a D-coded keyway 4 pin female M12 connector.  
 The Power connector is a single keyway 4 pin male 7/8" MINI connector.

### Modbus TCP Communication Connector Pin-Out

| Pin No. | Function | Description            |
|---------|----------|------------------------|
| 1       | TX+      | Positive Transmit Line |
| 2       | RX+      | Positive Receive Line  |
| 3       | TX-      | Negative Transmit Line |
| 4       | RX-      | Negative Receive Line  |

### Power Connector with Cenelec Pin-Out

| Cenelec Pin No. | Function                        | Description                                                                  |
|-----------------|---------------------------------|------------------------------------------------------------------------------|
| 1               | +24 VDC<br>(Valves and Outputs) | Voltage used to power outputs<br>(valve coils and discrete outputs) SW       |
| 2               | +24 VDC<br>(Node and Inputs)    | Voltage used to power discrete inputs and<br>node electronics UNSW           |
| 3               | 0 VDC<br>(Node and Inputs)      | 0 VDC Voltage used to power discrete inputs and<br>node electronics UNSW     |
| 4               | 0 VDC<br>(Valves and Outputs)   | 0 VDC Voltage used to power outputs<br>(valve coils and discrete outputs) SW |



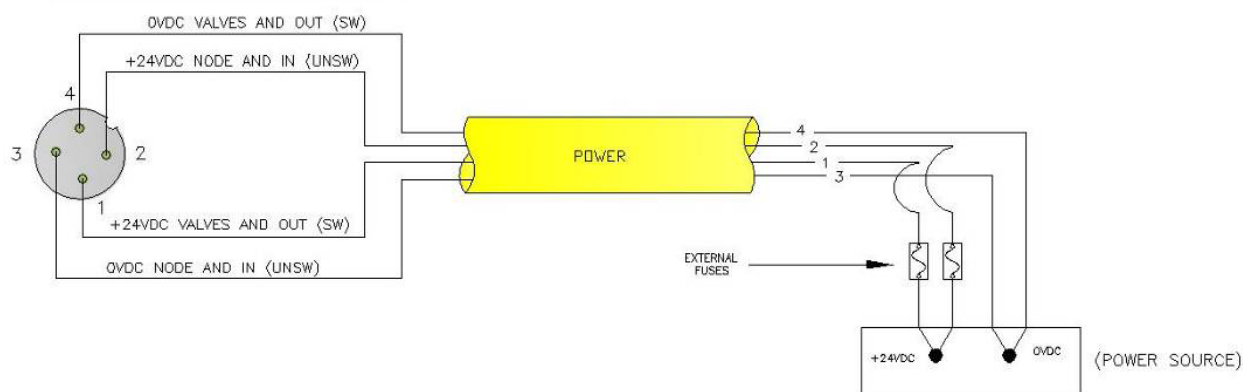
- *Power common (0 VDC) pins 3 and 4 are isolated from each other to allow separate (isolated) power supply connection if required. However, they can be tied together if a single common, non-isolated, application is preferred.*
- *The combined draw of the +24VDC Valves and Outputs and +24VDC Node and Inputs pins cannot exceed 8 Amps, at any given moment in time.*
- *The Node and Inputs pin supplies power to the node electronics. This pin must be powered at all times for communication node to be functional.*

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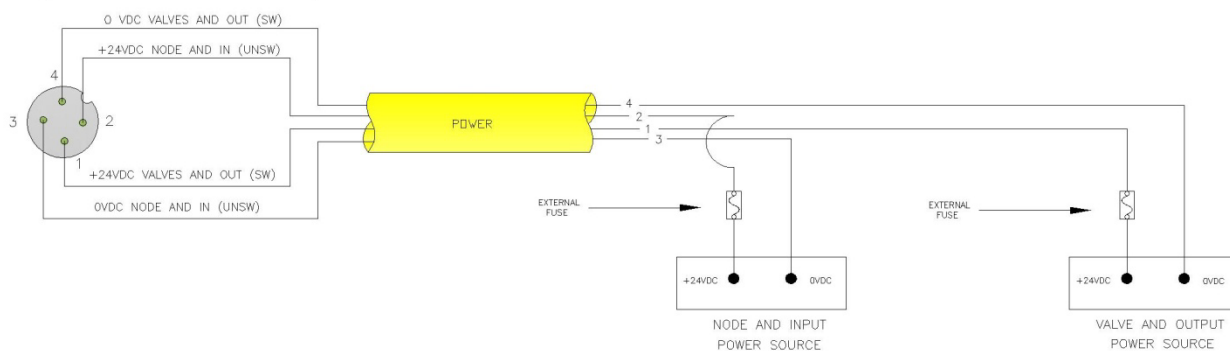
## Electrical Connections

### Power Connector Wiring Diagram

#### Power Supply Example (Non-isolated commons)



#### Power Supply Example (Isolated commons)



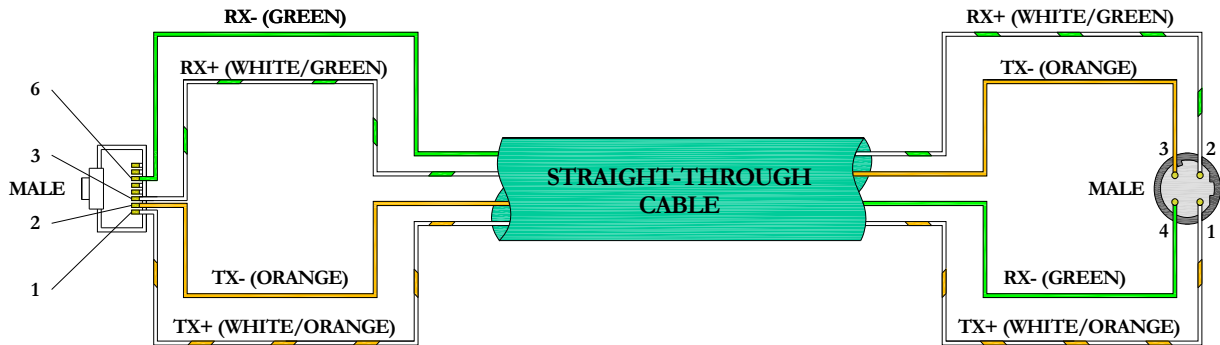
- Please see page 18 for external fuse sizing guide.
- When using molded connector power cables, **Do Not** rely on wire colors for Pin-Out. **Always use pin number references.**

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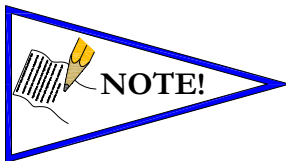
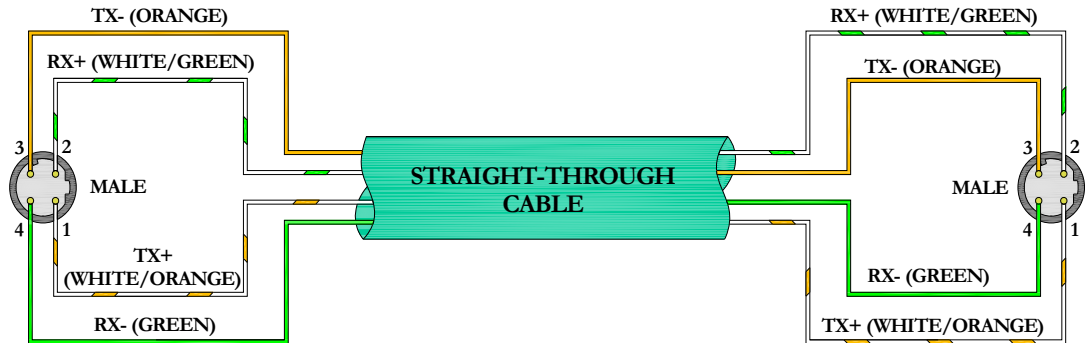
## Ethernet Straight-Through Cabling Diagrams

Straight-Through Ethernet cable is used when connecting an Ethernet node to a basic media component (router, switch, hub, etc.). Here are some basic wiring examples of Straight-Through cabling.

### RJ45 to M12 D Coded Cable



### M12 D Coded to M12 D Coded Cable



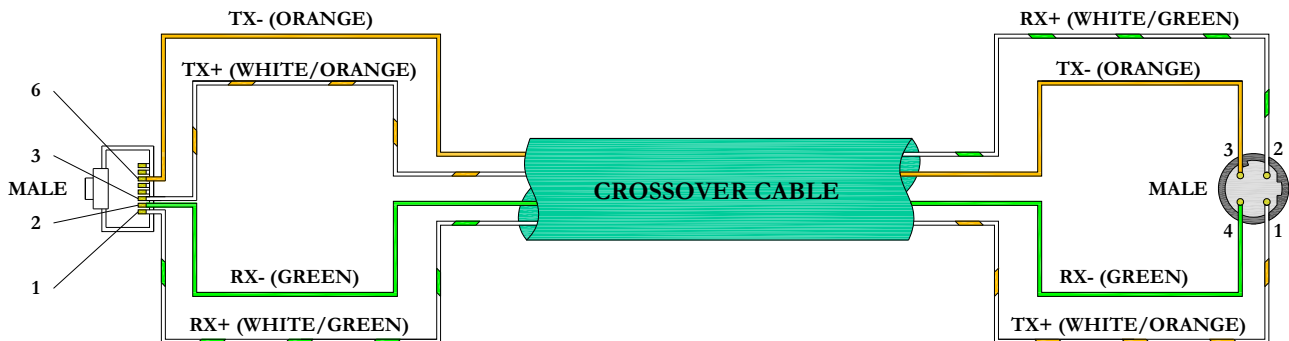
- These are examples only. For appropriate network cabling information, please see the ODVA document titled, "EtherNet/IP™: Media Planning and Installation Manual".
- RJ45 shown as T-568B standard.

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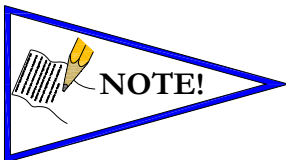
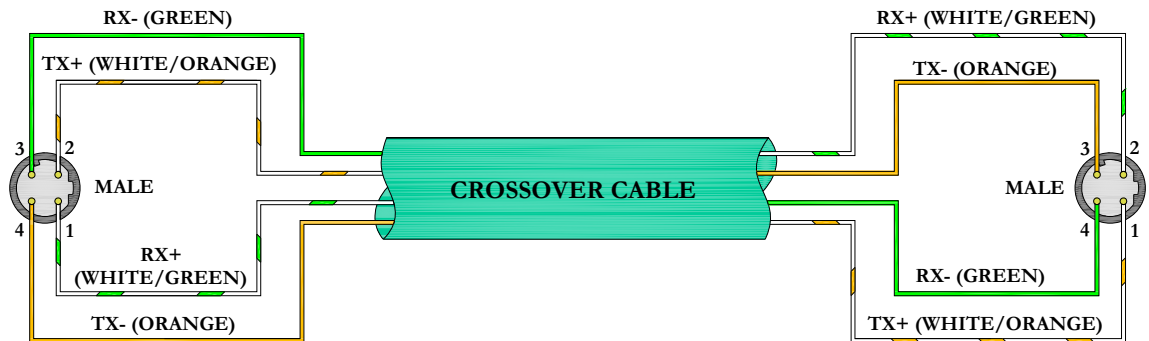
## Ethernet Crossover Cabling Diagrams

A Crossover Ethernet cable is used when connecting two Ethernet nodes directly together. For example, when you connect a computer directly to a Numatics' valve manifold, a Crossover cable would be used. Here are some basic wiring examples of Crossover cabling.

### RJ45 to M12 D Coded Cable



### M12 D Coded to M12 D Coded Cable



- *These are examples only. For appropriate network cabling information, please see the ODVA document titled, "EtherNet/IP™: Media Planning and Installation Manual".*
- *RJ45 shown as T-568B standard.*

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## Power Consumption

### Power Connection

| <i>CENELEC<br/>Pin No.</i> | <i>Function</i>                      | <i>Description</i>                                                                |
|----------------------------|--------------------------------------|-----------------------------------------------------------------------------------|
| 1                          | +24 VDC<br>(Valves and Outputs)      | Voltage used to power outputs<br>(valve coils and discrete outputs) SW            |
| 2                          | +24 VDC<br>(Node and Inputs)         | Voltage used to power discrete inputs and<br>node electronics UNSW                |
| 3                          | 0 VDC Common<br>(Node and Inputs)    | 0 VDC (-V) Voltage used to power discrete inputs and<br>node electronics UNSW     |
| 4                          | 0 VDC Common<br>(Valves and Outputs) | 0 VDC (-V) Voltage used to power outputs<br>(valve coils and discrete outputs) SW |

### Power Rating

- For maximum supply current capability please refer to page 45.
- Loads should not draw more than 0.5 Amps of current from any one individual discrete output point (Contact factory for higher current capability requirements).

| <i>Component</i>                     | <i>Voltage</i> | <i>Tolerance</i> | <i>+24VDC<br/>(Valves and Outputs)<br/>Pins 1 &amp; 4</i> |              | <i>+24VDC<br/>(Node and Inputs)<br/>Pins 2 &amp; 3</i> |              |
|--------------------------------------|----------------|------------------|-----------------------------------------------------------|--------------|--------------------------------------------------------|--------------|
|                                      |                |                  | <i>Current</i>                                            | <i>Power</i> | <i>Current</i>                                         | <i>Power</i> |
| Solenoid Valve Coil 2002 (Each)      | 24 VDC         | +10%/-15%        | 0.021 A                                                   | 0.5 W        | 0 A                                                    | 0 W          |
| Solenoid Valve Coil 2005 (Each)      | 24 VDC         | +10%/-15%        | 0.056 A                                                   | 1.35 W       | 0 A                                                    | 0 W          |
| Solenoid Valve Coil 2012 (Each)      | 24 VDC         | +10%/-15%        | 0.105 A                                                   | 2.5 W        | 0 A                                                    | 0 W          |
| Solenoid Valve Coil 2035 (Each)      | 24 VDC         | +10%/-15%        | 0.105 A                                                   | 2.5 W        | 0 A                                                    | 0 W          |
| Solenoid Valve Coil ISO - SPA        | 24 VDC         | +10%/-15%        | 0.167 A                                                   | 4.0 W        | 0 A                                                    | 0 W          |
| Valve Adapter (Driver)               | 24 VDC         | +/- 10%          | .134 A                                                    | 3.22 W       | 0 A                                                    | 0 W          |
| Discrete Digital Input Module        | 24 VDC         | +/- 10%          | .012 A                                                    | .29 W        | .085 A*                                                | 2.04 W*      |
| Discrete Digital Output Module       | 24 VDC         | +/- 10%          | .051 A                                                    | 1.2 W        | .060 A*                                                | 1.44 W*      |
| Discrete Digital I/O Module          | 24 VDC         | +/- 10%          | .035 A                                                    | 0.84 W       | .076 A*                                                | 1.82 W*      |
| Discrete Analog Input Module (V & C) | 24 VDC         | +/- 10%          | .012 A                                                    | 0.288 W      | .077 A*                                                | 1.85 W*      |
| Discrete Analog I/O Module (V & C)   | 24 VDC         | +/- 10%          | .018 A                                                    | 0.432 W      | .087 A*                                                | 2.08 W*      |
| Communication Module (Node)          | 24 VDC         | +/- 10%          | .006 A                                                    | 0.144 W      | .091 A*                                                | 1.7 W*       |
| Sub-Bus Valve Module                 | 24 VDC         | +/- 10%          | .012 A                                                    | 0.288 W      | .066 A*                                                | 1.58 W*      |
| Auto Recovery Module (ARM)           | 24 VDC         | +/- 10%          | 0A                                                        | 0 W          | .022 A                                                 | .53 W        |
| Manual Configuration Module (MCM)    | 24 VDC         | +/- 10%          | 0 A                                                       | 0 W          | .022 A                                                 | .53 W        |

\* Current depends on graphic display brightness setting. Max. value shown with high brightness.  
Values decrease by approx. 12% for Medium and 25% for Low brightness settings.



- *Total power consumption for each Discrete I/O point is dependent on the specific current draw of input sensor devices and output loads.*

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## Recommended External Fuses

External fuses should be chosen based upon the physical manifold configuration. Please refer to the table below for the fuse sizing chart.

## External Fuse Sizing Chart

| <i>Power Consumption - Power Connector Pin for Valves and Outputs</i>  |   |      |                |
|------------------------------------------------------------------------|---|------|----------------|
| <u>Description</u>                                                     |   |      | <u>Current</u> |
| Number of Solenoid Valve Coils Energized Simultaneously                |   |      |                |
| ___ X 0.167 A (ISO - SPA Series)                                       | = | ___  | Amps           |
| ___ X 0.105 A (2012 and 2035 Series)                                   | = | ___  | Amps           |
| ___ X 0.056 A (2005 Series)                                            | = | ___  | Amps           |
| ___ X 0.021 A (2002 Series)                                            | = | ___  | Amps           |
|                                                                        |   |      | +              |
| Total load current drawn by simultaneously energized Discrete Outputs  | = | ___  | Amps           |
|                                                                        |   |      | +              |
| Number of I/O modules installed ___ X 0.008 A                          | = | ___  | Amps           |
|                                                                        |   |      | +              |
| Valve Adapter                                                          | = | .134 | Amps           |
|                                                                        |   |      | +              |
| Communication Node Power Consumption                                   | = | .006 | Amps           |
|                                                                        |   |      | +              |
| Total:                                                                 |   | ___  | Amps           |
| Surge Compensation:                                                    | X | 1.25 |                |
| Suggested External +24 VDC (Valves and Outputs) Fuse Value:            |   | ___  | Amps           |
| <i>Power Consumption - Power Connector Pin for Node and Inputs</i>     |   |      |                |
| <u>Description</u>                                                     |   |      | <u>Current</u> |
| Communication Node Power Consumption                                   | = | .091 | Amps           |
|                                                                        |   |      | +              |
| Total load current drawn by Sensor Devices from Discrete Inputs source | = | ___  | Amps           |
|                                                                        |   |      | +              |
| Number of I/O modules installed ___ X 0.080 A                          | = | ___  | Amps           |
|                                                                        |   |      | +              |
| Total:                                                                 |   | ___  | Amps           |
| Surge Compensation:                                                    | X | 1.25 |                |
| Suggested External Pin +24 VDC (Node and Inputs) Fuse Value:           |   | ___  | Amps           |

\*Factory Default Settings



- The Node and Inputs Aux Power pins supply power to the node electronics. These pins must be powered at all times for communication node and Inputs to be functional.
- The internal electronic fuses exist to protect against damage due to catastrophic failure of internal components. External fuses are always recommended for protection against power supply failure, over-current conditions, etc...

# numatics® G3 Series Modbus TCP Technical Manual

## Diagnostics

### Communication Module LED Functions

Upon power up, the LEDs indicate the status of the unit. There are three LEDs on the G3 Ethernet node. These LEDs are described below.



| LED Name       | Color | Status   | Description                                                                                                                         |
|----------------|-------|----------|-------------------------------------------------------------------------------------------------------------------------------------|
| MODULE STATUS  | Off   | OFF      | No power applied to $+24V_{NODE/IN}$ .                                                                                              |
|                | Green | ON       | Device operational. The module is operating correctly.                                                                              |
|                |       | FLASHING | Standby. The module has not been configured.                                                                                        |
|                | Red   | ON       | Major fault. A major internal error has been detected.                                                                              |
|                | Red   | FLASHING | Minor fault. A minor recoverable fault has been detected.<br>Self -Test Mode - An error has occurred in the initialization process. |
| NETWORK STATUS | Green | Red      | Self -Test Mode.                                                                                                                    |
|                | Off   | OFF      | IP address has not been assigned to node or no power applied to $+24V_{NODE/IN}$ .                                                  |
|                | Green | ON       | Connected. The module has established an Modbus TCP connection.                                                                     |
|                |       | FLASHING | No connection. There are no Modbus TCP connections established to the module.                                                       |
|                | Red   | ON       | Duplicate IP address. The module has detected that its IP address is already being used elsewhere on the network                    |
| ACTIVITY/LINK  |       | FLASHING | Modbus TCP connection has timed out. One or more of the connections for which this module is the target has timed out.              |
|                | Green | OFF      | No Ethernet connection is detected                                                                                                  |
|                |       | ON       | The module is connected to an Ethernet network                                                                                      |
|                |       | FLASHING | The LED flashes each time a packet is received or transmitted.                                                                      |



# G3 Series Modbus TCP Technical Manual

## Output Short Circuit Protection

### Status Bit Action During Fault Condition

| <i>Output Type</i>         | <i>Output State</i> | <i>Fault Condition</i>                        | <i>Status Bit</i> |
|----------------------------|---------------------|-----------------------------------------------|-------------------|
| Valve Solenoid Coil Driver | ON                  | No Fault                                      | 0                 |
|                            |                     | Fault - Short Circuit, Over Temp/Over Current | 1                 |
| Valve Solenoid Coil Driver | OFF                 | No Fault                                      | 0                 |
|                            |                     | Fault - Open Load                             | 1                 |
| Discrete Outputs           | ON                  | No Fault                                      | 0                 |
|                            |                     | Fault - Short Circuit, Over Temp/Over Current | 1                 |

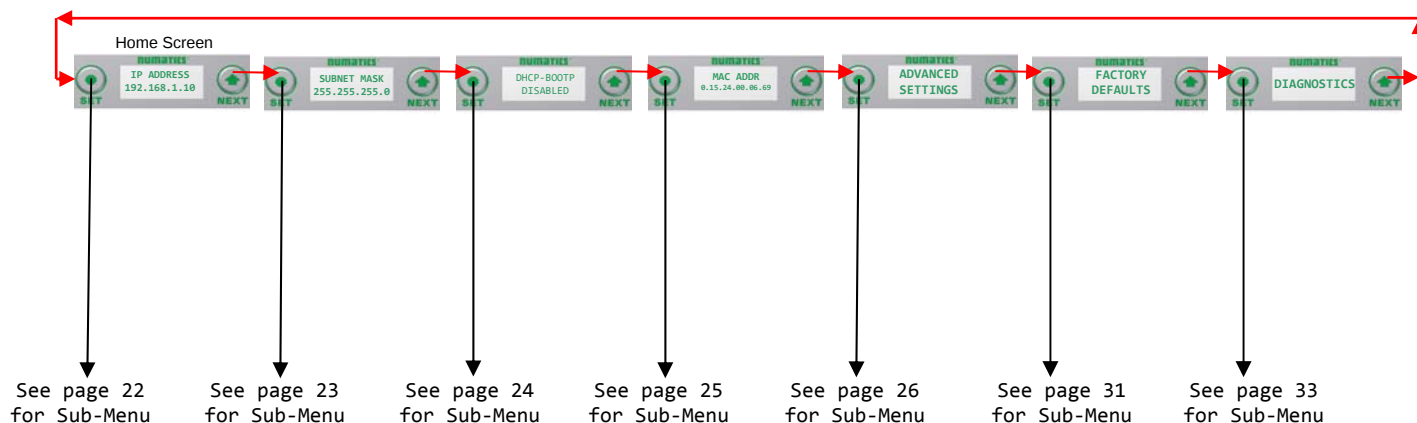
# numatics™ G3 Series Modbus TCP Technical Manual

## G3 Graphic Display

The G3 Communication and I/O modules have an integrated graphic display that may be used to configure the parameters of the modules as well as showing diagnostic information.



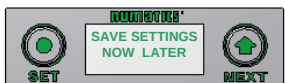
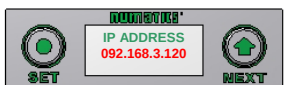
The following graphic displays represent the main menu selections of the communication module (node). Use the NEXT button to scroll through the Main menu headings shown below. At this level pressing the SET button allows access the Sub-Menus. Please see the appropriate pages referenced below for further details and descriptions of the Sub-Menus. **NOTE: WHEN A NETWORK I/O CONNECTION IS ESTABLISHED MANUAL CHANGES TO NODE PARAMETERS ARE NOT ALLOWED!**



# numatics® G3 Series Modbus TCP Technical Manual

## IP Address Sub-Menu

### Steps to Set IP Address



1. Press the SET button to enter the IP ADDRESS sub-menu.
2. Press the NEXT button to select the octet that you would like to change. Press the SET button to change the value.
3. Press the SET button to scroll through the hundred, tens and ones digits of the octet. Press the NEXT button to scroll through the valid digits (0-9). Press the SET button to advance through the octet. Press the NEXT button to advance to the next octet, scroll pass the fourth octet to accept the entire IP Address
4. Press the SET button to input the address shown on the display,
5. Press the NEXT button to select **Yes** or **No** to accept the IP Address shown on the display..
  - a. Selecting **No** will bring you back to the main Address menu.
  - b. Selecting **Yes** will take you to the following SAVE SETTINGS menu
6. Press the NEXT button to select either **NOW** or **LATER**.
  - a. Selecting **NOW** will cause the node to reset and apply the new setting.
  - b. Selecting **LATER** will cause the new Address to be saved in temporary memory to allow you to make additional parameter changes before the node is reset. However, you must **ACCEPT** the saved changes before your next power cycle otherwise they will be lost.

Press the SET button to confirm your choice.

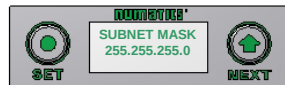


- *Factory default address is 192.168.3.120*
- *0 and 255 are not valid for the fourth octet*

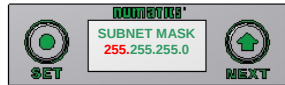
# numatics® G3 Series Modbus TCP Technical Manual

## Subnet Mask Sub-Menu

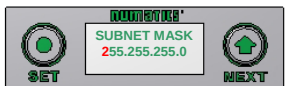
### Steps to Set Subnet Mask



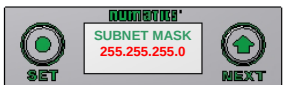
1. Press the SET button to enter the Subnet Mask sub-menu.



2. Press the NEXT button to select the octet that you would like to change. Press the SET button to change the value.



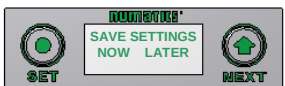
3. Press the SET button to scroll through the hundred, tens and ones digits of the octet. Press the NEXT button to scroll through the valid digits (0-9). Press the SET button to advance through the octet. Press the NEXT button to advance to the next octet, scroll pass the fourth octet to accept the entire Subnet Mask



4. Press the SET button to input the value shown on the display,



5. Press the NEXT button to select **Yes** or **No** to accept the Subnet Mask shown on the display..
  - c. Selecting **No** will bring you back to the main Subnet Mask menu.
  - d. Selecting **Yes** will take you to the following SAVE SETTINGS menu



6. Press the NEXT button to select either **NOW** or **LATER**.
  - c. Selecting **NOW** will cause the node to reset and apply the new setting.
  - d. Selecting **LATER** will cause the new Address to be saved in temporary memory to allow you to make additional parameter changes before the node is reset. However, you must **ACCEPT** the saved changes before your next power cycle otherwise they will be lost.

Press the SET button to confirm your choice.



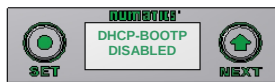
- *Factory default subnet mask is 255.255.255.0*

# numatics® G3 Series Modbus TCP Technical Manual

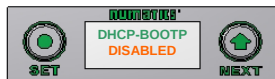
## DHCP-BOOTP Sub-Menu

This will allow the enabling / disabling of the DHCP (Dynamic Host Control Protocol) and / BOOTP parameters. Enabling this parameter will allow the IP Address to be set via a BOOTP/DHCP server.

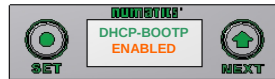
### DHCP-BOOTP Steps



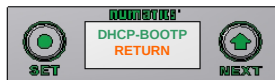
1. Press the SET button to enter the DHCP-BOOTP sub-menu.



2. Press the NEXT button to scroll through the choices to enable or disable the feature.
  - a. ENABLED (Factory Default)
  - b. DISABLED
  - c. RETURN (this will return you to the main menu)



Press the SET button to confirm your choice.



3. Press the NEXT button to select Yes or No to accept the selection.
  - a. Selecting No will bring you back to the main menu.
  - b. Selecting Yes will take you to the following apply changes menu.

Press the SET button to confirm your choice.



### Apply Changes Steps



4. Press the NEXT button to select either NOW or LATER.
  - a. Selecting NOW will cause the node to reset and apply the new setting.
  - b. Selecting LATER will cause the new setting to be saved in memory, you must accept the saved changes before your next power cycle otherwise they will be lost.

Press the SET button to confirm your choice.

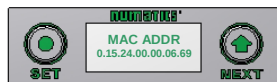


- *Factory default setting for DHCP-BOOTP is enabled.*

# numatics G3 Series Modbus TCP Technical Manual

## MAC ADDR Menu

### MAC (Machine Access Control) Address



1. The MAC Address is a fixed unique value that can not be edited.

The actual MAC ADDR has an extra leading zero. The actual number in the example shown is 00-15-24-00-06-69



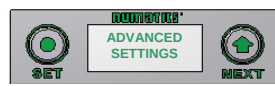
- *The MAC ADDR can not be edited*
- *Please note that the leading 0 in this number has been left off*

# numatics® G3 Series Modbus TCP Technical Manual

## Advanced Settings - I/O Diag. Menu

This will allow the enabling / disabling of the IO Status bits. The IO status bits include valve coil, discrete output, short circuit and alarm status bits.

### I/O Status Steps



1. Press the SET button to enter the ADVANCED SETTINGS sub-menu.



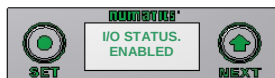
2. Press the SET button to enter the ADVANCED MENU / SET STATUS.



3. Press the SET button to enter the SET STATUS / I/O STATUS.



4. The current state of the parameter is shown.



5. Press the SET button to change this parameter  
Use the NEXT button to scroll through the choices to enable/disable the Diagnostic status for I/O.

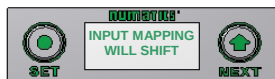
- a. ENABLED (Factory Default)
- b. DISABLED
- c. RETURN (this will return you to the SET STATUS menu)



Press the SET button to confirm your choice.



6. Press NEXT to confirm the warning message.



7. Press the NEXT button to select Yes or No to accept the selection
  - a. Selecting No will bring you back to the main SET STATUS menu.
  - b. Selecting Yes will take you to the following saved settings menu.

Press the SET button to confirm your choice.



### Save Settings Steps



8. Press the NEXT button to select either NOW or LATER.
  - a. Selecting NOW will cause the node to reset and apply the new setting.
  - b. Selecting LATER will cause the new I/O STATUS selection to be saved in memory, you must Accept the saved changes before your next power cycle otherwise they will be lost.

Press the SET button to confirm your choice.

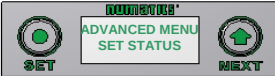
# numatics® G3 Series Modbus TCP Technical Manual

## Advanced Settings - Diagnostic Word

This will allow the enabling / disabling of the Diagnostic Word Status bits. The Diagnostic word bits include power status and sub-bus related status bits. Detailed information regarding these bits can be found on page 93. The Diagnostic Word comes enabled from the factory.

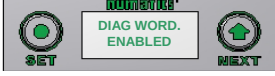
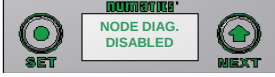
### Diag. Word Status Settings

- 

9. Press the SET button to enter the ADVANCED SETTINGS menu.
- 

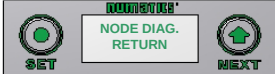
10. Press the SET button to enter the ADVANCED MENU /SET STATUS.
- 


11. Press the NEXT button to scroll to the SET STATUS / DIAG WORD menu.  
Press the SET button to enter the SET STATUS / DIAG WORD menu.
- 

12. The current state of the parameter is shown.
- 


13. Press the SET button to change this parameter  
Use the NEXT button to scroll through the choices to enable/disable the Diagnostic Word status for.

  - a. ENABLED (Factory Default)
  - b. DISABLED
  - c. RETURN (this will return you to the SET STATUS menu)

Press the SET button to confirm your choice.
- 

14. Press Next to confirm the warning message.
- 

15. Press the NEXT button to select Yes or No to accept the selection

  - a. Selecting No will bring you back to the main SET STATUS menu.
  - b. Selecting Yes will take you to the following saved settings menu.

Press the SET button to confirm your choice.
- 

16. Press the NEXT button to select either NOW or LATER.

  - a. Selecting NOW will cause the node to reset and apply the new setting.
  - b. Selecting LATER will cause the new NODE DIAG selection to be saved in memory, you must Accept the saved changes before your next power cycle otherwise they will be lost.

Press the SET button to confirm your choice.
- 

**Save Settings Steps**

# numatics® G3 Series Modbus TCP Technical Manual

## Advanced Settings - Fault Action

### Fault Action Settings



1. Press the SET button to enter the ADVANCED SETTINGS menu.
2. Press the NEXT button to scroll to the ADVANCED MENU / SET FAULT IDLE.
3. Press the SET button to enter the ADVANCED MENU / SET FAULT IDLE.
4. Press the SET button to enter the SET FAULT IDLE / FAULT ACTION menu.
5. The current state of the parameter is shown
6. Press the SET button to change this parameter  
Press the NEXT button to scroll the choices for the desired output action during a fault state.
  - a. OFF (Factory Default)
  - b. HOLD LAST STATE
  - c. RETURN (this will return you to the SET FAULT/IDLE menu)

Press the SET button to confirm your choice.
7. Press the NEXT button to select **Yes** or **No** to accept the selection  
Press the SET button to confirm your choice
  - a. Selecting **No** will bring you back to the main SET FAULT/IDLE menu.
  - b. Selecting **Yes** will take you to the following saved settings menu.

### Save Settings Steps

8. Press the NEXT button to select either **NOW** or **LATER**.  
Press the SET button to confirm your choice.
  - a. Selecting **NOW** will cause the node to reset and apply the new setting
  - b. Selecting **LATER** will cause the new FAULT ACTION selection to be saved in memory, you must Accept the saved changes before your next power cycle otherwise they will be lost.

Press the SET button to confirm your choice.



- See page 78 for more details.
- Factory Default is "ALL OFF"

# numatics® G3 Series Modbus TCP Technical Manual

## Advanced Settings - Idle Action

### Idle Action Settings



9. Press the SET button to enter the ADVANCED SETTINGS menu.
10. Press the NEXT button to scroll to the ADVANCED MENU / SET FAULT IDLE.
11. Press the SET button to enter the ADVANCED MENU / SET FAULT IDLE.
12. Press the NEXT button to scroll to the IDLE ACTION menu
13. Press the SET button to enter the SET FAULT IDLE / IDLE menu.
14. The current state of the parameter is shown
15. Press the SET button to change this parameter  
Press the NEXT button to scroll the choices for the desired output action during a fault state.
  - d. OFF (Factory Default)
  - e. HOLD LAST STATE
  - f. RETURN (this will return you to the SET FAULT/IDLE menu)

Press the SET button to confirm your choice.
16. Press the NEXT button to select **Yes** or **No** to accept the selection  
Press the SET button to confirm your choice
  - c. Selecting **No** will bring you back to the main SET FAULT/IDLE menu.
  - d. Selecting **Yes** will take you to the following saved settings menu.

### Save Settings Steps

17. Press the NEXT button to select either **NOW** or **LATER**.  
Press the SET button to confirm your choice.
  - c. Selecting **NOW** will cause the node to reset and apply the new setting
  - d. Selecting **LATER** will cause the new FAULT ACTION selection to be saved in memory, you must Accept the saved changes before your next power cycle otherwise they will be lost.

Press the SET button to confirm your choice.

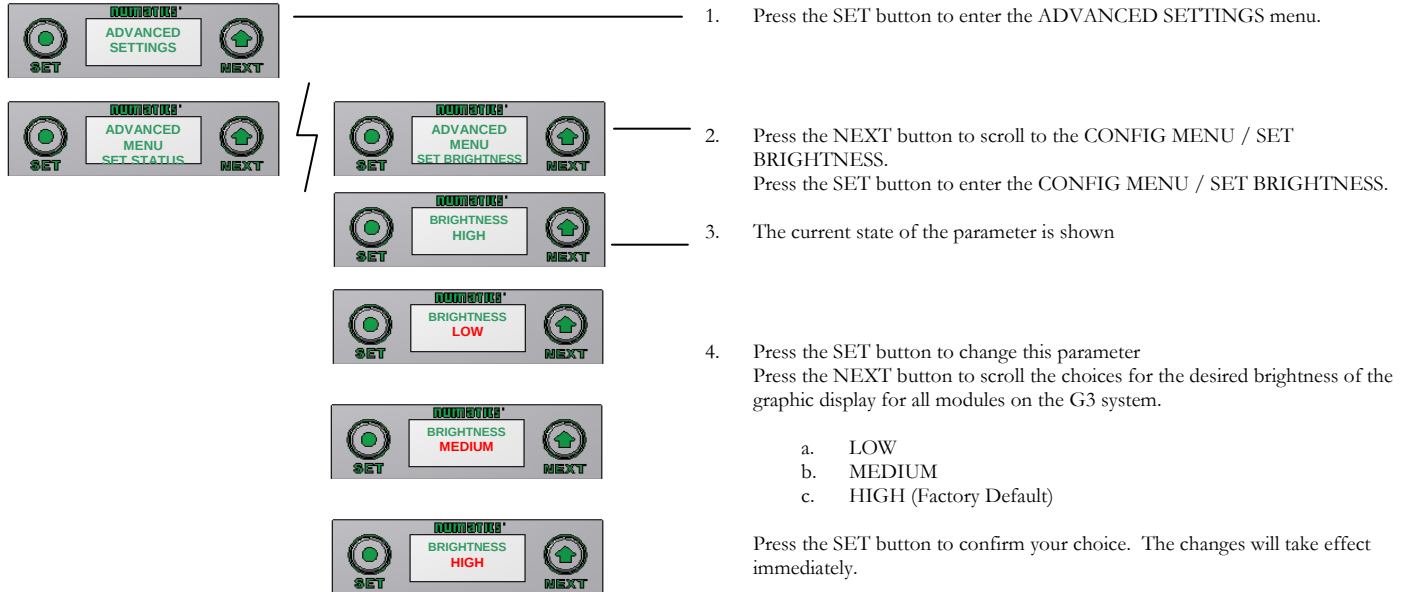


- See page 78 for more details.
- Factory Default is **ALL OFF**

# numatics® G3 Series Modbus TCP Technical Manual

## Advanced Settings - Brightness

### Brightness Settings



- *This a global setting that affects all modules*
- *Each module, however, has its own setting if different settings are required.*

# numatics® G3 Series Modbus TCP Technical Manual

## Advanced Settings - Parameters

### PARAMETER Steps



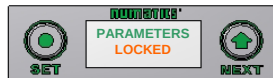
1. Press the SET button to enter the Parameters sub-menu.



2. Press the NEXT button to scroll through the choices to enable or disable the feature.

- d. UNLOCKED (Factory Default)
- e. LOCKED
- f. RETURN (this will return you to the main menu)

Press the SET button to confirm your choice.



By choosing LOCKED, all settable parameters will be read only via the graphic display. UNLOCKED, the factory default, will allow all parameters to be settable through the graphic display.

*Please note that all parameters are read only, regardless of this setting, when an IO connection between the communication module and the controller (PLC) is present*



3. Press the NEXT button to select Yes or No to accept the selection.
  - c. Selecting No will bring you back to the main menu.
  - d. Selecting Yes will take you to the following apply changes menu.

Press the SET button to confirm your choice.



### Apply Changes Steps

4. Press the NEXT button to select either NOW or LATER.
  - c. Selecting NOW will cause the node to reset and apply the new setting.
  - d. Selecting LATER will cause the new setting to be saved in memory, you must accept the saved changes before your next power cycle otherwise they will be lost.

Press the SET button to confirm your choice.



# numatics G3 Series Modbus TCP Technical Manual

## Factory Defaults

### Factory Default Settings



1. Press the SET button to enter the FACTORY DEFAULTS sub-menu.



2. Press the SET button to change this parameter



3. Press the NEXT button to select Yes or No.
  - a. Selecting No will bring you back to the main FACTORY DEFAULTS menu.
  - b. Selecting Yes will cause the node to reset and return all parameters to the factory default conditions.
  - c. Selecting RETURN will bring you back to the main FACTORY DEFAULTS menu

Press the SET button to confirm your choice.

| <i><b>FACTORY DEFAULT SETTINGS</b></i> |                       |
|----------------------------------------|-----------------------|
| <i><b>Description</b></i>              | <i><b>Default</b></i> |
| IP Address                             | 193.168.3.120         |
| Sub Net Mask                           | 255.255.255.0         |
| Diagnostic Word                        | Enabled               |
| I/O Diagnostic Status                  | Enabled               |
| Fault Action                           | Reset to All Off      |
| Idle Action                            | Reset to All Off      |
| Brightness                             | High                  |
| Parameters                             | Unlocked              |

# numatics G3 Series Modbus TCP Technical Manual

## Diagnostics - Self Test Mode

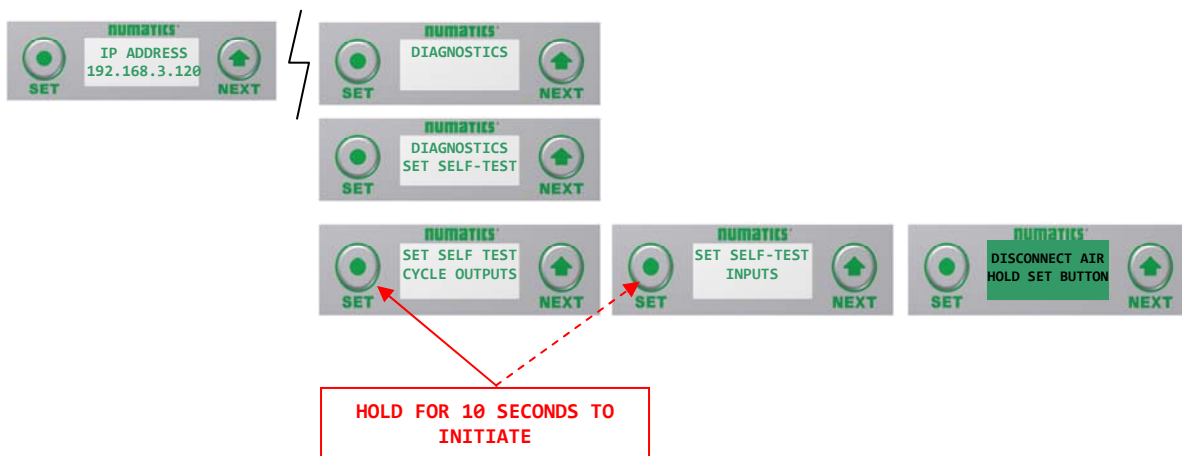
An internal diagnostic tool can be enabled on the communication module (node) using the graphic display. This tool allows the user to confirm that all of the inputs and outputs on the manifold and any of the distributed modules are fully functional without needing a network connection or controller. There are two test modes that the user can choose. The “CYCLE OUTPUTS” test mode tests all the outputs by sequentially turning them ON and OFF for approximately .5 seconds. The “INPUTS” test mode tests the inputs by causing all of the outputs to toggle between even and odd values when any input is made. The Self Test mode on the communication module (node) is a global setting and will test all devices connected on the main manifold as well as any distributed modules and/or manifolds.

Similar “local” self tests are available on all output modules types. This “local” self test function allows any output module to be tested without affecting any other output module.

NOTE: The number of Valve outputs that are tested are affected by the I/O size settings.

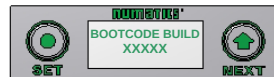
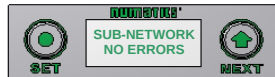
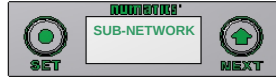
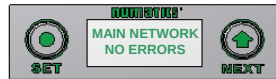
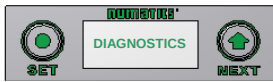
To use the Self Test Mode, the user must first set some initial conditions. Follow these steps to initiate the self-test mode.

- 1) **Disconnect Air and Communication from the manifold!**
- 2) Select the desired test mode using the graphic display. (See example below)
- 3) Starting at the Home Screen, navigate the menus by selecting the NEXT button until the **DIAGNOSTICS** menu is shown.
- 4) Select the SET button to access the **DIAGNOSTICS** menu and then again to access the **SELF-TEST** menu
- 5) Push NEXT to navigate to the desired test mode: **CYCLE OUTPUTS** or **INPUTS**
- 6) Push SET to select the desired test mode.
- 7) A message will appear: **DISCONNECT AIR HOLD SET BUTTON**
- 8) Hold the SET button down for approximately 10 seconds to enable the test. The Display will flash the above message while the button is pushed.
- 9) When the display stops flashing, the self-test mode will run and the Module Status LED will flash Red/Green while the display shows **SELF TEST RUNNING**.
- 10) The global self-test mode can only be disabled by disconnecting the power to the manifold.



# numatics® G3 Series Modbus TCP Technical Manual

## Diagnostics Cont.



1. All diagnostic information is read only
2. Press the SET button to enter DIAGNOSTICS sub-menu.
3. Press the NEXT button to scroll through the main diagnostic menu choices.
  - a. UNSW POWER
    - i. - Displays voltage level of unswitched power (Node & Inputs)
  - b. NETWORK ERRORS - ERROR CODE
    - i. - Displays fieldbus network errors
  - c. MAIN NETWORK
    - i. - Displays
  - d. SUB-NETWORK
    - i. - Displays log of network errors
  - e. FIRMWARE REV.
    - i. - For service personnel
  - f. FIRMWARE BUILD
    - i. - For service personnel
  - g. BOOTCODE REV.
    - i. -For service personnel
  - h. BOOTCODE BUILD
    - i. -
  - j. PART NUMBER
    - i. - Displays replacement part number of module



- The UNSW POWER screen indicates the voltage level present on the UNSW (Node & Input) power pins (Pin No. 2 and 3) of the main power connector.
- A voltage level less than 19 volts will generate an error screen and an associated diagnostic bit (see 'Diagnostic' section for more details).

# numatics® G3 Series Modbus TCP Technical Manual

## Error Messages

The following are automatic error messages that are displayed when specific faults occur during operation:



Displayed when a short circuit condition is detected on the Sub-Bus power lines.



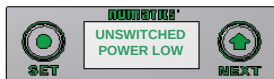
Displayed when a short circuit condition is detected on a valve coil



Displayed when a Sub-Bus module that had been previously installed becomes absent from the configuration



Displayed when +24 VDC on Pin No. 1 and No. 4 (Valves and Outputs) is not present or below 22 VDC



Displayed when +24 VDC on Pin No. 2 and No. 3 (Node and Inputs) is below 19 VDC

## MCM – Manual Configuration Module (Optional)

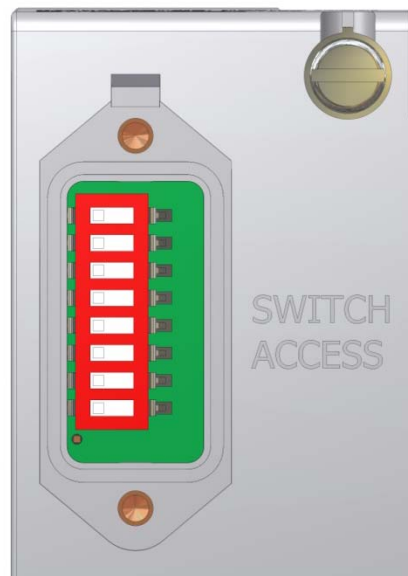


The MCM is an optional module that is installed between the node and the valve adapter module and allows the user to manually set the last octet of the IP address without the need for software configuration or the use of the integrated graphic display in the node. If software configuration or configuration via the integrated graphic display in the node is preferred, this module is not necessary.

| <i>Description</i> | <i>Replacement Part Number</i> |
|--------------------|--------------------------------|
| Complete Module    | 240-186                        |

# numatics G3 Series Modbus TCP Technical Manual

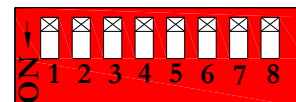
## DIP Switch Settings



### IP Address:

The DIP switches provide a manual way to configure the node's IP address. The values of the first, second and third octets are factory set to 192.168.001, respectively. The switches set the binary value of the last octet in the IP address. When all DIP switches are set to OFF, manual configuration is disabled and other means of setting the IP address must be used. DIP switch configuration settings require power to be cycled before any changes will take effect.

IP address: 192.168.001.**XXX** (192.168.001.SW1)  
 Subnet Mask: 255.255.255.0  
 Gateway address: 0.0.0.0 (no gateway set)



All switches shown in the "OFF" position.

**XXX** = DIP switch setting per the table below

| $2^7=128$<br>SW-8 | $2^6=64$<br>SW-7 | $2^5=32$<br>SW-6 | $2^4=16$<br>SW-5 | $2^3=8$<br>SW-4 | $2^2=4$<br>SW-3 | $2^1=2$<br>SW-2 | $2^0=1$<br>SW-1 | Octet Value<br>(Decimal) |
|-------------------|------------------|------------------|------------------|-----------------|-----------------|-----------------|-----------------|--------------------------|
| OFF               | OFF              | OFF              | OFF              | OFF             | OFF             | OFF             | OFF             | 0*                       |
| OFF               | OFF              | OFF              | OFF              | OFF             | OFF             | OFF             | ON              | 1                        |
| OFF               | OFF              | OFF              | OFF              | OFF             | OFF             | ON              | OFF             | 2                        |
| OFF               | OFF              | OFF              | OFF              | OFF             | OFF             | ON              | ON              | 3                        |
| OFF               | OFF              | OFF              | OFF              | OFF             | ON              | OFF             | OFF             | 4                        |
| OFF               | ON               | ON               | ON               | ON              | OFF             | OFF             | OFF             | 120                      |
| ON                | ON               | ON               | ON               | ON              | ON              | OFF             | ON              | 253                      |
| ON                | ON               | ON               | ON               | ON              | ON              | ON              | OFF             | 254                      |
| ON                | ON               | ON               | ON               | ON              | ON              | ON              | ON              | 255*                     |

\*Not valid for fourth octet

## ARM – Auto Recovery Module (Optional)



The Auto Recovery Module (ARM) is an optional memory module that is installed between the node and the valve adapter module and is used to preserve the manifold configuration settings even during catastrophic failure. During the power-up process it reads the configuration of the manifold, including any user settable parameters of I/O modules, and stores the information in its non volatile memory. Once the information is stored, it automatically disconnects itself from the power circuits while still mechanically attached to the manifold. Upon power-up it reconnects itself and compares the stored configuration settings to the actual manifold configuration. If these settings are different it gives the user the option of:

1. Updating the manifold setting with the stored values
2. Updating the ARM module with the current settings
3. Continue operation with present configuration without updating ARM

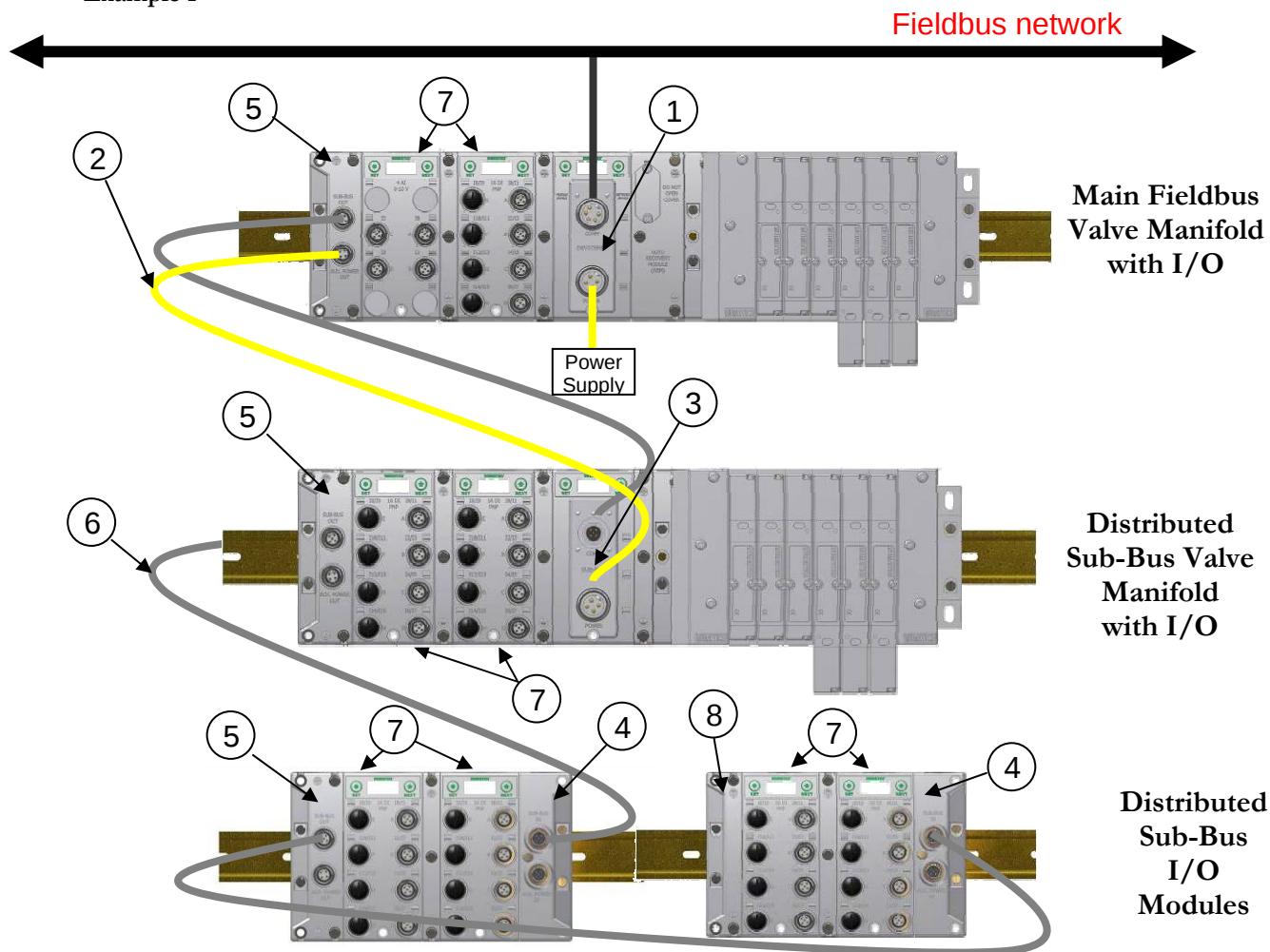
| <i>Description</i>  | <i>Replacement Part Number</i> |
|---------------------|--------------------------------|
| Complete ARM Module | 240-182                        |

# numatics G3 Series Modbus TCP Technical Manual

## Distribution

Distribution of I/O capability can be easily achieved with the G3 platform by means of Sub-Bus modules. I/O modules, valve manifolds and/or a combination of both can be simply separated from the main manifold and distributed via a sub-bus communication cable. The G3 platform uses the same I/O modules on the main manifold as on the distribution chain. The main communication module can control up to 16 I/O modules either on the main manifold or as part of the sub-bus connections. To utilize the sub-bus distribution capabilities the Sub-Bus OUT module must be located on the end of the main communication manifold and a Terminator Module must be located at the last sub-bus component.

Example 1



| Detail No. | Description                                                       |
|------------|-------------------------------------------------------------------|
| 1          | Main Communication Module (Node)                                  |
| 2          | Sub-Bus Power Cable (Can be connected to additional power supply) |
| 3          | Distributed Sub-Bus Valve Module                                  |
| 4          | Sub-Bus IN module                                                 |
| 5          | Sub-Bus OUT module                                                |
| 6          | Sub-Bus Communication Cable                                       |
| 7          | I/O Modules                                                       |
| 8          | Terminator Module                                                 |

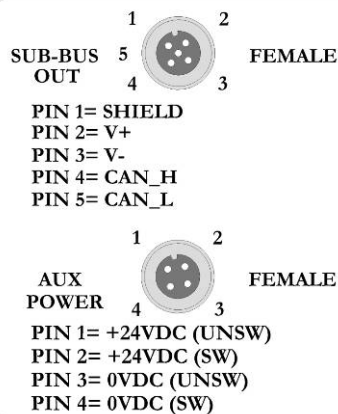
# numatics G3 Series Modbus TCP Technical Manual

## Sub-Bus Distribution Modules

### SUB-BUS OUT Module

- Used only when distributing the Sub-Bus to another assembly is required.
- SUB-BUS OUT - 5 pin M12 female communication connector.
  - Used to distribute the Sub-Bus to the next Sub-Bus assembly.
  - Carries 24 VDC power for electronics of the next module.
- AUX. POWER OUT - 4 pin M12 female aux. power connector.
  - Optional connection.
  - Used as a convenience way to distribute the power connection to the next Sub-Bus assembly.

| Description                                  | Replacement Part Number |
|----------------------------------------------|-------------------------|
| Sub-Bus OUT Module with Din Rail Mounting    | 240-244                 |
| Sub-Bus OUT module without Din Rail Mounting | 240-183                 |

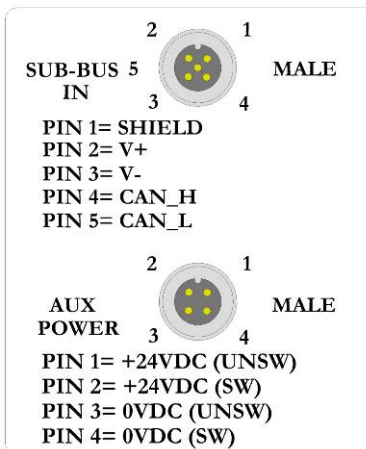
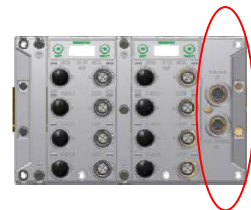


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## SUB-BUS IN Modules

- Used to distribute I/O assemblies that do not have valves
  - Must be installed to the right of the I/O modules.
- SUB-BUS IN - 5 pin M12 male communication connector.
  - Must be connected to the Sub-Bus Out connector of the previous assembly
  - Carries 24 VDC power for electronics of module
- AUX. POWER IN - 4 pin M12 male connector.
  - Aux power is required for Output modules. This connection also allows Output power to be interrupted to all Output modules connected to this module.
  - Aux. Power is optional for Inputs. Power from the SUN-BUS IN connection is used to power sensors but can be augmented, if necessary, by adding additional power to this connector.

| <i>Description</i>                          | <i>Part Number</i> |
|---------------------------------------------|--------------------|
| Sub-Bus IN module with Din Rail Mounting    | 240-246            |
| Sub-Bus IN module without Din Rail Mounting | 240-185            |

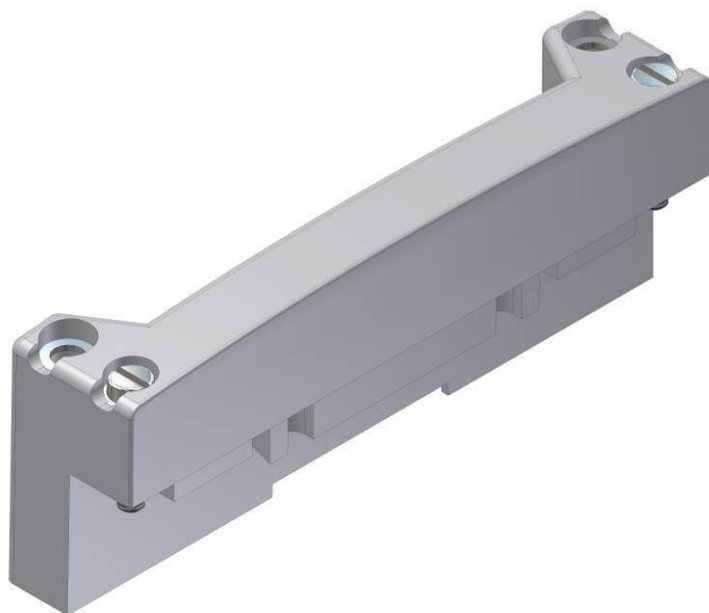


# numatics G3 Series Modbus TCP Technical Manual

## Terminator Module

- Used to terminate SUB-BUS connections.
  - Must be installed on the left side of the last Sub-Bus module.

| <i>Description</i>                          | <i>Part Number</i> |
|---------------------------------------------|--------------------|
| Terminator Module with Din Rail Mounting    | 240-245            |
| Terminator Module without Din Rail Mounting | 240-184            |



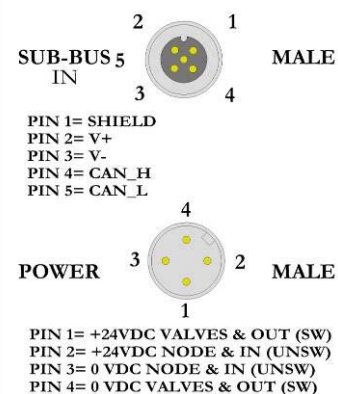
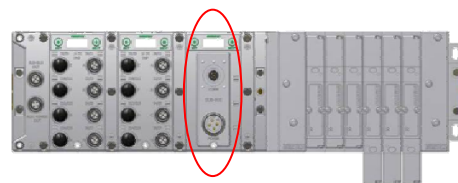
The terminator module is required to be installed in the G3 system for proper operation

# numatics G3 Series Modbus TCP Technical Manual

## Sub-Bus Valve Module

- **COMM** - 5 pin M12 male Sub-Bus input communication connector.
  - Must be connected to the SUB-BUS OUT connector of the previous assembly
  - Carries 24 VDC power for electronics of module
- **POWER** - 4 pin MINI male power connector.
  - Power is required for Outputs
- Used to distribute Valves on the Sub-Bus.
  - Can accepts discrete I/O module to allow a Sub-Bus Valve manifold with I/O

| Description          | Part Number |
|----------------------|-------------|
| Sub-Bus Valve Module | 240-241     |



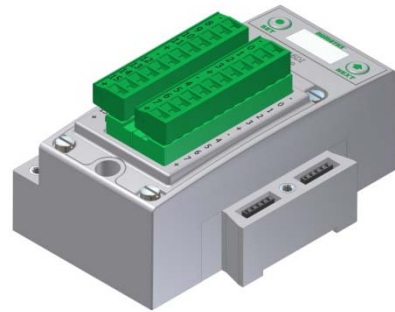
There is a 0.8 VDC drop in power across this module.  
Please consider this when distributing the Aux. Power after this module.

## Digital I/O Module

### Digital I/O Module Rules

The maximum number of modules that can be used on the Discrete I/O side of the manifold is 16. These modules can be centralized on the main fieldbus manifold, distributed or a combination of both. Modules can be connected in any combination of inputs, outputs and specialty up to the physical limitation of 16 modules.

### Input Module Types



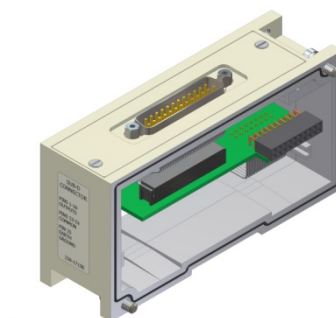
### Output Module Types



### Input/Output Module Types



### Valve Side Output Module Types

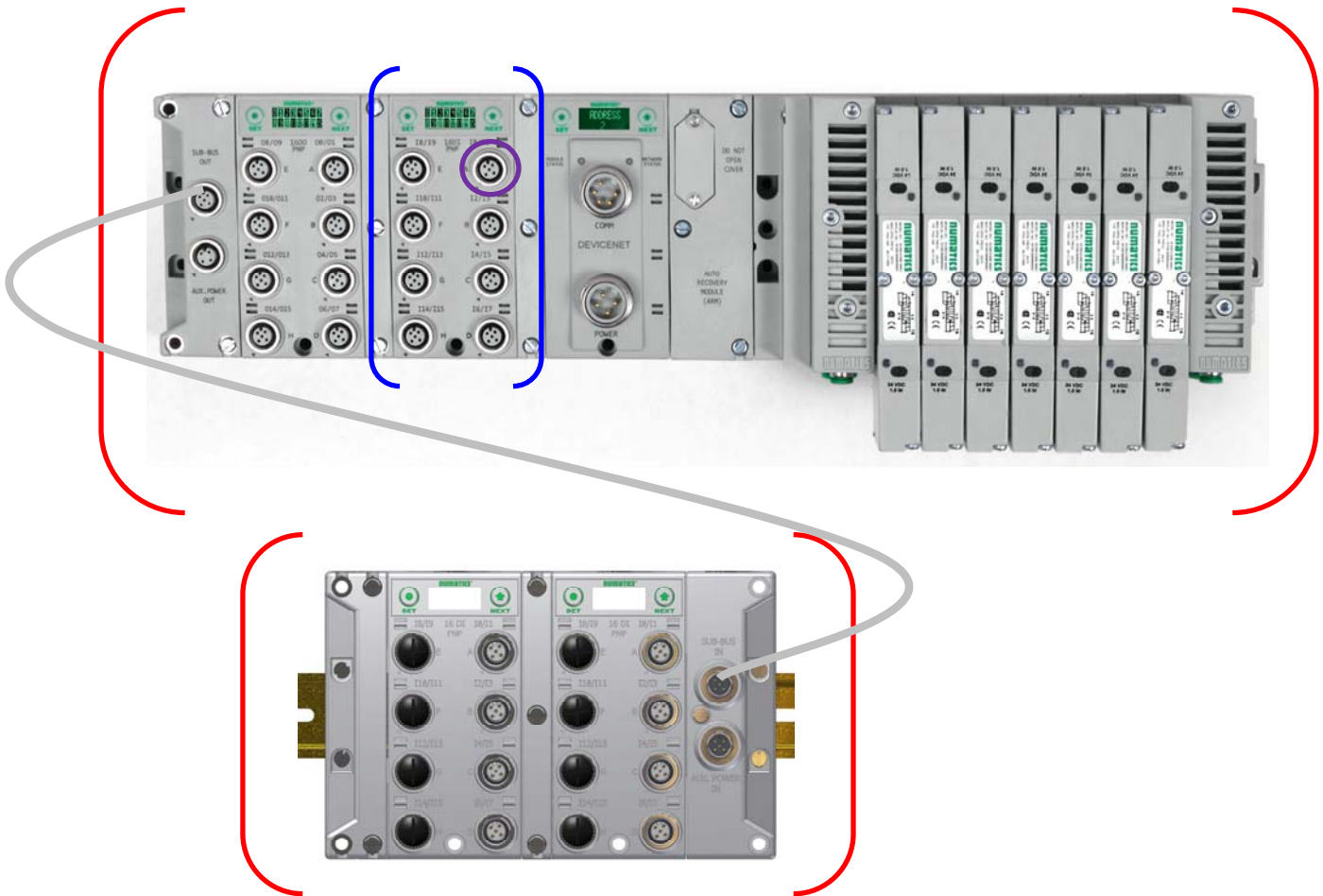


# NUMATICS

# G3 Series Modbus TCP Technical Manual

## I/O Module Technical Data

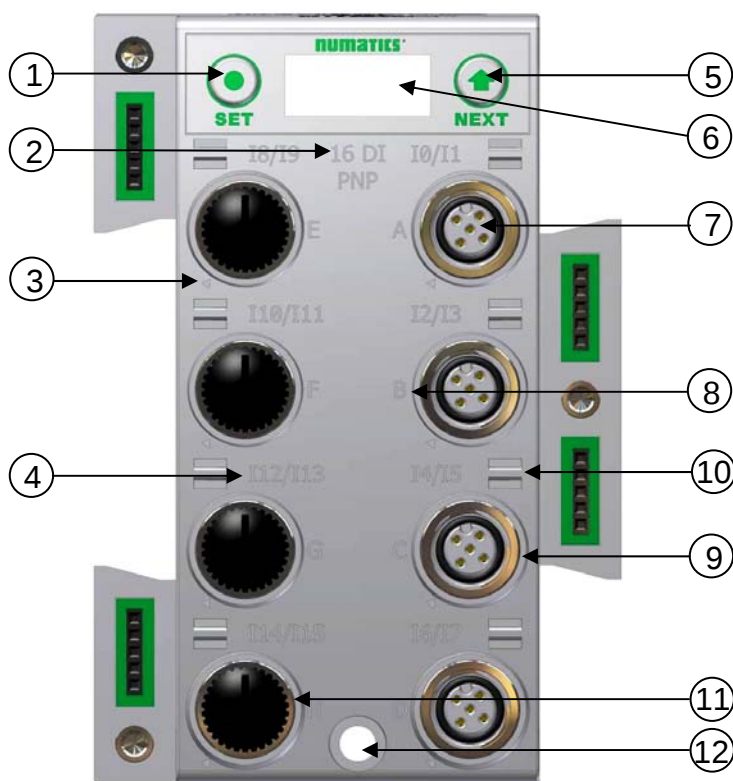
| Module No. | Description                   | Connector Type | Current Limitation for Module | Current Limitation for connector                                                      | Current Limitation for physical manifold assembly                              |
|------------|-------------------------------|----------------|-------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 240-203    | 16 PNP Inputs                 | Terminal Strip | 1.2A                          | .30A for each +24VDC terminal                                                         | <div>4A for +24 Valves and Outputs</div> <div>4A for +24 Node and Inputs</div> |
| 240-204    | 16 NPN Inputs                 | Terminal Strip | 1.2A                          | .30A for each +24VDC terminal                                                         |                                                                                |
| 240-205    | 16 PNP Inputs                 | M12            | 1.2A                          | .15A (Pin 1 to Pin 3)                                                                 |                                                                                |
| 240-206    | 8 PNP Inputs                  | M12            | 1.2A                          | .15A (Pin 1 to Pin 3)                                                                 |                                                                                |
| 240-207    | 16 PNP Outputs                | M12            | 1.2A                          | .50A (Pin 3 to Pin 2/4)                                                               |                                                                                |
| 240-208    | 8 PNP Outputs                 | M12            | 1.2A                          | .50A (Pin 3 to Pin 2/4)                                                               |                                                                                |
| 240-209    | 16 NPN Inputs                 | M12            | 1.2A                          | .15A (Pin 1 to Pin 3)                                                                 |                                                                                |
| 240-210    | 8 NPN Inputs                  | M12            | 1.2A                          | .15A (Pin 1 to Pin 3)                                                                 |                                                                                |
| 240-211    | 8 PNP Input and 8 PNP Outputs | M12            | 1.2A                          | .50A / output connector (Pin 3 to Pin 2/4)<br>.15A / input connector (Pin 1 to Pin 3) |                                                                                |



# numatics® G3 Series Modbus TCP Technical Manual

## I/O Module Descriptions and Menus

| Detail No. | Description                                                            |
|------------|------------------------------------------------------------------------|
| 1          | “Set” Button – used to navigate through user menus and set parameters  |
| 2          | Module Function (I/O Type)                                             |
| 3          | Alignment arrow for SPEEDCON connector                                 |
| 4          | Bit Designation for I/O                                                |
| 5          | “Next” Button – used to navigate through user menus and set parameters |
| 6          | Graphic Display                                                        |
| 7          | 5 Pin M12 female I/O connector                                         |
| 8          | Connector designation                                                  |
| 9          | Metal threads for SPEEDCON connector                                   |
| 10         | Slot for text ID tags                                                  |
| 11         | Dust Cover                                                             |
| 12         | Mounting hole                                                          |



## Menu



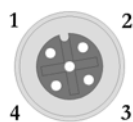
# numatics® G3 Series Modbus TCP Technical Manual

## Digital Input Modules

### One Digital Input per Connector – M12 Female Modules

| Module Part No. | I/O Type       | Short Circuit Protection | Short Circuit Protection Status Bits | Input Points |
|-----------------|----------------|--------------------------|--------------------------------------|--------------|
| 240-206         | NPN (Sinking)  | YES – Visual             | YES – Optional                       | 8            |
| 240-210         | PNP (Sourcing) |                          |                                      |              |

| Input Mapping     |                          |                          |                          |                          |                          |                          |                          |                          |
|-------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| BYTE              | Bit 7                    | Bit 6                    | Bit 5                    | Bit 4                    | Bit 3                    | Bit 2                    | Bit 1                    | Bit 0                    |
| X<br>(Required)   | Input 7                  | Input 6                  | Input 5                  | Input 4                  | Input 3                  | Input 2                  | Input 1                  | Input 0                  |
| X+1<br>(Optional) | Conn. H<br>SCP<br>Status | Conn. G<br>SCP<br>Status | Conn. F<br>SCP<br>Status | Conn. E<br>SCP<br>Status | Conn. D<br>SCP<br>Status | Conn. C<br>SCP<br>Status | Conn. B<br>SCP<br>Status | Conn. A<br>SCP<br>Status |



FEMALE

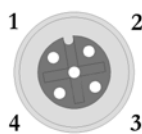
PIN 1= +24VDC (UNSW)  
 PIN 2= NOT USED  
 PIN 3= 0VDC (UNSW)  
 PIN 4= INPUT 1

# numatics® G3 Series Modbus TCP Technical Manual

## Two Digital Inputs per Connector – M12 Female Modules

| Module Part No. | I/O Type       | Short Circuit Protection | Short Circuit Protection Status Bits | Input Points |
|-----------------|----------------|--------------------------|--------------------------------------|--------------|
| 240-209         | NPN (Sinking)  | YES – Visual             | YES – Optional                       | 16           |
| 240-205         | PNP (Sourcing) |                          |                                      |              |

| Input Mapping     |                          |                          |                          |                          |                          |                          |                          |                          |
|-------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| BYTE              | Bit 7                    | Bit 6                    | Bit 5                    | Bit 4                    | Bit 3                    | Bit 2                    | Bit 1                    | Bit 0                    |
| X<br>(Required)   | Input 7                  | Input 6                  | Input 5                  | Input 4                  | Input 3                  | Input 2                  | Input 1                  | Input 0                  |
| X+1<br>(Required) | Input 15                 | Input 14                 | Input 13                 | Input 12                 | Input 11                 | Input 10                 | Input 9                  | Input 8                  |
| X+2<br>(Optional) | Conn. H<br>SCP<br>Status | Conn. G<br>SCP<br>Status | Conn. F<br>SCP<br>Status | Conn. E<br>SCP<br>Status | Conn. D<br>SCP<br>Status | Conn. C<br>SCP<br>Status | Conn. B<br>SCP<br>Status | Conn. A<br>SCP<br>Status |



FEMALE

PIN 1= +24VDC (UNSW)  
PIN 2= INPUT 2  
PIN 3= 0VDC (UNSW)  
PIN 4= INPUT 1

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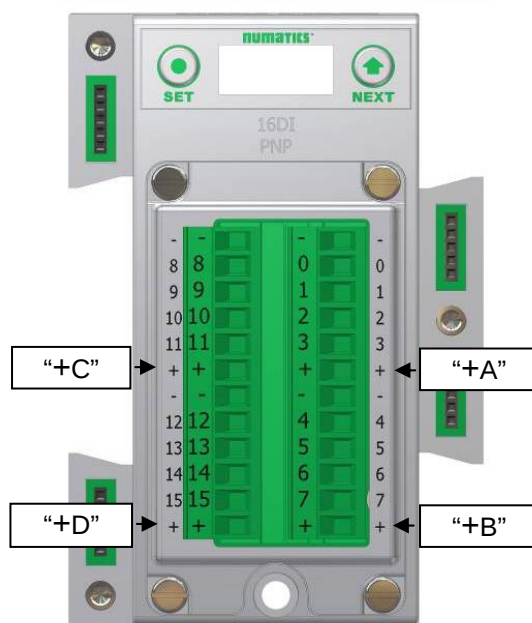
## Sixteen Digital Inputs – Terminal Strip Modules

### Specifications

- Wire Range: 12 to 24 AWG
- Strip Length: 7mm
- Tightening Torque: 0.5 Nm

| Module Part No. | I/O Type       | Short Circuit Protection                 | Short Circuit Protection Status Bits                                                                                 | Input Points |
|-----------------|----------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------|
| 240-203         | PNP (Sourcing) | YES<br>Visual and<br>Logical Status Bits | 4 user enabled bits<br>monitor Short Circuits on<br>the four different +<br>voltage connections of<br>terminal strip | 16           |
| 240-204         | NPN (Sinking)  |                                          |                                                                                                                      |              |

| Input Mapping     |                              |                              |                              |                              |                               |                               |                               |                               |
|-------------------|------------------------------|------------------------------|------------------------------|------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| BYTE              | Bit 7                        | Bit 6                        | Bit 5                        | Bit 4                        | Bit 3                         | Bit 2                         | Bit 1                         | Bit 0                         |
| X<br>(Required)   | Input 7                      | Input 6                      | Input 5                      | Input 4                      | Input 3                       | Input 2                       | Input 1                       | Input 0                       |
| X+1<br>(Required) | Input 15                     | Input 14                     | Input 13                     | Input 12                     | Input 11                      | Input 10                      | Input 9                       | Input 8                       |
| X+2<br>(Optional) | Allocated<br>and<br>Reserved | Allocated<br>and<br>Reserved | Allocated<br>and<br>Reserved | Allocated<br>and<br>Reserved | SCP Status<br>1 = Fault<br>+D | SCP Status<br>1 = Fault<br>+C | SCP Status<br>1 = Fault<br>+B | SCP Status<br>1 = Fault<br>+A |



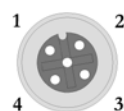
# numatics® G3 Series Modbus TCP Technical Manual

## Digital Output Modules

### One Digital Output per Connector - M12 Female Modules

| Module Part No. | I/O Type       | Short Circuit Protection | Short Circuit Protection Status Bits | Output Points |
|-----------------|----------------|--------------------------|--------------------------------------|---------------|
| 240-208         | PNP (Sourcing) | YES – Visual             | YES (8) – Optional                   | 8             |

| Output Mapping |                 |                 |                 |                 |                 |                 |                 |                 |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| BYTE           | Bit 7           | Bit 6           | Bit 5           | Bit 4           | Bit 3           | Bit 2           | Bit 1           | Bit 0           |
| X (Required)   | Output 7        | Output 6        | Output 5        | Output 4        | Output 3        | Output 2        | Output 1        | Output 0        |
| Input Mapping  |                 |                 |                 |                 |                 |                 |                 |                 |
| BYTE           | Bit 7           | Bit 6           | Bit 5           | Bit 4           | Bit 3           | Bit 2           | Bit 1           | Bit 0           |
| X (Optional)   | Output 7 Status | Output 6 Status | Output 5 Status | Output 4 Status | Output 3 Status | Output 2 Status | Output 1 Status | Output 0 Status |



FEMALE

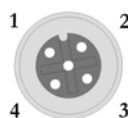
PIN 1= +24VDC (SW)  
PIN 2= NOT USED  
PIN 3= 0VDC (SW)  
PIN 4= OUTPUT 1

# numatics® G3 Series Modbus TCP Technical Manual

## Two Digital Outputs per Connector - M12 Female Modules

| Module Part No. | I/O Type       | Short Circuit Protection | Short Circuit Protection Status Bits | Output Points |
|-----------------|----------------|--------------------------|--------------------------------------|---------------|
| 240-207         | PNP (Sourcing) | YES – Visual             | YES (8) – Optional                   | 16            |

| Output Mapping    |                  |                  |                  |                  |                  |                  |                 |                 |
|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-----------------|
| BYTE              | Bit 7            | Bit 6            | Bit 5            | Bit 4            | Bit 3            | Bit 2            | Bit 1           | Bit 0           |
| X<br>(Required)   | Output 7         | Output 6         | Output 5         | Output 4         | Output 3         | Output 2         | Output 1        | Output 0        |
| X+1<br>(Required) | Output 15        | Output 14        | Output 13        | Output 12        | Output 11        | Output 10        | Output 9        | Output 8        |
| Input Mapping     |                  |                  |                  |                  |                  |                  |                 |                 |
| BYTE              | Bit 7            | Bit 6            | Bit 5            | Bit 4            | Bit 3            | Bit 2            | Bit 1           | Bit 0           |
| X<br>(Optional)   | Output 7 Status  | Output 6 Status  | Output 5 Status  | Output 4 Status  | Output 3 Status  | Output 2 Status  | Output 1 Status | Output 0 Status |
| X+1<br>(Optional) | Output 15 Status | Output 14 Status | Output 13 Status | Output 12 Status | Output 11 Status | Output 10 Status | Output 9 Status | Output 8 Status |



FEMALE

PIN 1= +24VDC (SW)  
PIN 2= OUTPUT 2  
PIN 3= 0VDC (SW)  
PIN 4= OUTPUT 1

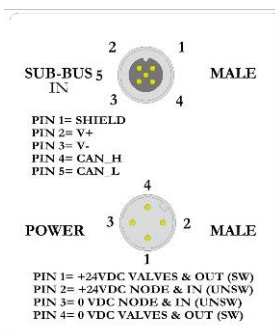
# numatics G3 Series Modbus TCP Technical Manual

## Sub-Bus Valve Module

Used to control a distributed valve manifold through the Sub-Bus. See page 43 for more information.

| Module Part No. | I/O Type      | Short Circuit Protection | Short Circuit Protection Status Bits | Output Points |
|-----------------|---------------|--------------------------|--------------------------------------|---------------|
| 240-241         | NPN (Sinking) | YES – Visual             | YES (32) – Optional                  | 32            |

| Output Mapping |                   |                   |                   |                   |                   |                   |                   |                   |
|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| BYTE           | Bit 7             | Bit 6             | Bit 5             | Bit 4             | Bit 3             | Bit 2             | Bit 1             | Bit 0             |
| X (Required)   | Valve Coil No. 7  | Valve Coil No. 6  | Valve Coil No. 5  | Valve Coil No. 4  | Valve Coil No. 3  | Valve Coil No. 2  | Valve Coil No. 1  | Valve Coil No. 0  |
| X+1 (Optional) | Valve Coil No. 15 | Valve Coil No. 14 | Valve Coil No. 13 | Valve Coil No. 12 | Valve Coil No. 11 | Valve Coil No. 10 | Valve Coil No. 9  | Valve Coil No. 8  |
| X+2 (Optional) | Valve Coil No. 23 | Valve Coil No. 22 | Valve Coil No. 21 | Valve Coil No. 20 | Valve Coil No. 19 | Valve Coil No. 18 | Valve Coil No. 17 | Valve Coil No. 16 |
| X+3 (Optional) | Valve Coil No. 31 | Valve Coil No. 30 | Valve Coil No. 29 | Valve Coil No. 28 | Valve Coil No. 27 | Valve Coil No. 26 | Valve Coil No. 25 | Valve Coil No. 24 |
| Input Mapping  |                   |                   |                   |                   |                   |                   |                   |                   |
| BYTE           | Bit 7             | Bit 6             | Bit 5             | Bit 4             | Bit 3             | Bit 2             | Bit 1             | Bit 0             |
| X (Optional)   | Coil 7 Status     | Coil 6 Status     | Coil 5 Status     | Coil 4 Status     | Coil 3 Status     | Coil 2 Status     | Coil 1 Status     | Coil 0 Status     |
| X+1 (Optional) | Coil 15 Status    | Coil 14 Status    | Coil 13 Status    | Coil 12 Status    | Coil 11 Status    | Coil 10 Status    | Coil 9 Status     | Coil 8 Status     |
| X+2 (Optional) | Coil 23 Status    | Coil 22 Status    | Coil 21 Status    | Coil 20 Status    | Coil 19 Status    | Coil 18 Status    | Coil 17 Status    | Coil 16 Status    |
| X+3 (Optional) | Coil 31 Status    | Coil 30 Status    | Coil 29 Status    | Coil 28 Status    | Coil 27 Status    | Coil 26 Status    | Coil 25 Status    | Coil 24 Status    |



# numatics® G3 Series Modbus TCP Technical Manual

## Digital Input/Output Modules

### Two Digital I/O per Connector - 12mm Female Modules

| Module Part No. | I/O Type       | Short Circuit Protection | Short Circuit Protection Status Bits | Output Points | Input Points |
|-----------------|----------------|--------------------------|--------------------------------------|---------------|--------------|
| 240-211         | PNP (Sourcing) | YES – Visual             | YES (8) – Optional                   | 8             | 8            |

| Output Mapping    |                        |                        |                        |                        |                     |                     |                     |                     |
|-------------------|------------------------|------------------------|------------------------|------------------------|---------------------|---------------------|---------------------|---------------------|
| BYTE              | Bit 7                  | Bit 6                  | Bit 5                  | Bit 4                  | Bit 3               | Bit 2               | Bit 1               | Bit 0               |
| X<br>(Required)   | Output 7               | Output 6               | Output 5               | Output 4               | Output 3            | Output 2            | Output 1            | Output 0            |
| Input Mapping     |                        |                        |                        |                        |                     |                     |                     |                     |
| BYTE              | Bit 7                  | Bit 6                  | Bit 5                  | Bit 4                  | Bit 3               | Bit 2               | Bit 1               | Bit 0               |
| X<br>(Required)   | Input 7                | Input 6                | Input 5                | Input 4                | Input 3             | Input 2             | Input 1             | Input 0             |
| X+1<br>(Optional) | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Conn. D SCP Status  | Conn. C SCP Status  | Conn. B SCP Status  | Conn. A SCP Status  |
| X+2<br>(Optional) | Output 7 Status Bit    | Output 6 Status Bit    | Output 5 Status Bit    | Output 4 Status Bit    | Output 3 Status Bit | Output 2 Status Bit | Output 1 Status Bit | Output 0 Status Bit |



FEMALE

|                         |                         |
|-------------------------|-------------------------|
| CONNECTORS E, F, G, & H | CONNECTORS A, B, C, & D |
| PIN 1= +24VDC (SW)      | PIN 1= +24VDC (UNSW)    |
| PIN 2= OUTPUT 2         | PIN 2= INPUT 2          |
| PIN 3= 0VDC (SW)        | PIN 3= 0VDC (UNSW)      |
| PIN 4= OUTPUT 1         | PIN 4= INPUT 1          |

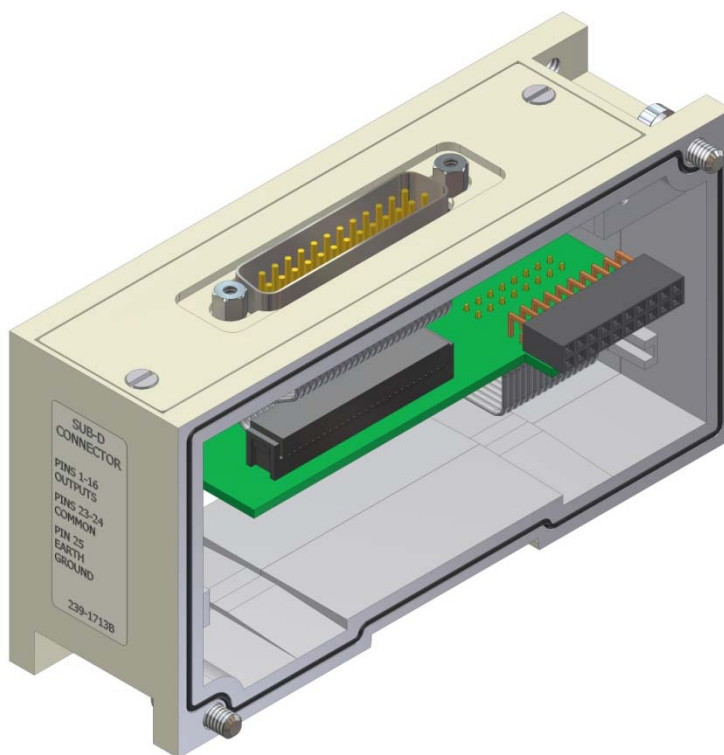
# numatics® G3 Series Modbus TCP Technical Manual

## Valve Side Digital Output Modules

The valve side output module is used to distribute available valve side output points (i.e. when valves are located away from the rest of the electronics). These modules go to the right of the G3 valve adapter. The 16 bit output module utilizes the last 16 output bits on the valve side of the manifold (bits 16-31).

### Sixteen Outputs per Connector - Sub-D 25 Pin Female Module

| <i>Module Part No.</i> | <i>I/O Type</i> | <i>Short Circuit Protection</i> | <i>Internal Status Bits</i> | <i>Output Points</i> | <i>Module Size</i> |
|------------------------|-----------------|---------------------------------|-----------------------------|----------------------|--------------------|
| 239-1713               | NPN (Sinking)   | Yes                             | 16 – Optional               | 16                   | Narrow             |



## Analog I/O Modules

### Analog I/O Module Rules

The analog I/O modules follow the same rules as the digital I/O modules. The maximum total number of modules on the Sub-Bus is 16. The analog boards allow the user to control devices using an analog signal. The analog modules also allow the user to relay analog information from input devices. These modules are available in two analog signal types: 0-10 V and 4-20 mA. These two signal types are offered in two different I/O configurations: 2 analog input channels/ 2 analog outputs channels and 4 analog input channels.

### Four I/O - 12mm Female Modules

#### Specifications

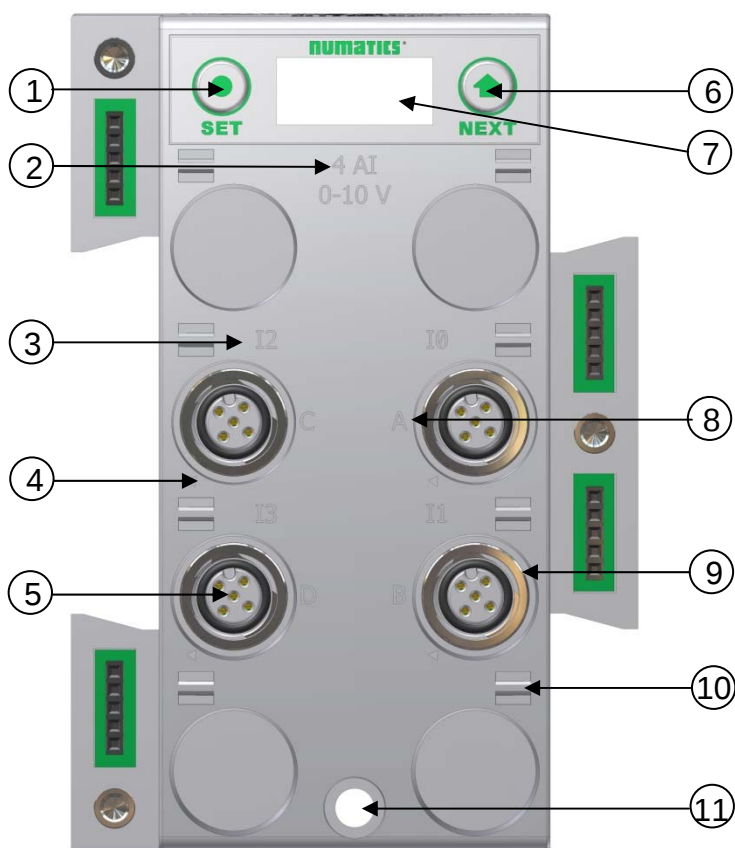
- Input Resolution: 16 bit (65,536 Counts),
- Output Resolution: 16 bit (65,536 Counts)
- Settling Time: 3 ms Max
- Absolute Precision:  $\leq 1.0\%$  of Signal
- Voltage Input Impedance: 0-10VDC – 40K Ohms
- Current Input Impedance: 250 Ohms
- Input Cutoff Frequency: 100 Hz

| <i>Module Part No.</i> | <i>Signal Type</i> | <i>Input Points</i> | <i>Output Points</i> | <i>Short Circuit Protection</i> |
|------------------------|--------------------|---------------------|----------------------|---------------------------------|
| 240-212                | 0 - 10V            | 4                   | 0                    | Yes                             |
| 240-213                | 0 - 10V            | 2                   | 2                    |                                 |
| 240-214                | 4 - 20mA           | 4                   | 0                    |                                 |
| 240-215                | 4 - 20mA           | 2                   | 2                    |                                 |

# numatics® G3 Series Modbus TCP Technical Manual

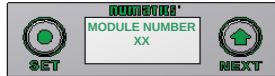
## Analog Module Descriptions and Menus

| Detail No. | Description                                                            |
|------------|------------------------------------------------------------------------|
| 1          | “Set” Button – used to navigate through user menus and set parameters  |
| 2          | Module Function (I/O Type)                                             |
| 3          | Bit Designation for I/O                                                |
| 4          | Alignment arrow for SPEEDCON connector                                 |
| 5          | 5 Pin M12 female I/O connector                                         |
| 6          | “Next” Button – used to navigate through user menus and set parameters |
| 7          | Graphic Display                                                        |
| 8          | Connector designation                                                  |
| 9          | Metal threads for SPEEDCON connector                                   |
| 10         | Slot for text ID tags                                                  |
| 11         | Mounting hole                                                          |



# numatics® G3 Series Modbus TCP Technical Manual

## Analog Graphic Display Menu

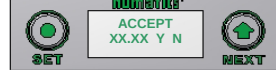


4. Analog Bar Graph
  - a. 2 separate screens, each with 2 I/O points
5. Input mapping designations
  - a. Byte allocations for inputs.
6. Input mapping designations
  - a. Byte allocations for outputs (2I/2O modules only)
7. Module Number
  - a. Details the Sub-Bus module number (1-16)
8. Alarm Settings
  - a. See page 58 for more information
9. Description
  - a. Describes the number and type of inputs and outputs
10. Part number
  - a. Displays replacement part number of module
11. Firmware Rev.
  - a. For service personnel
12. Set Brightness Level
  - a. Changes brightness level of display between low, medium and high.
13. Self Test mode
  - a. Allows the ability to test the Analog output points on the module.

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## Analog Alarm Settings Graphic Display Menu

### Alarm Setting Steps



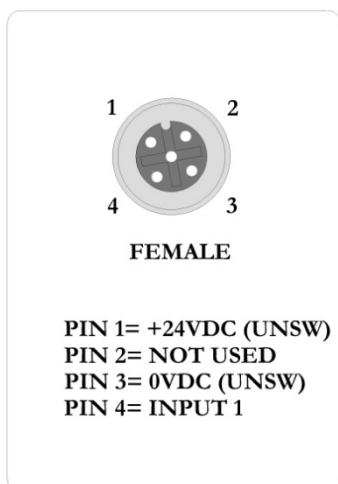
5. Press the SET button to enter the Alarm Settings sub-menu.
6. Press the NEXT button to scroll through the different analog channels
  - a. Press SET to confirm your choice
7. Press the NEXT button to choose between low and high alarms
  - e. Pressing SET will allow you to change the value of the alarm
  - f. Pressing NEXT will change the value of the digit highlighted
  - g. Pressing SET will accept the value highlighted
8. Press the NEXT button to select either Yes or No to accept the value.

# numatics G3 Series Modbus TCP Technical Manual

## One Analog Input per Connector – M12 Female Modules

| Module Part No. | Signal Type | Short Circuit Protection | Short Circuit Protection Status Bits | Input Points |
|-----------------|-------------|--------------------------|--------------------------------------|--------------|
| 240-212         | 0-10 VDC    | YES – Visual             | YES (4) – Optional                   | 4            |
| 240-214         | 4-20 mA     |                          |                                      |              |

| Input Mapping     |                        |                        |                        |                        |                          |                          |                          |                          |
|-------------------|------------------------|------------------------|------------------------|------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| BYTE              | Bit 7                  | Bit 6                  | Bit 5                  | Bit 4                  | Bit 3                    | Bit 2                    | Bit 1                    | Bit 0                    |
| X<br>(Required)   | Input No. 1            | Input No. 1            | Input No. 1            | Input No. 1            | Input No. 1              | Input No. 1              | Input No. 1              | Input No. 1 (LSB)        |
| X+1<br>(Required) | Input No. 1 (MSB)      | Input No. 1            | Input No. 1            | Input No. 1            | Input No. 1              | Input No. 1              | Input No. 1              | Input No. 1              |
| X+2<br>(Required) | Input No. 2            | Input No. 2            | Input No. 2            | Input No. 2            | Input No. 2              | Input No. 2              | Input No. 2              | Input No. 2 (LSB)        |
| X+3<br>(Required) | Input No. 2 (MSB)      | Input No. 2            | Input No. 2            | Input No. 2            | Input No. 2              | Input No. 2              | Input No. 2              | Input No. 2              |
| X+4<br>(Required) | Input No. 3            | Input No. 3            | Input No. 3            | Input No. 3            | Input No. 3              | Input No. 3              | Input No. 3              | Input No. 3 (LSB)        |
| X+5<br>(Required) | Input No. 3 (MSB)      | Input No. 3            | Input No. 3            | Input No. 3            | Input No. 3              | Input No. 3              | Input No. 3              | Input No. 3              |
| X+6<br>(Required) | Input No. 4            | Input No. 4            | Input No. 4            | Input No. 4            | Input No. 4              | Input No. 4              | Input No. 4              | Input No. 4 (LSB)        |
| X+7<br>(Required) | Input No. 4 (MSB)      | Input No. 4            | Input No. 4            | Input No. 4            | Input No. 4              | Input No. 4              | Input No. 4              | Input No. 4              |
| X+8<br>(Optional) | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Power Status for Conn. D | Power Status for Conn. C | Power Status for Conn. B | Power Status for Conn. A |
| X+9<br>(Optional) | High Alarm for Conn. D | Low Alarm for Conn. D  | High Alarm for Conn. C | Low Alarm for Conn. C  | High Alarm for Conn. B   | Low Alarm for Conn. B    | High Alarm for Conn. A   | Low Alarm for Conn. A    |

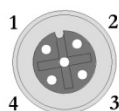


# numatics G3 Series Modbus TCP Technical Manual

## One Analog I/O per Connector – M12 Female Modules

| Module Part No. | Signal Type | Short Circuit Protection | Short Circuit Protection Status Bits | Output Points | Input Points |
|-----------------|-------------|--------------------------|--------------------------------------|---------------|--------------|
| 240-213         | 0-10 VDC    | YES – Visual             | YES (4) – Optional                   | 2             | 2            |
| 240-215         | 4-20 mA     |                          |                                      |               |              |

| Output Mapping    |                        |                        |                        |                        |                          |                          |                          |                          |
|-------------------|------------------------|------------------------|------------------------|------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| BYTE              | Bit 7                  | Bit 6                  | Bit 5                  | Bit 4                  | Bit 3                    | Bit 2                    | Bit 1                    | Bit 0                    |
| X<br>(Required)   | Output No. 1           | Output No. 1           | Output No. 1           | Output No. 1           | Output No. 1             | Output No. 1             | Output No. 1             | Output No. 1 (LSB)       |
| X+1<br>(Required) | Output No. 1 (MSB)     | Output No. 1           | Output No. 1           | Output No. 1           | Output No. 1             | Output No. 1             | Output No. 1             | Output No. 1             |
| X+2<br>(Required) | Output No. 2           | Output No. 2           | Output No. 2           | Output No. 2           | Output No. 2             | Output No. 2             | Output No. 2             | Output No. 2 (LSB)       |
| X+3<br>(Required) | Output No. 2 (MSB)     | Output No. 2           | Output No. 2           | Output No. 2           | Output No. 2             | Output No. 2             | Output No. 2             | Output No. 2             |
| Input Mapping     |                        |                        |                        |                        |                          |                          |                          |                          |
| BYTE              | Bit 7                  | Bit 6                  | Bit 5                  | Bit 4                  | Bit 3                    | Bit 2                    | Bit 1                    | Bit 0                    |
| X<br>(Required)   | Input No. 1            | Input No. 1            | Input No. 1            | Input No. 1            | Input No. 1              | Input No. 1              | Input No. 1              | Input No. 1 (LSB)        |
| X+1<br>(Required) | Input No. 1 (MSB)      | Input No. 1            | Input No. 1            | Input No. 1            | Input No. 1              | Input No. 1              | Input No. 1              | Input No. 1              |
| X+2<br>(Required) | Input No. 2            | Input No. 2            | Input No. 2            | Input No. 2            | Input No. 2              | Input No. 2              | Input No. 2              | Input No. 2 (LSB)        |
| X+3<br>(Required) | Input No. 2 (MSB)      | Input No. 2            | Input No. 2            | Input No. 2            | Input No. 2              | Input No. 2              | Input No. 2              | Input No. 2              |
| X+8<br>(Optional) | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Power Status for Conn. D | Power Status for Conn. C | Power Status for Conn. B | Power Status for Conn. A |
| X+9<br>(Optional) | High Alarm for Conn. D | Low Alarm for Conn. D  | High Alarm for Conn. C | Low Alarm for Conn. C  | High Alarm for Conn. B   | Low Alarm for Conn. B    | High Alarm for Conn. A   | Low Alarm for Conn. A    |



FEMALE

### CONNECTORS C & D

PIN 1= +24VDC (UNSW)  
PIN 2= OUTPUT  
PIN 3= 0VDC (UNSW)  
PIN 4= INPUT

### CONNECTORS A & B

PIN 1= +24VDC (UNSW)  
PIN 2= NOT USED  
PIN 3= 0VDC (UNSW)  
PIN 4= INPUT

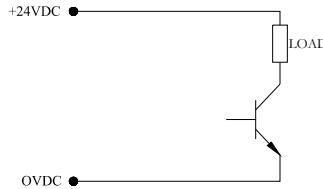


## I/O Module(s) Wiring Diagrams

### NPN/PNP Definitions

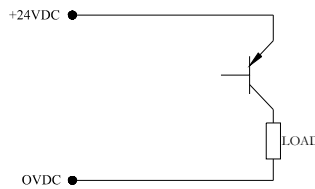
#### NPN Descriptions

- Sinking
- Switching Negative
- Positive Common



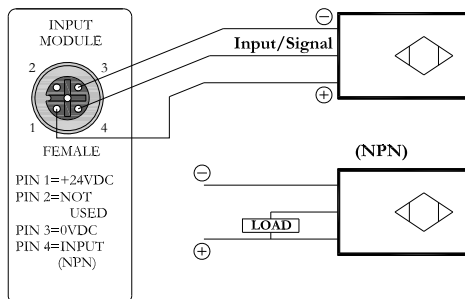
#### PNP Descriptions

- Sourcing
- Switching Positive
- Negative Common

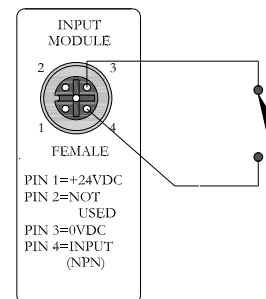


### NPN (Sinking) Input Connection

#### Electric Sensor Type

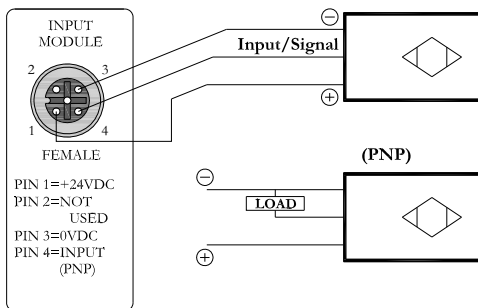


#### Mechanical Sensor Type

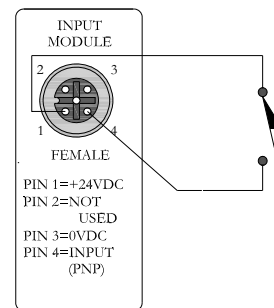


### PNP (Sourcing) Input Connection

#### Electric Sensor Type



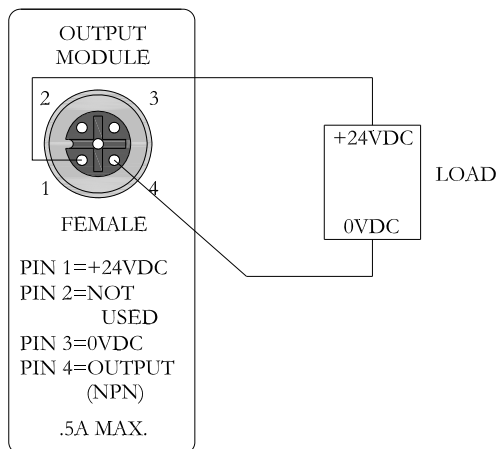
#### Mechanical Sensor Type



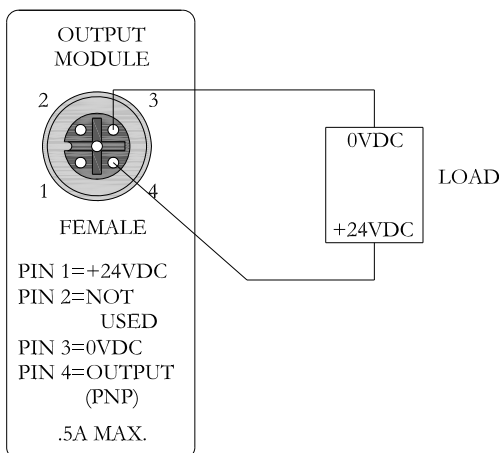
# numatics G3 Series Modbus TCP Technical Manual

## I/O Module(s) Wiring Diagrams Continued

### NPN (Sinking) Output Connection



### PNP (Sourcing) Output Connection

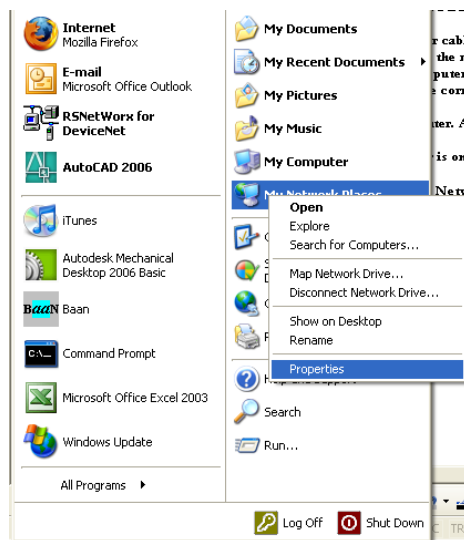


## Modbus TCP Configuration and Mapping

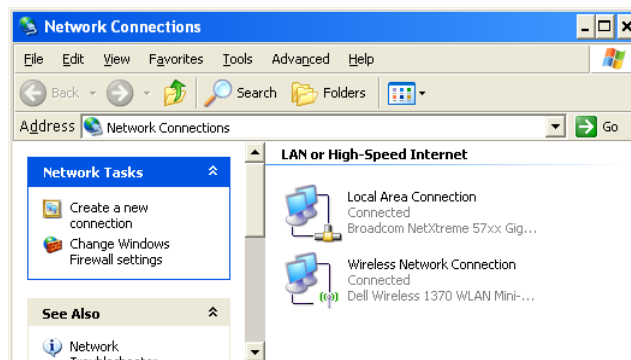
### Connecting to a G3 Series Modbus TCP Node

This section will discuss how to connect a computer to a G3 Series Modbus TCP node. There are multiple ways to complete this task, so only two will be discussed. All computer commands are shown in Windows XP.

1. Connect a 24VDC power supply to the valve manifold. The power pin-out can be found on the side of the Modbus TCP node or on page 12 of this document. (Note: 24VDC only needs to be applied to the “+24VDC (NODE & INPUTS)” pin to power the node.)
2. Connect a crossover cable directly from the manifold to the computer -OR- Connect a straight-through cable from the manifold to a router, hub, or switch. Next, connect a straight-through cable from the computer to the router, hub, or switch. (Network lights should appear on the router, hub, or switch if the correct cables are used).
3. Turn on the computer. Also, make sure the manifold and the router, hub, or switch has power.
4. To communicate with an Modbus TCP manifold the IP address of your computer must be known. To start this process, left click on the “Start” button.
5. Right click on “My Network Places” and then scroll down to “Properties”. Left click on “Properties”.

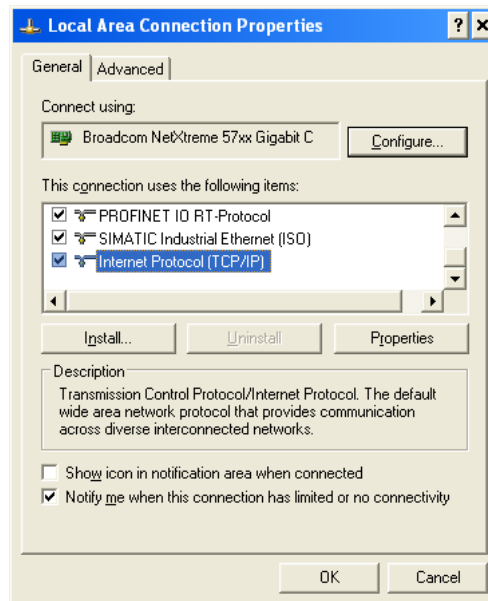


6. The “Network Connections” window will open. Right click on “Local Area Connection”.

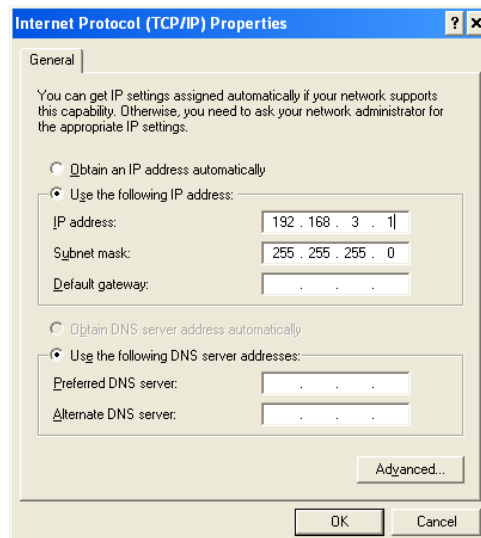


# numatics G3 Series Modbus TCP Technical Manual

7. The “Local Area Connection Properties” window will now open. Scroll down in the box labeled, “This connection uses the following items”. Locate the “Internet Protocol (TCP/IP)” option and highlight it.



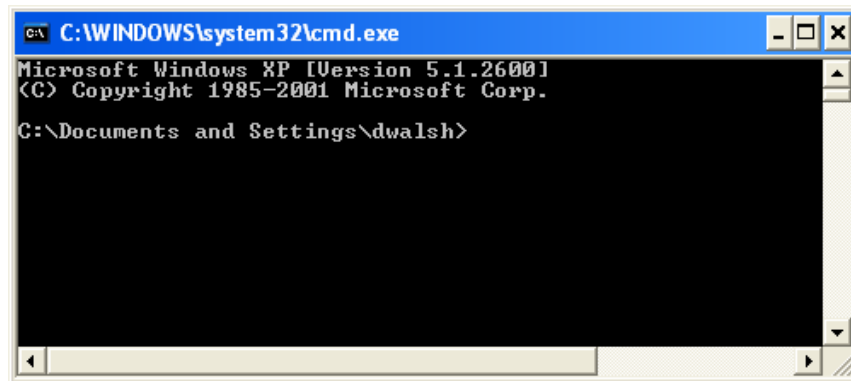
8. Left click on the “Properties” button. The “Internet Protocol (TCP/IP) Properties” window will open. Choose the option marked “Use the following IP address” and type in an IP address that has the same first three octets as the address that you will set the manifold to. For the last octet you may choose any number from 0-255, just make sure that it is not the same number as the IP address that the manifold will have. Make sure your subnet mask is set to “255.255.255.0” (this value can be changed, but this value will be used for demonstration purposes).



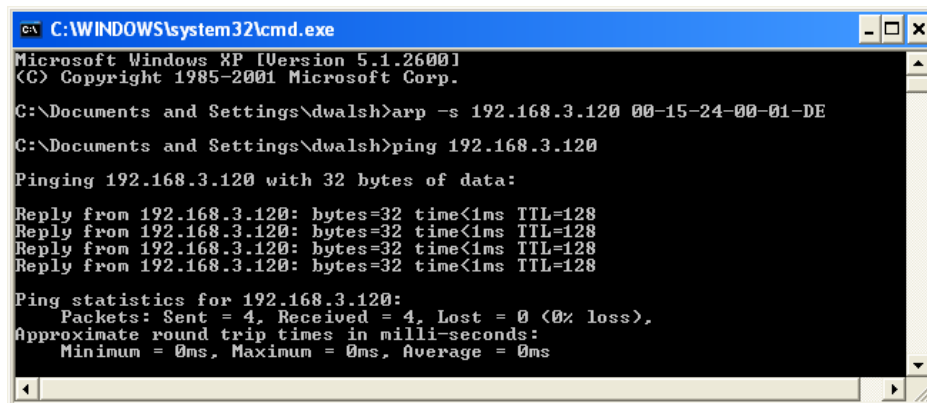
9. Left click “OK” in the “Internet Protocol (TCP/IP) Properties” and “Local Area Connection” windows for the changes to take effect on the computer. Close out of any open windows.

# numatics G3 Series Modbus TCP Technical Manual

10. Once the IP address for the computer is known, you can set the IP address of the Numatics manifold using one of the methods described on page 73 .
11. Left click on “Run”. This will open up the “Run” window.
12. Type “cmd” on the command line and left click “OK”. The command prompt will open.

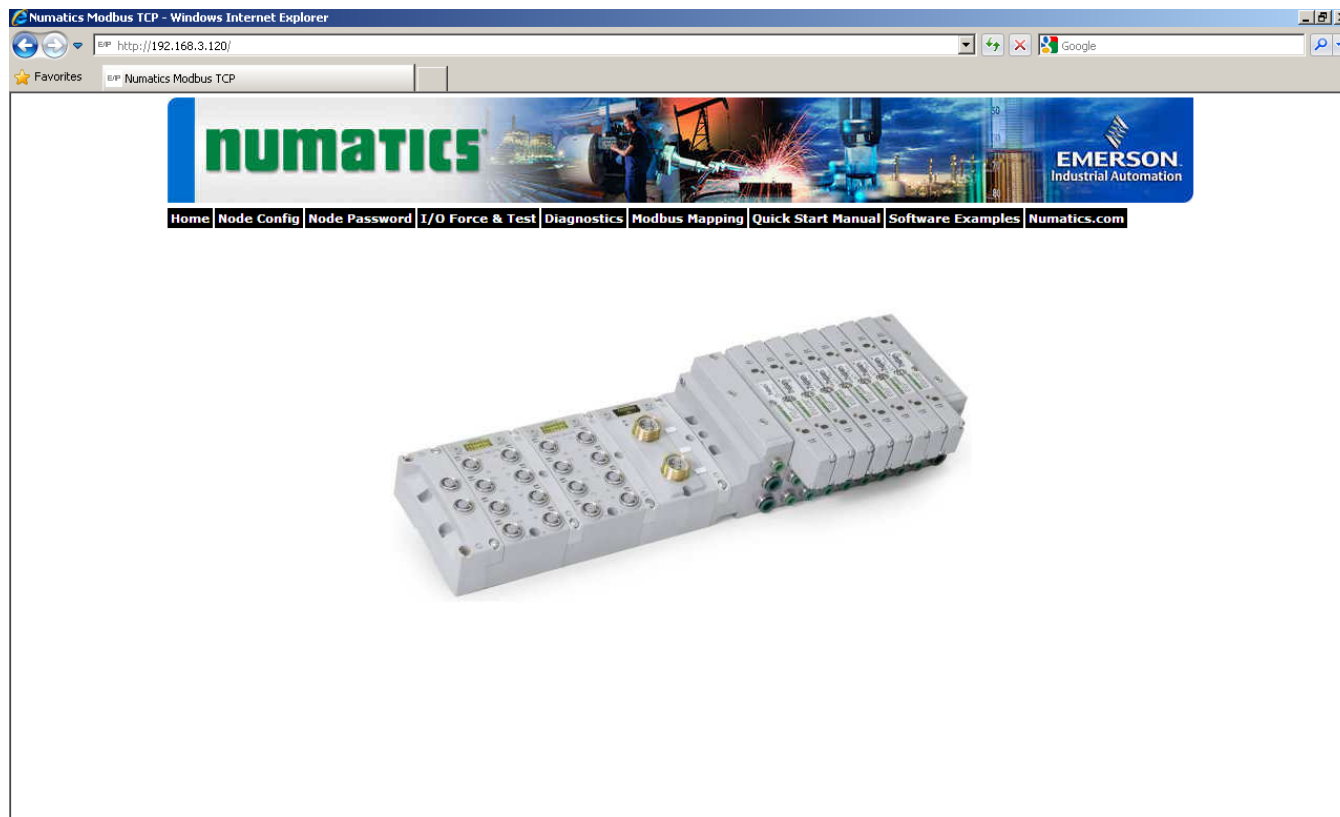


13. Type, “Ping, and then the IP address that the manifold is set to, you can view the address on the graphical display. For example, if the IP address is 192.168.3.120, “ping 192.168.3.120” would be typed. You will get a message stating, “Reply from 192.168.3.120: bytes=32 time<1ms TTL=128”, if the manifold responds.



# numatics® G3 Series Modbus TCP Technical Manual

14. Open a web browser on the computer and type in the IP address of the manifold.  
Ex. <http://192.168.3.120>



15. You have successfully connected a computer to a Numatics Modbus TCP manifold.

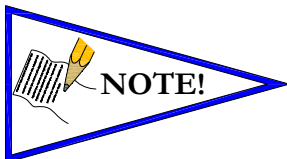
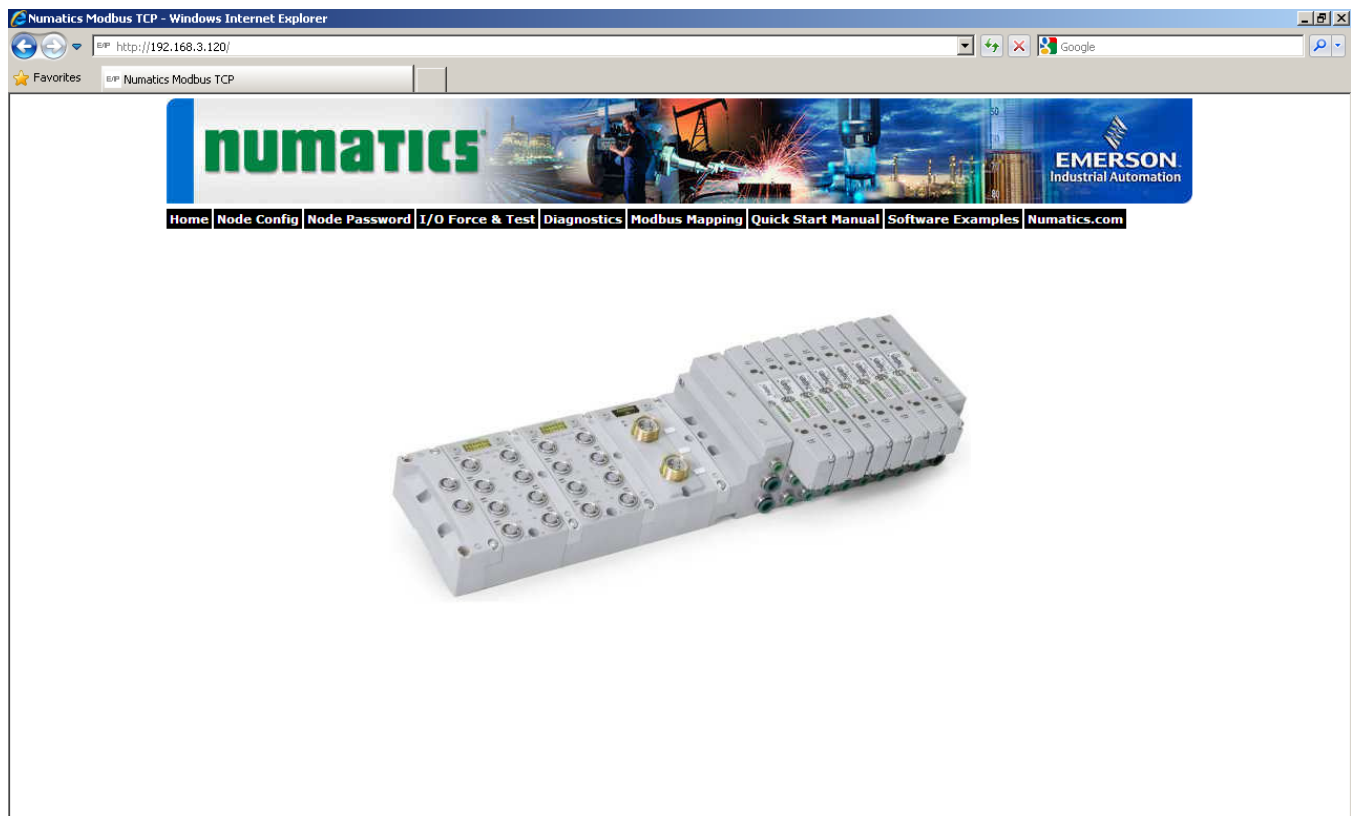
# numatics® G3 Series Modbus TCP Technical Manual

## Using the Functionality of the G3 Series Modbus TCP Web Server

This section will discuss the functionality of the built in Ethernet server. Every Numatics Modbus TCP has this feature. Through this server you can configure the node, force I/O, check diagnostics, etc. Each Numatics' web page will be explained.

### Home

To get to the Numatics "Home" page, open a web browser. In the URL line, type in the IP address of the manifold and press "Enter". The Numatics "Home" page will appear. This page shows a picture of the Numatics Modbus TCP manifold. From this page, the user can navigate the entire built-in web server.



- *The 1<sup>st</sup> three octets of the IP address of the computer **MUST** match the IP address of the node.*

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## Node Configuration

The “Node Configuration” window can be used to control different parameters within the manifold. These parameters include, “IP Address”, “Subnet Mask”, “Gateway Address”, “SMTP Server”, “DHCP/BOOTP enabled”, “MAC Address”, and “COMM Fault/Idle Mode”. “DHCP/BOOTP enabled” is controlled by a single check mark box. “COMM Fault/Idle Mode” has two options that can be chosen: “Hold last Output State” and “Turn OFF All Outputs”.

| Node Configuration      |                                                                                                       |
|-------------------------|-------------------------------------------------------------------------------------------------------|
| IP Address:             | 192.168.3.120                                                                                         |
| Subnet Mask:            | 255.255.255.0                                                                                         |
| DHCP/BOOTP Enabled:     | <input type="checkbox"/>                                                                              |
| MAC Address:            | 00-15-24-00-0A-53                                                                                     |
| Link Type:              | 100Mbps/Full Duplex                                                                                   |
| COMM Fault / Idle Mode: | <input type="radio"/> Hold Last Output State<br><input checked="" type="radio"/> Turn OFF All Outputs |

Update Configuration

Once the changes have been made, left click on the “Update Configuration” button. The “Configuration Successfully Updated” window will appear. The Modbus TCP™ node will reset in a few seconds, or the user may cycle power to enable the new configuration.



### Configuration Successfully Updated

This EtherNet node will reset in a few seconds,  
or you may cycle power to enable the new configuration.

Note: If you have altered the IP Address or subnet settings,  
be sure to adjust your browser/computer settings accordingly

# numatics G3 Series Modbus TCP Technical Manual

## Password

The “Password” window allows the user to set a password that will prevent unwanted access to the I/O Force and Test functionality. The password comes disabled from the factory. To set the initial password, leave the “Enter Current Password” field blank and type in the new password in the “Enter New Password” field.



| Change Password                                  |                      |
|--------------------------------------------------|----------------------|
| Enter Current Password:<br>(up to 20 characters) | <input type="text"/> |
| Enter New Password:<br>(up to 20 characters)     | <input type="text"/> |
| Repeat New Password:                             | <input type="text"/> |

This page allows password protection of the I/O Force & Test page. To disable password protection, leave the "Enter New password" box empty. If you have forgotten a previously set password please contact Numatics Technical support.

Once a Password has been set, the security check screen will appear when accessing the I/O force and test page



| Security Check |                      |
|----------------|----------------------|
| Password:      | <input type="text"/> |



- If the password has been lost or forgotten, go through the process of changing the password. Enter the last 6 digits of the MAC Address in the current password field and then enter the desired password in the new password field.*

# numatics® G3 Series Modbus TCP Technical Manual

## I/O Force and Test

The “I/O Force and Test” window allows the user to test the outputs and inputs of the manifold. A Safety Warning will appear telling the user to shut off the air supply to the valve manifold. Once the air is shut off, left click on “Accept”.



**\* SAFETY WARNING \***

Shut Off Air Supply To Manifold & Machinery BEFORE Operating Valves! Serious Personal Injury & Death Can Result From Moving Parts!

Numatics Incorporated is NOT responsible for injuries or equipment damage, as a result of manually operating valves and machinery using this interface. By clicking the accept button below, you acknowledge you have read and understand this warning, and you assume all responsibility and liability for the use of this application and any consequences.

The “Force Outputs and View Inputs” window will open. This window lets the user turn on outputs and monitor the status of inputs that are connected to the manifold. Use the drop box to choose which I/O word to control/monitor. Output forces can be applied using either the check boxes or “Output Byte Decimal Value”. Left click on “Send I/O data” to force the outputs on/monitor the inputs.

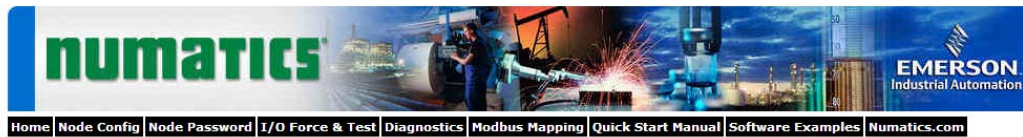


| Force Output and View Inputs |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Select I/O Word: 0           | I/O Byte: 0              |                          |                          |                          |                          |                          |                          | I/O Byte: 1              |                          |                          |                          |                          |                          |                          |                          |                          |
| Bit:                         | 0                        | 1                        | 2                        | 3                        | 4                        | 5                        | 6                        | 7                        | 0                        | 1                        | 2                        | 3                        | 4                        | 5                        | 6                        | 7                        |
| Output Data:                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Input Data:                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Output Byte Decimal Value:   | 0                        |                          |                          |                          |                          |                          |                          | 0                        |                          |                          |                          |                          |                          |                          |                          |                          |

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## Diagnostics

The “Diagnostics” window allows the user to monitor different values. These values include, “MAC Address”, “Serial Number”, “Firmware Revision”, and “Valve Diagnostic Table”. The “Valve Diagnostic Table” enables the user to check the status of the valve side outputs.



|                    |                     |
|--------------------|---------------------|
| IP Address:        | 192.168.3.120       |
| Subnet Mask:       | 255.255.255.0       |
| DHCP/BOOTP:        | Disabled            |
| MAC Address:       | 00-15-24-00-0A-53   |
| Link Type:         | 100Mbps/Full Duplex |
| Serial Number:     | 24000A53            |
| Firmware Revision: | 2.1 - 40112         |

| Valve Diagnostics Table |        |        |        |        |        |        |        |
|-------------------------|--------|--------|--------|--------|--------|--------|--------|
| Bit 0                   | Bit 1  | Bit 2  | Bit 3  | Bit 4  | Bit 5  | Bit 6  | Bit 7  |
| ✓                       | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |
| Bit 8                   | Bit 9  | Bit 10 | Bit 11 | Bit 12 | Bit 13 | Bit 14 | Bit 15 |
| ✓                       | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |
| Bit 16                  | Bit 17 | Bit 18 | Bit 19 | Bit 20 | Bit 21 | Bit 22 | Bit 23 |
| ✓                       | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |
| Bit 24                  | Bit 25 | Bit 26 | Bit 27 | Bit 28 | Bit 29 | Bit 30 | Bit 31 |
| ✓                       | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |

## Software Examples

The “Software Examples” window provides examples of a Numatics’ Modbus TCP module with ProWORX 32 and Unity PRO software

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Numatics.com

The “Numatics.com” tab is a quick link to Numatics’ website. The computer must have internet access for this tab to be functional.

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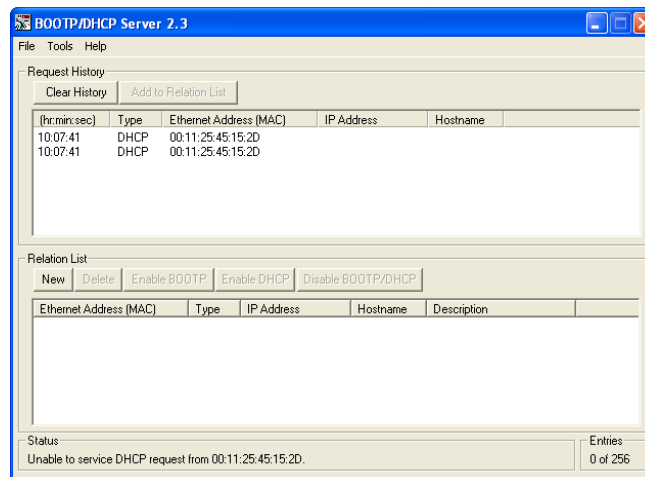
## IP Address Configuration

The IP address of the Numatics G3 Modbus TCP node may be configured via several different methods:

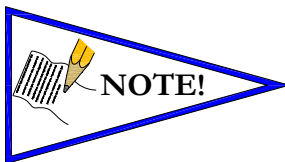
- DHCP/BOOTP
- Integrated Web Page Configuration
- Manual Configuration via DIP Switch
- Graphical display

## DHCP / BOOTP

The node is shipped from the factory with the DHCP/BOOTP feature enabled. This allows a DHCP server to automatically set the IP address to the node when connected to the network, or a BOOTP server to establish communication to the node and set the IP address. These addressing methods require that the unique MAC ADDRESS of the node is known. The MAC ADDRESS is displayed on the graphical display of the node. It will be different for every node. When DHCP/BOOTP is enabled and a DHCP server is found, the IP address, Subnet mask, and gateway are automatically configured by the DHCP server.



The DHCP/BOOTP setting can be enabled or disabled via the nodes integrated web server or graphical display.



*If the optional MCM module is installed, for the DHCP/BOOTP feature is disabled.*

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## Integrated Web Page Configuration

The Numatics Modbus TCP node has an integrated web server. This server can be accessed via any standard web browser program. With the IP Address, the “Node Configuration” page for the node can be called up and the configuration parameters updated. Please note that the PC, where the web browser is installed, must be correctly configured for operation with the appropriate network IP ranges and Subnet settings that match the Modbus TCP node.



- *Consult appropriate personnel before changing your computer's network settings and always record previous settings for later reversal before attempting changes.*

Below is a representation of the “Node Configuration” page which is stored in the Modbus TCP node. *IP address, Subnet Mask, and DHCP/BOOTP enabled* selections can all be configured from this page. These parameters will be programmed in the node's non-volatile FLASH memory once “Update Configuration” is clicked, and power to the node is cycled.



| Node Configuration      |                                                                                                       |
|-------------------------|-------------------------------------------------------------------------------------------------------|
| IP Address:             | 192.168.3.120                                                                                         |
| Subnet Mask:            | 255.255.255.0                                                                                         |
| DHCP/BOOTP Enabled:     | <input type="checkbox"/>                                                                              |
| MAC Address:            | 00-15-24-00-0A-53                                                                                     |
| Link Type:              | 100Mbps/Full Duplex                                                                                   |
| COMM Fault / Idle Mode: | <input type="radio"/> Hold Last Output State<br><input checked="" type="radio"/> Turn OFF All Outputs |

Update Configuration



- *The Modbus TCP node will reset in a few seconds, or the user may cycle power to enable the new configuration.*

## Manual Configuration via DIP Switch

Please see page 36 for Manual Configuration Module information and settings.

## Graphic Display

Please see page 21 for graphical display settings

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## Configuration with Unity Pro XL

Below is a sample configuration of a manifold setup with Unity software.

Screen shot from G3 built in web server

| Advanced Modbus I/O Mapping Configuration<br>(all values in decimal) |                                                             |                                                       |
|----------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------|
| Discrete Inputs start address:<br>(Default = 0)                      | 0                                                           | Discrete Inputs length:<br>(Default = 192; Max = 320) |
| Coils start address:<br>(Default = 320)                              | 320                                                         | Coils length:<br>(Default = 192; Max = 320)           |
| Input register start address:<br>(Default = 0)                       | 0                                                           | Input register length:<br>(Default = 20; Max = 20)    |
| Holding register start address:<br>(Default = 20)                    | 20                                                          | Holding register length:<br>(Default = 20; Max = 20)  |
| Discrete Inputs/Coils<br>bit reversal:                               | <input type="checkbox"/> enabled<br>(Default: not selected) |                                                       |
| Register<br>bit reversal:                                            | <input type="checkbox"/> enabled<br>(Default: not selected) |                                                       |
| Register<br>byte swap:                                               | <input type="checkbox"/> enabled<br>(Default: not selected) |                                                       |
| Comm timeout (ms):<br>(Default = 5000)                               | 5000                                                        |                                                       |
| Update Configuration                                                 |                                                             |                                                       |

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## Configuration with ProWORX 32

Card #1

Local Device

IP Address: 192.168.1.1

Health Block: 30001

Slot Number: 1

Device Control Block: 40001

Enable Device Control

Show Registers

Select Transaction

| Transaction # | Remote IP    |
|---------------|--------------|
| ✓ 001         | 192.168.1.00 |
| ✗ 002         | Empty        |
| ✗ 003         | Empty        |
| ✗ 004         | Empty        |
| ✗ 005         | Empty        |
| ✗ 006         | Empty        |
| ✗ 007         | Empty        |
| ✗ 008         | Empty        |

Transaction

Function: Read/Write

Fallback Value: Hold Last

Read From Remote:

To: 40300

From: 400001

Length: 1

Write To Remote:

From: 40320

To: 400021

Length: 1

| Advanced Modbus I/O Mapping Configuration<br>(all values in decimal) |     |                                                             |     |
|----------------------------------------------------------------------|-----|-------------------------------------------------------------|-----|
| Discrete Inputs start address:<br>(Default = 0)                      | 0   | Discrete Inputs length:<br>(Default = 192; Max = 320)       | 192 |
| Coils start address:<br>(Default = 320)                              | 320 | Coils length:<br>(Default = 192; Max = 320)                 | 192 |
| Input register start address:<br>(Default = 0)                       | 0   | Input register length:<br>(Default = 20; Max = 20)          | 20  |
| Holding register start address:<br>(Default = 20)                    | 20  | Holding register length:<br>(Default = 20; Max = 20)        | 20  |
| Discrete Inputs/Coils bit reversal:                                  |     | <input type="checkbox"/> enabled<br>(Default: not selected) |     |
| Register bit reversal:                                               |     | <input type="checkbox"/> enabled<br>(Default: not selected) |     |
| Register byte swap:                                                  |     | <input type="checkbox"/> enabled<br>(Default: not selected) |     |
| Comm timeout (ms):<br>(Default = 5000)                               |     | 5000                                                        |     |

Update Configuration

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## Modbus Mapping Configuration

The Numatics G3 node allows the customizing of Modbus register values and lengths. This is accomplished through the “Modbus Mapping” tab on the integrated web server in the node. Please see page XX for more information.

## User Configurable Device Parameters

The Numatics’ G3 node allows the user to set many user options which define how the manifold behaves in certain instances. The following is a description of these device parameters.

| <i>Name</i>           | <i>Description</i>                                                | Settable Via   |                   |            |
|-----------------------|-------------------------------------------------------------------|----------------|-------------------|------------|
|                       |                                                                   | <i>Display</i> | <i>Web Server</i> | <i>MCM</i> |
| IP Address            | Node address                                                      | ✓              | ✓                 | ✓          |
| Diagnostic Word       | Enables / Disables the diagnostic word                            | ✓              | X                 | X          |
| I/O Diagnostic Status | Allocates I/O diagnostic status bits                              | ✓              | X                 | X          |
| DHCP Boot-P           | Enables / Disables DHCP/Boot-P functionality                      | ✓              | ✓                 | X          |
| Output Idle Action    | Determines whether to use idle value attribute or hold last state | ✓              | ✓                 | X          |
| Output Fault Action   | Determines whether to use idle value attribute or hold last state | ✓              | ✓                 | X          |

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## Communication Fault/Idle Mode Parameter

This parameter is used to describe characteristics or behaviors of output points (bits). The parameter shown below is used to determine what state the outputs will have, during an “Idle” event and a “Fault” event. The Communication Fault/Idle Mode parameter will allow control of all output points on the manifold.

The user, through web page or graphic display settings, can determine how the outputs behave when a communication fault or idle actions occurs. These settings are non-volatile and thus will not change upon loss of power.

The two behavior options are:

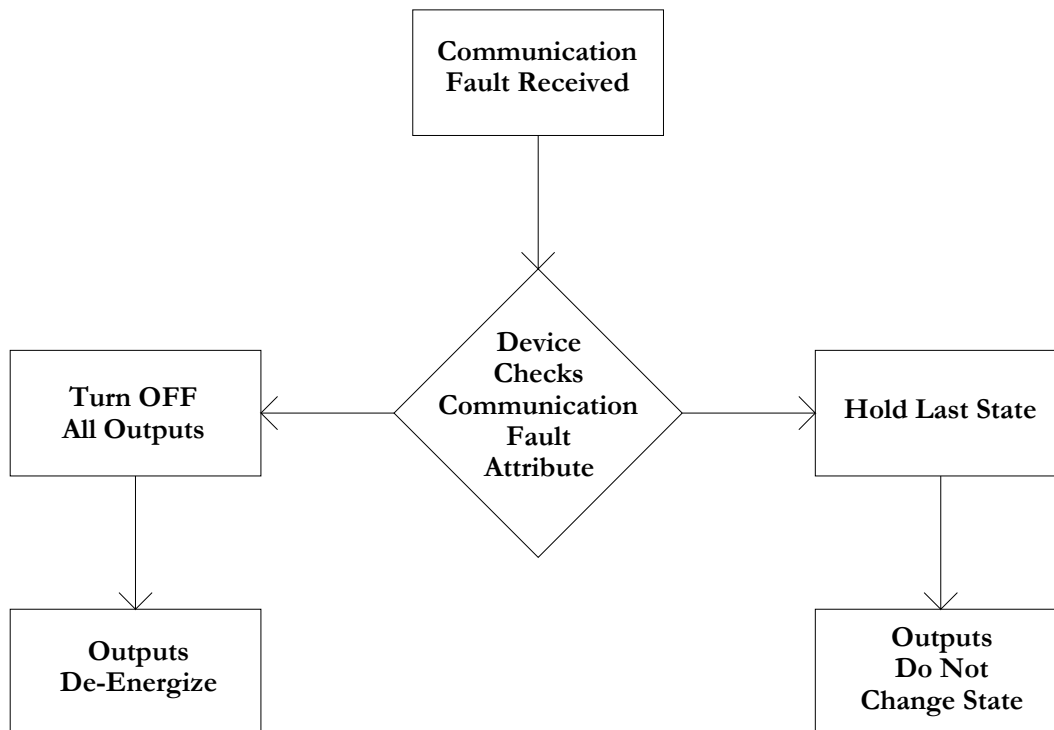
1. Hold Last State
2. Turn Off All Outputs

## Communication Fault / Idle Mode Sequence

The Communication Fault/Idle Mode parameter determines the output state if the device encounters a communication fault and/or idle action. A Communication Fault is defined as an inability for the master node to communicate with a slave node on a network. Idle Mode is a condition when the processor is in program mode.

The process for determining the output state during a Communication Fault/Idle Mode is as follows:

1. The device receives a Communication Fault/Idle Mode event.
2. The device determines what action to take based on the Communication Fault/Idle Mode attribute setting.
3. If the attribute is set to turn off all outputs, all of the outputs will turn off (Factory Default Setting).
4. If the attribute is set to hold last state, all of the outputs will hold their last state.



## Modbus TCP Mapping

### I/O Sizes

### Manifold

#### Outputs

Outputs are defined as any valve solenoid coil and/or any discrete output point from any output module. The output size depends upon the physical configuration of the manifold (i.e. module type and how many are used). Please reference the following pages for a detailed explanation for calculating the output size.

#### Inputs

Inputs are defined as physical input bits from input modules and status bits (i.e. diagnostic word generated by the node, status input bits produced by output drivers and SCP status bits). Thus, the input size will include physical input points, as well as status input bits. Please reference the following pages for a detailed explanation for calculating the input size.

#### Valve Side

The size for the “valve side” of the manifold consists of an output bit for each valve solenoid coil driver and an input bit for the corresponding diagnostic status input bit. This value for the valve side size is 4 bytes of inputs and 4 bytes of outputs.

#### Discrete Side

The discrete side of the manifold is defined as all I/O modules connected to the left of the communication node. This includes physically attached modules as well as any distributed sub-bus modules. I/O sizes for the discrete side are automatically configured based on the I/O module type installed. However, the user can affect these sizes manually via settable parameters on the node. The output value consists of physical outputs (i.e. output bit for each output point). The input value consists of physical inputs (i.e. input bit for each input point) and user settable status input bits for corresponding physical outputs and SCP status bits.

#### Total I/O Size

The overall size of the I/O data for the manifold will consist of the valve size plus the discrete I/O size and all enabled Diagnostic bits. The I/O size can vary greatly, due to the many physical configuration and user settable parameters combinations. The worksheet on page 80 will allow accurate sizing of the I/O data.

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## Manifold and I/O Data Sizing Worksheet

Step

- 1** : Choose appropriate value and place the corresponding Input and Output values in the boxes labeled, "Valve Byte Requirements" at the bottom of the page
- 2** : Choose up to sixteen modules to be included on the discrete I/O side of the manifold and place sum of the corresponding input bytes and output bytes in the boxes labeled, "Sub-Bus Byte Requirements" at the bottom of the page.
- 3** : Total the input bytes and output bytes values from the boxes labeled "Sub-Bus Byte Requirements" and "Valve Byte Requirements" in the boxes labeled "Total Input and Output Bytes for Manifold. This is the total input and output byte values required for the configured manifold.

| Valve Side |                         |  |                |                 |              |
|------------|-------------------------|--|----------------|-----------------|--------------|
| Step       | Valve Side              |  | Input Bytes    |                 | Output Bytes |
|            |                         |  | Status Enabled | Status Disabled |              |
| 1          | Up to 32 Solenoid Coils |  | 4              | 0               | 4            |

| Digital Modules |             |                                 |                |                 |              |
|-----------------|-------------|---------------------------------|----------------|-----------------|--------------|
| Step            | Module No.  | Description                     | Input Bytes    |                 | Output Bytes |
|                 |             |                                 | Status Enabled | Status Disabled |              |
| 2               | 240-203/204 | 16 Inputs - Terminal Strip      | 3              | 2               | 0            |
|                 | 240-205/209 | 16 Inputs - 8 x 12mm            | 3              | 2               | 0            |
|                 | 240-206/210 | 8 Inputs - 8 x 12mm             | 2              | 1               | 0            |
|                 | 240-207     | 16 Outputs - 8 x 12mm           | 2              | 0               | 2            |
|                 | 240-208     | 8 Outputs - 8 x 12mm            | 1              | 0               | 1            |
|                 | 240-211     | 8 Inputs / 8 Outputs - 8 x 12mm | 3              | 1               | 1            |
|                 | 240-241     | Sub - Bus Valve Output          | 4              | 0               | 4            |

| Analog Modules |             |                      |                |                 |              |
|----------------|-------------|----------------------|----------------|-----------------|--------------|
| Step           | Module No.  | Description          | Input Bytes    |                 | Output Bytes |
|                |             |                      | Status Enabled | Status Disabled |              |
| 2              | 240-212/214 | 4 Inputs             | 10             | 8               | 0            |
|                | 240-213/215 | 2 Inputs / 2 Outputs | 6              | 4               | 4            |

| Total Input/Output Size Calculation |                                           |              |             |              |
|-------------------------------------|-------------------------------------------|--------------|-------------|--------------|
| Step                                | Module Position                           | Model Number | Input Bytes | Output Bytes |
| 2                                   | 1 <sup>st</sup>                           |              |             |              |
|                                     | 2 <sup>nd</sup>                           |              |             |              |
|                                     | 3 <sup>rd</sup>                           |              |             |              |
|                                     | 4 <sup>th</sup>                           |              |             |              |
|                                     | 5 <sup>th</sup>                           |              |             |              |
|                                     | 6 <sup>th</sup>                           |              |             |              |
|                                     | 7 <sup>th</sup>                           |              |             |              |
|                                     | 8 <sup>th</sup>                           |              |             |              |
|                                     | 9 <sup>th</sup>                           |              |             |              |
|                                     | 10 <sup>th</sup>                          |              |             |              |
|                                     | 11 <sup>th</sup>                          |              |             |              |
|                                     | 12 <sup>th</sup>                          |              |             |              |
|                                     | 13 <sup>th</sup>                          |              |             |              |
|                                     | 14 <sup>th</sup>                          |              |             |              |
|                                     | 15 <sup>th</sup>                          |              |             |              |
|                                     | 16 <sup>th</sup>                          |              |             |              |
|                                     | Sub-Bus Byte Requirements:                |              |             |              |
|                                     | Optional Diagnostic Word:                 |              | 2           | 0            |
| 1                                   | Valve Byte Requirements:                  |              |             |              |
| 3                                   | Total Input and Output Bytes for Manifold |              |             |              |

## Bit Mapping Rules

The bit mapping for a G3 manifold varies with the physical configuration of the manifold. The following is a breakdown of the bit mapping rules associated with the Numatics valve manifold.

### Valve Side

- 1) Solenoid coil outputs are connected to the valve coils using the Z-Boards™.
- 2) The valve solenoid coil output portion of the total output size is fixed at 4 bytes.
- 3) Each solenoid coil output has an associated status input bit (refer to the section labeled, “Output Short Circuit Protection”, on page 20 for functional details). The solenoid coil status input size is fixed at 4 bytes.
- 4) Solenoid coil output addressing begins at the 1<sup>st</sup> manifold station nearest the node using “14” coil 1<sup>st</sup> and then, if applicable, the “12” coil, and continues in ascending order away from the communication node.
- 5) Each manifold station allocates 1 or 2 output bits. This is dependent on the Z-Board™ type installed. A single Z-Board™ allocates 1 output bit. A double Z-Board™ allocates 2 output bits.
- 6) Z-Boards™ can be used in any arrangement (all singles, all doubles, or any combination) as long as output group No.1 and output group No. 2 bits do not overlap (i.e. combinations of Z-Boards™ could exist where the physical configuration of the manifold could exceed the output capacity).



*Single solenoid valves can be used with double Z-Boards™. However, one of the two available outputs will remain unused.*

### Discrete I/O Side

#### Outputs

- 1) The Sub-Bus output byte size portion is self-configuring in byte increments, after an output module is installed on the Sub-Bus and power is applied.
- 2) Outputs are mapped consecutively by module. The output bits from the 1<sup>st</sup> module will be mapped directly after the bits from the valve coils. The output bits from the second module will be mapped directly after the output bits from the 1<sup>st</sup> module and so on.

#### Inputs

- 1) The Sub-Bus input byte size portion is self-configuring in byte increments, after an input module is plugged into back plane and power is applied.
- 2) Inputs are mapped consecutively by module. The input bits from the 1<sup>st</sup> module will be mapped directly after the status bits from the valve side. The input bits from the second module will be mapped directly after the input bits from the 1<sup>st</sup> module and so on.
- 3) All of the modules have associated internal status bits, which will affect the total value of input bytes..
- 4) When a module has discrete and status inputs, the status bits are mapped after the discrete input bits.

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## I/O Mapping Examples

### Assumed Settings

#### Example No. 1

- Double Z-Boards™ used with all valves
- I/O Modules and mapping schemes are identified by their corresponding color.
- I/O Status bits are enabled
- Diagnostic Word is enabled

### Manifold I/O Configuration

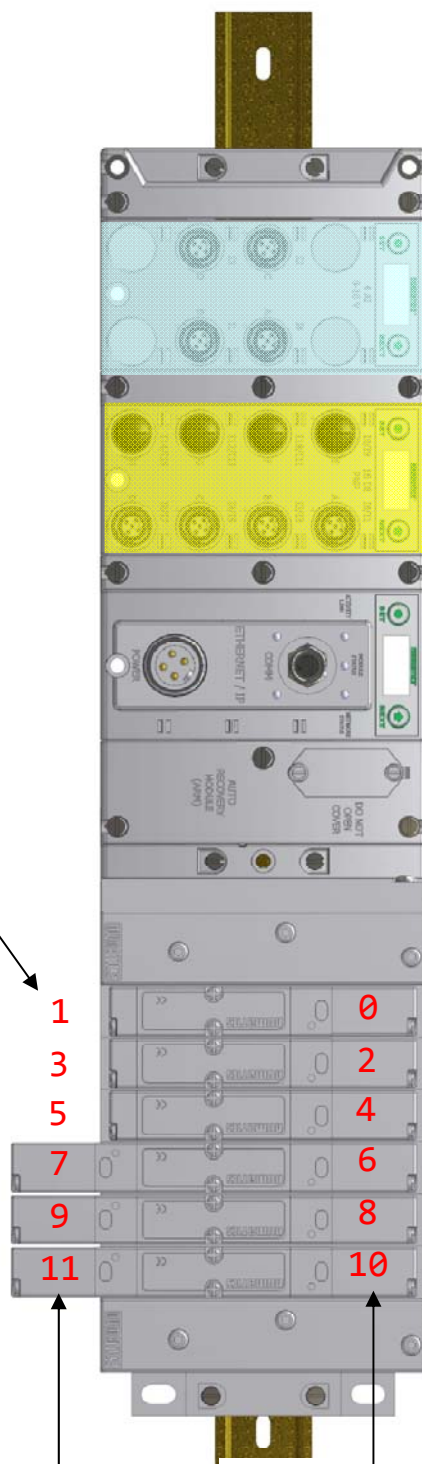
| Pos No.          | Module Type | Part No. | In Bytes | Out Bytes |
|------------------|-------------|----------|----------|-----------|
| 1                | 16I PNP     | 240-205  | 3        | 0         |
| 2                | 4AI Analog  | 240-212  | 10       | 0         |
| Diagnostic Word  |             |          | 2        | 0         |
| Local Valve Size |             |          | 4        | 4         |

Total: 19 4

### How to Order

| Qty | Part Number     |
|-----|-----------------|
| 1   | AK3EF00003NDRM  |
| 3   | 051BA4Z2MN00061 |
| 3   | 051BB4Z2MN00061 |
| 1   | G3EM102R0G32    |
| 1   | 240-205         |
| 1   | 240-212         |
|     | ASSEMBLED       |

Valve Coil Number



When the 12 End Solenoid is energized, the 2 port is pressurized

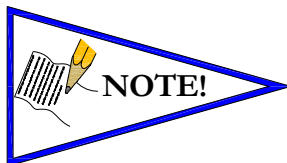
When the 14 End Solenoid is energized, the 4 port is pressurized

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Example No. 1 Table

| Output Table            |      |                        |                        |                        |                        |                        |                        |                        |                        |
|-------------------------|------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Modbus Register Address | BYTE | Bit 7                  | Bit 6                  | Bit 5                  | Bit 4                  | Bit 3                  | Bit 2                  | Bit 1                  | Bit 0                  |
| 40020                   | 0    | Valve Coil No. 7       | Valve Coil No. 6       | Valve Coil No. 5       | Valve Coil No. 4       | Valve Coil No. 3       | Valve Coil No. 2       | Valve Coil No. 1       | Valve Coil No. 0       |
|                         | 1    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Valve Coil No. 11      | Valve Coil No. 10      | Valve Coil No. 9       | Valve Coil No. 8       |
| 40021                   | 0    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |
|                         | 1    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |

| Input Table             |              |                             |                             |                             |                             |                             |                             |                             |                             |
|-------------------------|--------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Modbus Register Address | BYTE         | Bit 7                       | Bit 6                       | Bit 5                       | Bit 4                       | Bit 3                       | Bit 2                       | Bit 1                       | Bit 0                       |
| 40000                   | 0 (Optional) | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit |
|                         | 1 (Optional) | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      |
| 40001                   | 0 (Optional) | Coil No. 7 Status           | Coil No. 6 Status           | Coil No. 5 Status           | Coil No. 4 Status           | Coil No. 3 Status           | Coil No. 2 Status           | Coil No. 1 Status           | Coil No. 0 Status           |
|                         | 1 (Optional) | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Coil No. 11 Status          | Coil No. 10 Status          | Coil No. 9 Status           | Coil No. 8 Status           |
| 40002                   | 0 (Optional) | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      |
|                         | 1 (Optional) | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      |
| 400003                  | 0            | Discrete Input No. 7        | Discrete Input No. 6        | Discrete Input No. 5        | Discrete Input No. 4        | Discrete Input No. 3        | Discrete Input No. 2        | Discrete Input No. 1        | Discrete Input No. 0        |
|                         | 1            | Discrete Input No. 15       | Discrete Input No. 14       | Discrete Input No. 13       | Discrete Input No. 12       | Discrete Input No. 11       | Discrete Input No. 10       | Discrete Input No. 9        | Discrete Input No. 8        |
| 400004                  | 0 (Optional) | Power Status for Conn. H    | Power Status for Conn. G    | Power Status for Conn. F    | Power Status for Conn. E    | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |
|                         | 1            | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1 (LSB)    |
| 400005                  | 0            | Analog Input No. 1 (MSB)    | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          |
|                         | 1            | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2 (LSB)    |
| 40006                   | 0            | Analog Input No. 2 (MSB)    | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          |
|                         | 1            | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3 (LSB)    |
| 40007                   | 0            | Analog Input No. 3 (MSB)    | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          |
|                         | 1            | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4 (LSB)    |
| 40008                   | 0            | Analog Input No. 4 (MSB)    | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          |
|                         | 1 (Optional) | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |
| 40009                   | 0 (Optional) | High Alarm for Conn. D      | Low Alarm for Conn. D       | High Alarm for Conn. C      | Low Alarm for Conn. C       | High Alarm for Conn. B      | Low Alarm for Conn. B       | High Alarm for Conn. A      | Low Alarm for Conn. A       |



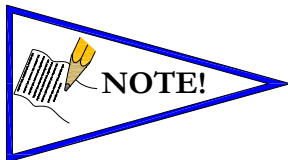
*The Comm. Module Diagnostic Bits, Sub-Bus Diagnostic Bits, Coil Status Bits and Power Status Bits are optional. The factory default condition is Diagnostic bits enabled. These bits may be disabled to optimize the logical size of the manifold.*

# numatics

Example No. 2 Table

| Output Table            |      |                        |                        |                        |                        |                        |                        |                        |                        |
|-------------------------|------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Modbus Register Address | BYTE | Bit 7                  | Bit 6                  | Bit 5                  | Bit 4                  | Bit 3                  | Bit 2                  | Bit 1                  | Bit 0                  |
| 400020                  | 0    | Valve Coil No. 7       | Valve Coil No. 6       | Valve Coil No. 5       | Valve Coil No. 4       | Valve Coil No. 3       | Valve Coil No. 2       | Valve Coil No. 1       | Valve Coil No. 0       |
|                         | 1    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Valve Coil No. 11      | Valve Coil No. 10      | Valve Coil No. 9       | Valve Coil No. 8       |
| 40021                   | 2    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |
|                         | 3    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |

| Input Table             |              |                             |                             |                             |                             |                             |                             |                             |                             |
|-------------------------|--------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Modbus Register Address | BYTE         | Bit 7                       | Bit 6                       | Bit 5                       | Bit 4                       | Bit 3                       | Bit 2                       | Bit 1                       | Bit 0                       |
| 40000                   | 0 (Optional) | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit |
|                         | 1 (Optional) | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      |
| 40001                   | 0 (Optional) | Coil No. 7 Status           | Coil No. 6 Status           | Coil No. 5 Status           | Coil No. 4 Status           | Coil No. 3 Status           | Coil No. 2 Status           | Coil No. 1 Status           | Coil No. 0 Status           |
|                         | 1 (Optional) | Coil No. 15 Status          | Coil No. 14 Status          | Coil No. 13 Status          | Coil No. 12 Status          | Coil No. 11 Status          | Coil No. 10 Status          | Coil No. 9 Status           | Coil No. 8 Status           |
| 40002                   | 0 (Optional) | Coil No. 23 Status          | Coil No. 22 Status          | Coil No. 21 Status          | Coil No. 20 Status          | Coil No. 19 Status          | Coil No. 18 Status          | Coil No. 17 Status          | Coil No. 16 Status          |
|                         | 1 (Optional) | Coil No. 31 Status          | Coil No. 30 Status          | Coil No. 29 Status          | Coil No. 28 Status          | Coil No. 27 Status          | Coil No. 26 Status          | Coil No. 25 Status          | Coil No. 24 Status          |



*The Comm. Module Diagnostic Bits, Sub-Bus Diagnostic Bits, Coil Status Bits and Power Status Bits are optional. The factory default condition is Diagnostic bits are enabled. These bits may be disabled to optimize the logical size of the manifold*

# numatics G3 Series Modbus TCP Technical Manual

## Assumed Settings

### Example No. 3

- Double Z-Boards™ used with all valves
- I/O Modules and mapping schemes are identified by their corresponding color.
- I/O Status bits are enabled
- Diagnostic Word is enabled

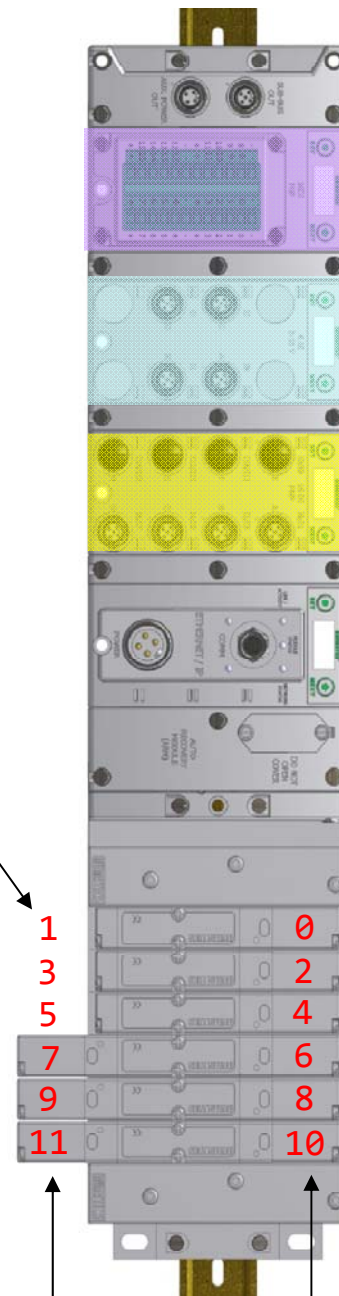
## Manifold I/O Configuration

| Pos No.         | Module Type | Part No. | In    | Out |
|-----------------|-------------|----------|-------|-----|
|                 |             |          | Bytes |     |
| 1               | 16I PNP     | 240-205  | 3     | 0   |
| 2               | 4AI Analog  | 240-212  | 10    | 0   |
| 3               | 16I PNP     | 240-203  | 3     | 0   |
| Diagnostic Word |             |          | 2     | 0   |
| Local Valves:   |             |          | 4     | 4   |
| Total:          |             |          | 22    | 4   |

## How to Order

| Qty | Part Number     |
|-----|-----------------|
| 1   | AK3EF00003NDRM  |
| 3   | 051BA4Z2MN00061 |
| 3   | 051BB4Z2MN00061 |
| 1   | G3EM103D0G32    |
| 1   | 240-205         |
| 1   | 240-212         |
| 1   | 240-203         |
|     | ASSEMBLED       |

Valve Coil Number



When the 12 End Solenoid is energized, the 2 port is pressurized

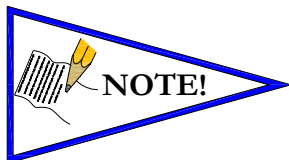
When the 14 End Solenoid is energized, the 4 port is pressurized

# numatics G3 Series Modbus TCP Technical Manual

Example No. 3 Table

| Output Table            |      |                        |                        |                        |                        |                        |                        |                        |                        |
|-------------------------|------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Modbus Register Address | BYTE | Bit 7                  | Bit 6                  | Bit 5                  | Bit 4                  | Bit 3                  | Bit 2                  | Bit 1                  | Bit 0                  |
| 40020                   | 0    | Valve Coil No. 7       | Valve Coil No. 6       | Valve Coil No. 5       | Valve Coil No. 4       | Valve Coil No. 3       | Valve Coil No. 2       | Valve Coil No. 1       | Valve Coil No. 0       |
|                         | 1    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Valve Coil No. 11      | Valve Coil No. 10      | Valve Coil No. 9       | Valve Coil No. 8       |
| 40021                   | 0    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |
|                         | 1    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |

| Input Table             |              |                             |                             |                             |                             |                             |                             |                             |                             |
|-------------------------|--------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Modbus Register Address | BYTE         | Bit 7                       | Bit 6                       | Bit 5                       | Bit 4                       | Bit 3                       | Bit 2                       | Bit 1                       | Bit 0                       |
| 40000                   | 0 (Optional) | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit |
|                         | 1 (Optional) | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      |
| 40001                   | 0 (Optional) | Coil No. 7 Status           | Coil No. 6 Status           | Coil No. 5 Status           | Coil No. 4 Status           | Coil No. 3 Status           | Coil No. 2 Status           | Coil No. 1 Status           | Coil No. 0 Status           |
|                         | 1 (Optional) | Coil No. 15 Status          | Coil No. 14 Status          | Coil No. 13 Status          | Coil No. 12 Status          | Coil No. 11 Status          | Coil No. 10 Status          | Coil No. 9 Status           | Coil No. 8 Status           |
| 40002                   | 0 (Optional) | Coil No. 23 Status          | Coil No. 22 Status          | Coil No. 21 Status          | Coil No. 20 Status          | Coil No. 19 Status          | Coil No. 18 Status          | Coil No. 17 Status          | Coil No. 16 Status          |
|                         | 1 (Optional) | Coil No. 31 Status          | Coil No. 30 Status          | Coil No. 29 Status          | Coil No. 28 Status          | Coil No. 27 Status          | Coil No. 26 Status          | Coil No. 25 Status          | Coil No. 24 Status          |
| 40003                   | 0            | Discrete Input No. 7        | Discrete Input No. 6        | Discrete Input No. 5        | Discrete Input No. 4        | Discrete Input No. 3        | Discrete Input No. 2        | Discrete Input No. 1        | Discrete Input No. 0        |
|                         | 1            | Discrete Input No. 15       | Discrete Input No. 14       | Discrete Input No. 13       | Discrete Input No. 12       | Discrete Input No. 11       | Discrete Input No. 10       | Discrete Input No. 9        | Discrete Input No. 8        |
| 40004                   | 0 (Optional) | Power Status for Conn. H    | Power Status for Conn. G    | Power Status for Conn. F    | Power Status for Conn. E    | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |
|                         | 1            | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1 (LSB)    |
| 40005                   | 0            | Analog Input No. 1 (MSB)    | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          |
|                         | 1            | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2 (LSB)    |
| 40006                   | 0            | Analog Input No. 2 (MSB)    | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          |
|                         | 1            | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3 (LSB)    |
| 40007                   | 0            | Analog Input No. 3 (MSB)    | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          |
|                         | 1            | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4 (LSB)    |
| 40008                   | 0            | Analog Input No. 4 (MSB)    | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          |
|                         | 1 (Optional) | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |
| 40009                   | 0 (Optional) | High Alarm for Conn. D      | Low Alarm for Conn. D       | High Alarm for Conn. C      | Low Alarm for Conn. C       | High Alarm for Conn. B      | Low Alarm for Conn. B       | High Alarm for Conn. A      | Low Alarm for Conn. A       |
|                         | 1            | Discrete Input No. 7        | Discrete Input No. 6        | Discrete Input No. 5        | Discrete Input No. 4        | Discrete Input No. 3        | Discrete Input No. 2        | Discrete Input No. 1        | Discrete Input No. 0        |
| 40010                   | 0            | Discrete Input No. 15       | Discrete Input No. 14       | Discrete Input No. 13       | Discrete Input No. 12       | Discrete Input No. 11       | Discrete Input No. 10       | Discrete Input No. 9        | Discrete Input No. 8        |
|                         | 1 (Optional) | Power Status for Conn. H    | Power Status for Conn. G    | Power Status for Conn. F    | Power Status for Conn. E    | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |



*The Comm. Module Diagnostic Bits, Sub-Bus Diagnostic Bits, Coil Status Bits and Power Status Bits are optional. The factory default condition is Diagnostic bits are enabled. These bits may be disabled to optimize the logical size of the manifold*

# numatics G3 Series Modbus TCP Technical Manual

## Assumed Settings

Example No. 4

- Double Z-Boards™ used with all valves
- I/O Modules and mapping schemes are identified by their corresponding color.
- I/O Status bits are enabled
- Diagnostic Word is enabled

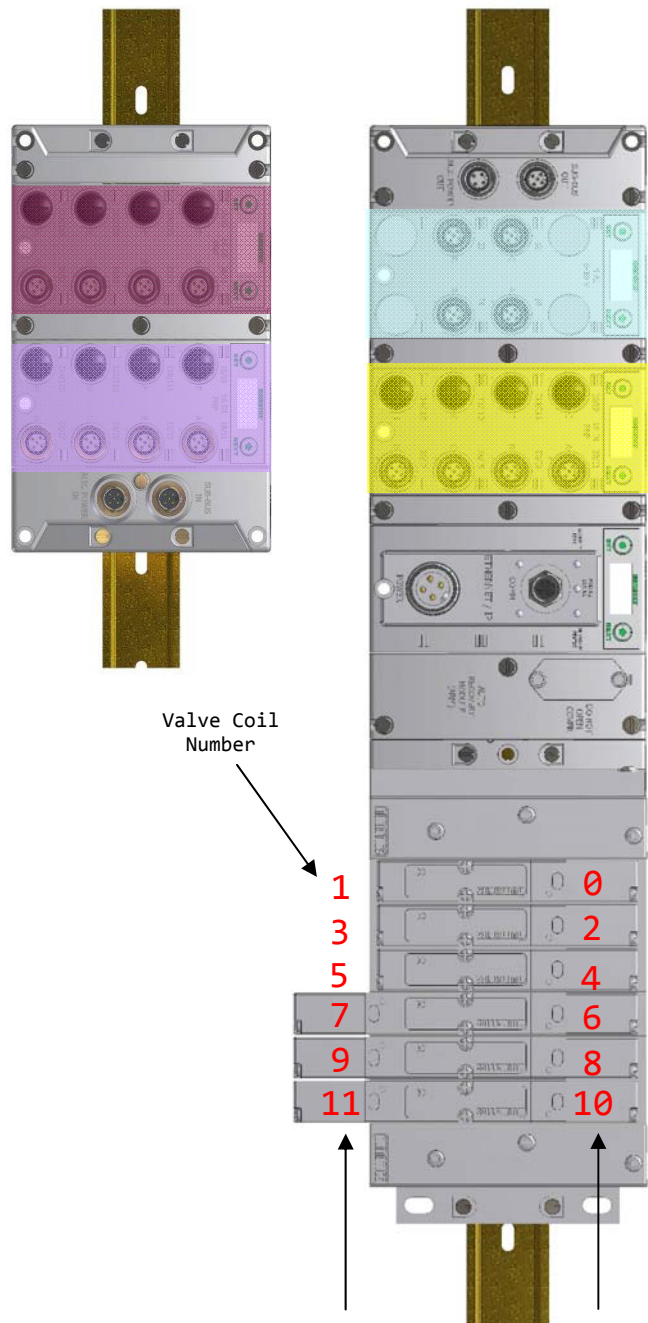
## Manifold I/O Configuration

| Pos No.         | Module Type | Part No. | In Bytes | Out Bytes |
|-----------------|-------------|----------|----------|-----------|
| 1               | 16I PNP     | 240-205  | 3        | 0         |
| 2               | 4I Analog   | 240-212  | 10       | 0         |
| 3               | 16I PNP     | 240-205  | 3        | 0         |
| 4               | 16I PNP     | 240-205  | 3        | 0         |
| Diagnostic Word |             |          | 2        | 0         |
| Local Valves:   |             |          | 4        | 4         |
| Total:          |             |          | 18       | 4         |

## How to Order

| Qty | Part Number     |
|-----|-----------------|
| 1   | AK3EF00003NDRM  |
| 3   | 051BA4Z2MN00061 |
| 3   | 051BB4Z2MN00061 |
| 1   | G3EM102R0G32    |
| 1   | 240-205         |
| 1   | 240-212         |
|     | ASSEMBLED       |

|   |              |
|---|--------------|
| 1 | G3DS302D0DRM |
| 1 | 240-205      |
| 1 | 240-205      |
|   | ASSEMBLED    |



When the 12 End Solenoid is energized, the 2 port is pressurized

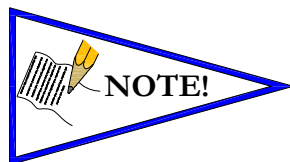
When the 14 End Solenoid is energized, the 4 port is pressurized

# numatics® G3 Series Modbus TCP Technical Manual

Example No. 4 Table

| Output Table            |      |                        |                        |                        |                        |                        |                        |                        |                        |
|-------------------------|------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Modbus Register Address | BYTE | Bit 7                  | Bit 6                  | Bit 5                  | Bit 4                  | Bit 3                  | Bit 2                  | Bit 1                  | Bit 0                  |
| 40020                   | 0    | Valve Coil No. 7       | Valve Coil No. 6       | Valve Coil No. 5       | Valve Coil No. 4       | Valve Coil No. 3       | Valve Coil No. 2       | Valve Coil No. 1       | Valve Coil No. 0       |
|                         | 1    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Valve Coil No. 11      | Valve Coil No. 10      | Valve Coil No. 9       | Valve Coil No. 8       |
| 40021                   | 0    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |
|                         | 1    | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |

| Input Table             |              |                             |                             |                             |                             |                             |                             |                             |                             |
|-------------------------|--------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Modbus Register Address | BYTE         | Bit 7                       | Bit 6                       | Bit 5                       | Bit 4                       | Bit 3                       | Bit 2                       | Bit 1                       | Bit 0                       |
| 40000                   | 0 (Optional) | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit |
|                         | 1 (Optional) | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      |
| 40001                   | 0 (Optional) | Coil No. 7 Status           | Coil No. 6 Status           | Coil No. 5 Status           | Coil No. 4 Status           | Coil No. 3 Status           | Coil No. 2 Status           | Coil No. 1 Status           | Coil No. 0 Status           |
|                         | 1 (Optional) | Coil No. 15 Status          | Coil No. 14 Status          | Coil No. 13 Status          | Coil No. 12 Status          | Coil No. 11 Status          | Coil No. 10 Status          | Coil No. 9 Status           | Coil No. 8 Status           |
| 40002                   | 0 (Optional) | Coil No. 23 Status          | Coil No. 22 Status          | Coil No. 21 Status          | Coil No. 20 Status          | Coil No. 19 Status          | Coil No. 18 Status          | Coil No. 17 Status          | Coil No. 16 Status          |
|                         | 1 (Optional) | Coil No. 31 Status          | Coil No. 30 Status          | Coil No. 29 Status          | Coil No. 28 Status          | Coil No. 27 Status          | Coil No. 26 Status          | Coil No. 25 Status          | Coil No. 24 Status          |
| 40003                   | 0            | Discrete Input No. 7        | Discrete Input No. 6        | Discrete Input No. 5        | Discrete Input No. 4        | Discrete Input No. 3        | Discrete Input No. 2        | Discrete Input No. 1        | Discrete Input No. 0        |
|                         | 1            | Discrete Input No. 15       | Discrete Input No. 14       | Discrete Input No. 13       | Discrete Input No. 12       | Discrete Input No. 11       | Discrete Input No. 10       | Discrete Input No. 9        | Discrete Input No. 8        |
| 40004                   | 0 (Optional) | Power Status for Conn. H    | Power Status for Conn. G    | Power Status for Conn. F    | Power Status for Conn. E    | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |
|                         | 1            | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1 (LSB)    |
| 40005                   | 0            | Analog Input No. 1 (MSB)    | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          |
|                         | 1            | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2 (LSB)    |
| 40006                   | 0            | Analog Input No. 2 (MSB)    | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          |
|                         | 1            | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3 (LSB)    |
| 40007                   | 0            | Analog Input No. 3 (MSB)    | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          |
|                         | 1            | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4 (LSB)    |
| 40008                   | 0            | Analog Input No. 4 (MSB)    | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          |
|                         | 1 (Optional) | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |
| 40009                   | 0 (Optional) | High Alarm for Conn. D      | Low Alarm for Conn. D       | High Alarm for Conn. C      | Low Alarm for Conn. C       | High Alarm for Conn. B      | Low Alarm for Conn. B       | High Alarm for Conn. A      | Low Alarm for Conn. A       |
|                         | 1            | Discrete Input No. 7        | Discrete Input No. 6        | Discrete Input No. 5        | Discrete Input No. 4        | Discrete Input No. 3        | Discrete Input No. 2        | Discrete Input No. 1        | Discrete Input No. 0        |
| 40010                   | 0            | Discrete Input No. 15       | Discrete Input No. 14       | Discrete Input No. 13       | Discrete Input No. 12       | Discrete Input No. 11       | Discrete Input No. 10       | Discrete Input No. 9        | Discrete Input No. 8        |
|                         | 1 (Optional) | Power Status for Conn. H    | Power Status for Conn. G    | Power Status for Conn. F    | Power Status for Conn. E    | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |
| 40011                   | 0            | Discrete Input No. 7        | Discrete Input No. 6        | Discrete Input No. 5        | Discrete Input No. 4        | Discrete Input No. 3        | Discrete Input No. 2        | Discrete Input No. 1        | Discrete Input No. 0        |
|                         | 1            | Discrete Input No. 15       | Discrete Input No. 14       | Discrete Input No. 13       | Discrete Input No. 12       | Discrete Input No. 11       | Discrete Input No. 10       | Discrete Input No. 9        | Discrete Input No. 8        |
| 40012                   | 0 (Optional) | Power Status for Conn. H    | Power Status for Conn. G    | Power Status for Conn. F    | Power Status for Conn. E    | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |



*The Comm. Module Diagnostic Bits, Sub-Bus Diagnostic Bits, Coil Status Bits and Power Status Bits are optional. The factory default condition is Diagnostic bits are enabled. These bits may be disabled to optimize the logical size of the manifold*

# numatics™ G3 Series Modbus TCP Technical Manual

## Assumed Settings

### Example No. 5

- Double Z-Boards™ used with all valves
- I/O Modules and mapping schemes are identified by their corresponding color.
- I/O Status bits are enabled
- Diagnostic Word is enabled

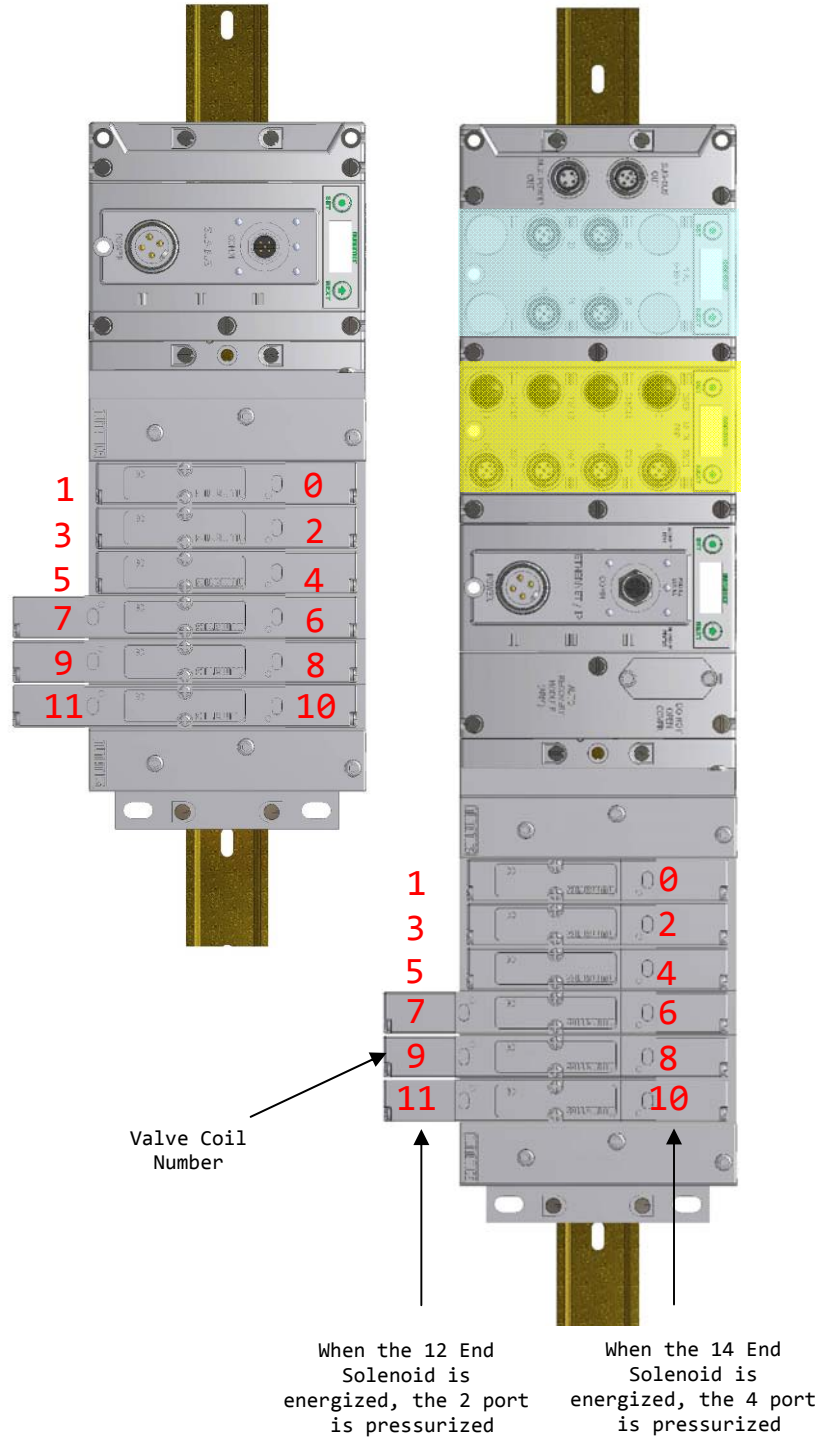
## Manifold I/O Configuration

| Pos No.                  | Module Type | Part No. | In Bytes | Out Bytes |
|--------------------------|-------------|----------|----------|-----------|
| 1                        | 16I PNP     | 240-205  | 3        | 0         |
| 2                        | 4I Analog   | 240-212  | 10       | 0         |
| Diagnostic Word          |             |          | 2        | 0         |
| Local Valves (DeviceNet) |             |          | 4        | 4         |
| Local Valves (Sub-Bus)   |             |          | 4        | 4         |
| Total:                   |             |          | 23       | 8         |

## How to Order

| Qty | Part Number     |
|-----|-----------------|
| 1   | AK3EF00003NDRM  |
| 3   | 051BA4Z2MN00061 |
| 3   | 051BB4Z2MN00061 |
| 1   | G3EM102D0G32    |
| 1   | 240-205         |
| 1   | 240-212         |
|     | ASSEMBLED       |

|   |                 |
|---|-----------------|
| 1 | AK3EF00003NDRM  |
| 3 | 051BA4Z2MN00061 |
| 3 | 051BB4Z2MN00061 |
| 1 | G3DS202R0DRM    |
|   | ASSEMBLED       |



Example No. 5 Table

| Output Table            |              |                        |                        |                        |                        |                        |                        |                        |                        |
|-------------------------|--------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Modbus Register Address | BYTE         | Bit 7                  | Bit 6                  | Bit 5                  | Bit 4                  | Bit 3                  | Bit 2                  | Bit 1                  | Bit 0                  |
| 40020                   | 0            | Valve Coil No. 7       | Valve Coil No. 6       | Valve Coil No. 5       | Valve Coil No. 4       | Valve Coil No. 3       | Valve Coil No. 2       | Valve Coil No. 1       | Valve Coil No. 0       |
|                         | 1            | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Valve Coil No. 11      | Valve Coil No. 10      | Valve Coil No. 9       | Valve Coil No. 8       |
| 40021                   | 2            | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |
|                         | 3            | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |
| 40022                   | 4            | Valve Coil No. 7       | Valve Coil No. 6       | Valve Coil No. 5       | Valve Coil No. 4       | Valve Coil No. 3       | Valve Coil No. 2       | Valve Coil No. 1       | Valve Coil No. 0       |
|                         | 5            | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Valve Coil No. 11      | Valve Coil No. 10      | Valve Coil No. 9       | Valve Coil No. 8       |
| 40023                   | 6 (Optional) | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |
|                         | 7 (Optional) | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved | Allocated and Reserved |

| Input Table             |              |                             |                             |                             |                             |                             |                             |                             |                             |
|-------------------------|--------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Modbus Register Address | BYTE         | Bit 7                       | Bit 6                       | Bit 5                       | Bit 4                       | Bit 3                       | Bit 2                       | Bit 1                       | Bit 0                       |
| 40000                   | 0 (Optional) | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit | Comm. Module Diagnostic Bit |
|                         | 1 (Optional) | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      | Sub-bus Diagnostic Bit      |
| 40001                   | 0 (Optional) | Coil No. 7 Status           | Coil No. 6 Status           | Coil No. 5 Status           | Coil No. 4 Status           | Coil No. 3 Status           | Coil No. 2 Status           | Coil No. 1 Status           | Coil No. 0 Status           |
|                         | 1 (Optional) | Coil No. 15 Status          | Coil No. 14 Status          | Coil No. 13 Status          | Coil No. 12 Status          | Coil No. 11 Status          | Coil No. 10 Status          | Coil No. 9 Status           | Coil No. 8 Status           |
| 40002                   | 0 (Optional) | Coil No. 23 Status          | Coil No. 22 Status          | Coil No. 21 Status          | Coil No. 20 Status          | Coil No. 19 Status          | Coil No. 18 Status          | Coil No. 17 Status          | Coil No. 16 Status          |
|                         | 1 (Optional) | Coil No. 31 Status          | Coil No. 30 Status          | Coil No. 29 Status          | Coil No. 28 Status          | Coil No. 27 Status          | Coil No. 26 Status          | Coil No. 25 Status          | Coil No. 24 Status          |
| 40003                   | 0            | Discrete Input No. 7        | Discrete Input No. 6        | Discrete Input No. 5        | Discrete Input No. 4        | Discrete Input No. 3        | Discrete Input No. 2        | Discrete Input No. 1        | Discrete Input No. 0        |
|                         | 1            | Discrete Input No. 15       | Discrete Input No. 14       | Discrete Input No. 13       | Discrete Input No. 12       | Discrete Input No. 11       | Discrete Input No. 10       | Discrete Input No. 9        | Discrete Input No. 8        |
| 40004                   | 0 (Optional) | Power Status for Conn. H    | Power Status for Conn. G    | Power Status for Conn. F    | Power Status for Conn. E    | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |
|                         | 1            | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1 (LSB)    |
| 40005                   | 0            | Analog Input No. 1 (MSB)    | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          | Analog Input No. 1          |
|                         | 1            | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2 (LSB)    |
| 40006                   | 0            | Analog Input No. 2 (MSB)    | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          | Analog Input No. 2          |
|                         | 1            | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3 (LSB)    |
| 40007                   | 0            | Analog Input No. 3 (MSB)    | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          | Analog Input No. 3          |
|                         | 1            | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4 (LSB)    |
| 40008                   | 0            | Analog Input No. 4 (MSB)    | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          | Analog Input No. 4          |
|                         | 1 (Optional) | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Allocated and Reserved      | Power Status for Conn. D    | Power Status for Conn. C    | Power Status for Conn. B    | Power Status for Conn. A    |
| 40009                   | 0 (Optional) | High Alarm for Conn. D      | Low Alarm for Conn. D       | High Alarm for Conn. C      | Low Alarm for Conn. C       | High Alarm for Conn. B      | Low Alarm for Conn. B       | High Alarm for Conn. A      | Low Alarm for Conn. A       |
|                         | 1 (Optional) | Coil No. 7 Status           | Coil No. 6 Status           | Coil No. 5 Status           | Coil No. 4 Status           | Coil No. 3 Status           | Coil No. 2 Status           | Coil No. 1 Status           | Coil No. 0 Status           |
| 40010                   | 0 (Optional) | Coil No. 15 Status          | Coil No. 14 Status          | Coil No. 13 Status          | Coil No. 12 Status          | Coil No. 11 Status          | Coil No. 10 Status          | Coil No. 9 Status           | Coil No. 8 Status           |
|                         | 1 (Optional) | Coil No. 23 Status          | Coil No. 22 Status          | Coil No. 21 Status          | Coil No. 20 Status          | Coil No. 19 Status          | Coil No. 18 Status          | Coil No. 17 Status          | Coil No. 16 Status          |
| 40011                   | 0 (Optional) | Coil No. 31 Status          | Coil No. 30 Status          | Coil No. 29 Status          | Coil No. 28 Status          | Coil No. 27 Status          | Coil No. 26 Status          | Coil No. 25 Status          | Coil No. 24 Status          |

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## Diagnostic Word

| <i>Diagnostic Word Format</i> |               |               |               |                   |                                         |                               |                                          |                                       |
|-------------------------------|---------------|---------------|---------------|-------------------|-----------------------------------------|-------------------------------|------------------------------------------|---------------------------------------|
| BYTE                          | Bit 7         | Bit 6         | Bit 5         | Bit 4             | Bit 3                                   | Bit 2                         | Bit 1                                    | Bit 0                                 |
| 0<br>(Comm. Status)           | Reserved      | Reserved      | Reserved      | Reserved          | Sub-Bus<br>Short Circuit<br>(1 = Error) | Sub-Bus<br>Error<br>(1=Error) | Un-Switched<br>Power Status<br>(1=Error) | Switched<br>Power Status<br>(1=Error) |
| 1<br>(Sub-Bus Status)         | Error<br>Code | Error<br>Code | Error<br>Code | Module<br>Address | Module<br>Address                       | Module<br>Address             | Module<br>Address                        | Module<br>Address                     |

### Byte 0 (Communication Status)

Byte 0, Bit 0 **Switched Power Status** = Bit is high when valve / output power is not present on the comm. module.

Byte 0, Bit 1 **Un-switched Power Status** = Bit is high when node / input power is below 19VDC

Byte 0, Bit 2 **Sub-Bus Error** = Bit is high when there is an error on the sub-bus; see “Byte 1” of diagnostic word for description.

Byte 0, Bit 3 **Sub-Bus Short Circuit** = A short circuit has been detected across the Sub-Bus

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## Diagnostic Word Cont.

Byte 1 (Sub-Bus Status)

Module Address

| Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 | Description                |
|-------|-------|-------|-------|-------|----------------------------|
| 0     | 0     | 0     | 0     | 0     | Communication Module       |
| 0     | 0     | 0     | 0     | 1     | I/O module No. 1           |
| 0     | 0     | 0     | 1     | 0     | I/O module No. 2           |
| 0     | 0     | 0     | 1     | 1     | I/O module No. 3           |
| 0     | 0     | 1     | 0     | 0     | I/O module No. 4           |
| 0     | 0     | 1     | 0     | 1     | I/O module No. 5           |
| 0     | 0     | 1     | 1     | 0     | I/O module No. 6           |
| 0     | 0     | 1     | 1     | 1     | I/O module No. 7           |
| 0     | 1     | 0     | 0     | 0     | I/O module No. 8           |
| 0     | 1     | 0     | 0     | 1     | I/O module No. 9           |
| 0     | 1     | 0     | 1     | 0     | I/O module No. 10          |
| 0     | 1     | 0     | 1     | 1     | I/O module No. 11          |
| 0     | 1     | 1     | 0     | 0     | I/O module No. 12          |
| 0     | 1     | 1     | 0     | 1     | I/O module No. 13          |
| 0     | 1     | 1     | 1     | 0     | I/O module No. 14          |
| 0     | 1     | 1     | 1     | 1     | I/O module No. 15          |
| 1     | 0     | 0     | 0     | 0     | I/O module No. 16          |
| 1     | 0     | 0     | 0     | 1     | Communication Valve driver |
| 1     | 0     | 0     | 1     | 0     | ARM                        |
| 1     | 0     | 0     | 1     | 1     | MCM                        |
| X     | X     | X     | X     | X     | N/A                        |

## Sub-Bus Errors

| Error Code | Bit 7 | Bit 6 | Bit 5 |
|------------|-------|-------|-------|
| 0          | 0     | 0     | 0     |
| 1          | 0     | 0     | 1     |
| 2          | 0     | 1     | 0     |
| 3          | 0     | 1     | 1     |
| 4          | 1     | 0     | 0     |
| 5          | 1     | 0     | 1     |
| 6          | 1     | 1     | 0     |
| 7          | 1     | 1     | 1     |

Error Code 0 = No Errors

Error Code 1 = Lost communications between I/O module and communications module

Error Code 2 = Valve / Output power is below 19VDC

Error Code 3...7 = not defined / reserved

## Appendix

### System Specifications

| <i>Electrical</i>                               |                                                                                                                                                                                       |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Supply Voltage                                  | Valves (2005, 2012, 2035): 24 VDC + 10%, -15%<br>Node and Discrete I/O: 24 VDC $\pm$ 10%                                                                                              |
| Current                                         | Total current on the Auxiliary Power Connector (“Valves and Outputs” and “Node and Inputs” Pins) must not exceed 8 Amps.                                                              |
| Internal Electronic Resettable Fuses            | The Auxiliary Power Connector pins are each internally fused with an electronically resettable fuse. These fuses are set to the maximum current allowable through the G3 electronics. |
| Recommended External Fuse                       | External fuses should be chosen depending upon manifold configuration. Please refer to power consumption chart on page 18 for additional fuse sizing information.                     |
| Spike Suppression                               | Output spike suppression is internally provided for both discrete and valve outputs.                                                                                                  |
| Discrete Outputs                                | Maximum 0.5 Amps per output. All outputs are short circuit protected and have internal spike suppression. Contact factory for higher current requirements.                            |
| Valve Solenoid Coil Output Drivers              | Maximum 0.5 Amps per output. All output points are short circuit protected and have internal spike suppression.                                                                       |
| Operating Temperature for Electronic Components | 23 to 114°F (-5 to 50°C)                                                                                                                                                              |

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## Factory Default Settings

| <i>Description</i>                | <i>Default Settings</i>                                                    |
|-----------------------------------|----------------------------------------------------------------------------|
| IP address                        | 192.168.3.120 in FLASH                                                     |
| MAC Address                       | A unique alpha-numeric code for each node<br>(00-15-24- <b>XX-XX-XX</b> ). |
| Baud Rate                         | 10/100 Mbit per sec. (Autobaud)                                            |
| DHCP/BOOTP                        | Enabled                                                                    |
| Communication Method              | Full/Half Duplex (Auto Detect)                                             |
| Valve Side Output Bytes           | 4 Bytes (32 Allocated Valve Coil Outputs)                                  |
| Discrete I/O Side - I/O Bytes     | Self-Configuring based on the I/O modules installed.                       |
| Discrete Input Starting Address   | 0                                                                          |
| Coil Starting Address             | 320                                                                        |
| Input Register Starting Address   | 0                                                                          |
| Holding Register Starting Address | 20                                                                         |
| Discrete / Coil Bit Reversal      | Disabled                                                                   |
| Register Bit Reversal             | Disabled                                                                   |
| Register Byte Swap                | Disabled                                                                   |
| Comm. Timeout                     | 5000 ms                                                                    |

## Troubleshooting

### Communication Node

| <i>Symptom</i>                                      | <i>Possible Cause</i>                                                                         | <i>Solution</i>                                                                                                                                                            |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The wrong valve solenoid coils are being energized. | Z-Board™ type mismatch. Single Z-Board™ present where double Z-Board™ expected or vice versa. | Check that correct Z-Board™ types are installed. Check that ribbon cable (Output group No. 2) is connected to appropriate valve station. See page 81 for bit mapping rules |
| Valve outputs do not energize.                      | Output power not present or connected improperly on Auxiliary Power connector.                | Check for 24VDC on the +24 VDC (Valves and Outputs) pin of the MINI Auxiliary Power connector of the Comm. module.                                                         |
| Unable to go to the manifold's web page.            | Bad cabling, incorrect computer settings, etc.                                                | Please see pages 63-66.                                                                                                                                                    |
| No Activity/Link LED                                | No network connection                                                                         | Verify the type of cable (straight-thru or crossover) that is being used. Also, verify the wiring of the cable.                                                            |

### I/O Modules

| <i>Symptom</i>                                                                | <i>Possible Cause</i>                                             | <i>Solution</i>                                                                                                     |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Outputs remain on when communication is lost and/or PLC is in "Program" mode. | Communication Fault parameters are set incorrectly. See pages 78. | Check the communication fault/idle mode parameter setting to ensure that it is not set to "Hold Last Output State". |

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## Glossary of Terms

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

| <i>Term</i>                                | <i>Description</i>                                                                                                                                                                                                          |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Address Resolution Protocol (ARP)          | A protocol used to set an IP address using a MAC Address hardware address. This can be done in the command prompt window.                                                                                                   |
| 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.                                                                                                                                               |
| BOOTstrap Protocol (BOOTP)                 | A protocol used to set an IP Address, Subnet Mask, and Gateway using a server.                                                                                                                                              |
| Broadcast                                  | A transmission method that sends packets to multiple unspecified devices.                                                                                                                                                   |
| Byte                                       | 8 bits (1/2 word)                                                                                                                                                                                                           |
| Comm. Fault                                | One or more of the I/O connections have timed out.                                                                                                                                                                          |
| Discrete I / O                             | The inputs / outputs that are available via the “Discrete I/O” side of manifold.                                                                                                                                            |
| Dynamic Host Configuration Protocol (DHCP) | A protocol used by a node to obtain an IP Address, Subnet Mask, and Gateway Address from a server.                                                                                                                          |
| EDS File                                   | <u>E</u> lectronic <u>D</u> ata <u>S</u> heet. A text file, which contains specific product information, definitions of product capabilities and configurable parameters necessary for operation on an Modbus TCP™ network. |
| Explicit Messaging                         | Messaging that sends data to perform request/response functions.                                                                                                                                                            |
| Ground                                     | This term is used to indicate an earth or chassis ground.                                                                                                                                                                   |
| I/O                                        | Any combination of inputs and outputs                                                                                                                                                                                       |
| Idle                                       | A zero (0) length poll message (i.e.: scanner in program mode)                                                                                                                                                              |
| IGMP Snooping                              | See Implicit Messaging                                                                                                                                                                                                      |
| Implicit Messaging                         | A function that that can control I/O messaging to another I/O device.                                                                                                                                                       |
| Internet Group Management Protocol (IGMP)  | A protocol used to keep local switches informed in a multicast group. Nodes that leave the group will no longer be sent packets of information from switches and routers.                                                   |
| Layer 2<br>(data link layer or level)      | The data layer that physically refers to the frame format and addressing. A layer 2 address is an Ethernet address.                                                                                                         |
| Layer 3<br>(network layer or level)        | The data layer that refers to IP and the IP packet format. A layer 3 address is an IP address.                                                                                                                              |
| Link                                       | A group of nodes with different MAC addresses. Segments connected by repeaters make a link. Links that are connected by routers make up a network.                                                                          |
| MAC Address                                | Media Access Connection Address                                                                                                                                                                                             |
| MCM                                        | <u>M</u> anual <u>C</u> onfiguration <u>M</u> odule. A module that allows configurable parameters to be set manually via DIP switches and rotary switches. Not required if software configuration is used.                  |
| Multicast                                  | A transmission where a packet is sent to all possible nodes of a certain subset.                                                                                                                                            |

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## Glossary of Terms Continued

| <i>Term</i>                               | <i>Description</i>                                                                                                                                                                      |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NEMA                                      | National Electrical Manufacturers Association                                                                                                                                           |
| Network                                   | A group of nodes connected by a communication medium through repeaters, router, and gateways.                                                                                           |
| Node                                      | A device on the network that contains a single MAC Address, which can communicate over a subnet.                                                                                        |
| Octet                                     | 8 bits of information. An IP address is made up of four octets.                                                                                                                         |
| ODVA                                      | Open DeviceNet Vendor Association ( <a href="http://www.odva.org">www.odva.org</a> )                                                                                                    |
| Ping                                      | A group of messages sent between a master and a slave that coordinates time.                                                                                                            |
| Ping Request                              | A request to see if a device has received a message.                                                                                                                                    |
| Ping Response                             | Response to a ping request.                                                                                                                                                             |
| Requested Packet Interval (RPI)           | The frequency measure of the required transmission of data from the originating device to the target device.                                                                            |
| RSNetWorx                                 | Rockwell Automation's configuration software                                                                                                                                            |
| Segment                                   | Nodes connected to a continuous section of communication media.                                                                                                                         |
| Simple Network Management Protocol (SNMP) | A protocol used to monitor Ethernet devices, switches, routers, and networks connected by communication media.                                                                          |
| Sinking (NPN)                             | Method of connecting electrical circuits in which the zero (0) volt DC side is switched and the common is positive                                                                      |
| Sourcing (PNP)                            | Method of connecting electrical circuits in which the positive side is switched and the common is zero (0) volts DC.                                                                    |
| Status Input bit                          | A bit in the input table that reports the health of a corresponding output. Indicates short circuit or open coil (load) diagnostics                                                     |
| Subnet                                    | Nodes using the same protocol and shared media access arbitration.                                                                                                                      |
| System                                    | Contains one or more domains.                                                                                                                                                           |
| Time to Live (TTL)                        | A method used in best-effort delivery systems to negate endlessly looping packets.                                                                                                      |
| Unicast                                   | A transmission where a packet is sent to a single node.                                                                                                                                 |
| Word                                      | 2 Bytes (16 bits)                                                                                                                                                                       |
| Z-Board™                                  | Circuit board installed in the valve manifold which electrically connects the valve solenoid to the electrical /electronics interface. Available in single or double solenoid versions. |



# G3 Series Modbus TCP Technical Manual

## Technical Support

For technical support, contact your local Numatics distributor. If further information is required, please call Numatics Inc. Technical Support Department at (248) 596-3333.

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

Information on device files, technical manuals, local distributors, and other Numatics, Inc. products and support issues can be found on the Numatics, Inc.'s. WEB site at [www.numatics.com](http://www.numatics.com)