INSTRUCTION MANUAL

**MultiGard 5000® System Integration**

# Modbus/TCP Gateway Option

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**Manufactured by**
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**PITTSBURGH, PENNSYLVANIA 15230**

3013-1048 Rev. 0

# MSA Permanent Instrument Warranty

**1. Warranty –** Seller warrants that this product will be free from mechanical defect or faulty workmanship for a period of eighteen (18) months from date of shipment or one (1) year from installation, whichever occurs first, provided it is maintained and used in accordance with Seller's instructions and / or recommendations. This warranty does not apply to expendable or consumable parts whose normal life expectancy is less than one (1) year such as, but not limited to, non-rechargeable batteries, filament units, filter, lamps, fuses etc. The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning the product. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass on to the Purchaser all warranties of manufacturers of such components. **THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**

**2. Exclusive Remedy –** It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the repair and / or replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective. Replacement equipment and /or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully repair any nonconforming product shall not cause the remedy established hereby to fail of its essential purpose.

**3. Exclusion of Consequential Damage –** Purchaser specifically understands and agrees that under no circumstances will Seller be liable to Purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of nonoperation of the goods. This exclusion is applicable to claims for breach of warranty, tortious conduct or any other cause of action against seller.

## 1.0 Introduction

This MultiGard 5000 System Integration Manual for the Modbus/TCP Gateway Option provides the information necessary for a customer or a third party integrator to successfully connect the system onto a larger industrial network using Modbus/TCP protocol. This interface is provided by an Industrial Control Communications, Inc. (ICC) ETH-1000 Ethernet Gateway added into the MultiGard 5000 system along with an Ethernet switch.

This document is intended to cover all six models of the MultiGard 5000 System that are factory configured at MSA from two platforms. The models are 8 point, 16 point, dual 8 point, 24 point, 32 point, and dual 16 point. Keep the purchased model and its size in mind while using this document.

The MultiGard 5000 system shall have the Compact Logix L24 processor installed as a standard offering. The L24 processor is capable of using this Modbus/TCP gateway option.

The MultiGard 5000 System is intended to be a complete stand-alone gas detection system and was designed to be the *only point of control* for its many features and user changeable parameters. For safety reasons MSA cannot allow the customer and third parties to have unrestricted access to the MultiGard System programming.

## 2.0 References

The user of this document should be familiar with Modbus addressing and compatible networks. The following references may be used with this manual:

- [MSA] Field Wiring Diagram, Multigard System (Drawing)
  [Delivered with a MultiGard System; part of the 3-ring binder.]
- [MSA] MultiGard System Instruction Manual - ASK 3103-35
  [Delivered with a MultiGard System; part of the 3-ring binder.]
- [MSA] MultiGard System Factory Configuration Sheets
  [Delivered with a MultiGard System; part of the 3-ring binder.]

References not supplied by MSA:

- Modbus/TCP protocol documentation and network reference materials
- Instruction Manuals – Appropriate to any third party equipment (hardware and software)

## 3.0 Modbus/TCP Communication Interface

The ICC ETH-1000 Ethernet gateway is configured for the appropriate Multigard 5000 system model at MSA during system assembly and test. This includes both the hardware and gateway configuration.

The gateway updates itself continuously with data from the Compact Logix L24 processor using Ethernet/IP protocol via the Ethernet switch.

Data then becomes available in Modbus/TCP protocol from the ICC ETH-1000 Ethernet gateway via the Ethernet switch. The gateway is a multiprotocol device using its single Ethernet port operating per the 10/100Base-T standard.

## 3.1 Interface Cables

The Multigard system L24 processor and the ICC ETH-1000 gateway are connected to an unmanaged Ethernet switch using patch cables of CAT-5e or better grade. See the Multigard 5000 system drawings for details on the hardware installation.

Also use a CAT-5e or better grade patch cable to connect to the Ethernet switch to the external network providing a Modbus/TCP connection from the Multigard system to other customer equipment.

## 3.2 Ethernet Addresses

The Ethernet addresses associated with the MultiGard 5000 System and the ICC ETH-1000 gateway must be set at MSA during factory configuration.

The addresses that will be set into the processor and gateway are from customer (or responsible third party) supplied information as follows:

- IP Address for the ICC ETH-1000 Gateway
- IP Address for the Multigard system Allen-Bradley L24 processor
- Subnet Mask common to this Ethernet network
- Default Gateway common to this Ethernet network
  NOTE: To satisfy the ETH-1000 the Default Gateway address must begin with 1-223 and it cannot consist of all zeros. If there is no desire to communicate over a default gateway, then the address provided should not physically exist on the network.

The addresses will be placed onto labels located inside the MultiGard 5000 System enclosure for easy reference as well as in the system configuration document (part of the 3-ring binder).

## 4.0 Guidelines For Accessing Data Table Addresses

Remember the following key items about the MultiGard 5000 System when using these tables to decide what is applicable:

- All Modbus data is read-only (holding register, 4X, or read input, 1X) except for the acknowledge items listed in Table 6 (force single coil, 0X).
- Model: 8 point, 16 point, dual 8 point, 24 point, 32 point, or dual 16 point
- Single or Dual: Single sequencer MultiGard 5000 Systems can have 4 sensors (#1 - #4) installed. Dual sequencer MultiGard 5000 Systems can have 2 sensors (#1, #2) on Sequencer A and 2 sensors (#3, #4) on Sequencer B. *Note that in the following tables reference to Single Sequencer is identical to Dual Sequencer A. In the tables this is represented as "Sequencer (A)".*
- Options: The User Configured Outputs (UCO) can be supplied as UCO #1 only or both UCO #1 & UCO #2 together.
- Additional information necessary to properly decode the data is supplied under each table if applicable.
- All analog data will automatically be in engineering units based on the MultiGard 5000 System factory configuration. No additional scaling is required.
- It may be desirable to read blocks of words out of the gateway instead of only the specific addresses listed in the tables. This depends on the interfacing requirements and the software capabilities of the third party product. If this is done, be sure to only use the addresses listed in this document for presentation purposes.

| ⚠ CAUTION |
| --- |
| Use only data table addresses defined in this manual. The use of undefined addresses will produce an incorrect presentation. Data table addresses not defined are reserved for MSA use only. |

- Customers who use bi-directional communications with the controller must avoid writing into addresses not referenced in this document.

| ⚠ WARNING |
| --- |
| Do not write into undefined addresses. Doing so may prevent the system from detecting gas. Data table addresses not defined are reserved for MSA use only.<br><br>**Failure to follow this warning can result in serious personal injury or death.** |

- The end user must verify all data transfers following the system integration effort.

- See Table 1 below, and its associated warning, for important information about

setting up an end user watchdog function to monitor the communications integrity between the Multigard 5000 System and the ETH-1000 gateway.

**Table 1: Multigard 5000 System to ETH-1000 Communication Status**

| Gateway | Address | Comments |
|---|---|---|
| **Communications Status Register:** | 40555 | Changing Value** – Normal<br>Stopped Value** – Failed |

** This value changes from 0 to 59 and is the seconds from the processor clock buffered through the Multigard program. The absolute value of the register has no direct significance to its use as a watchdog function.

In the end user's system, monitor this register for continuous activity. If it stops changing for a predetermined amount of time, declare a communications failure and flag all other data coming through this gateway as outdated.

Only when the above register is continuously changing can the other data presented via the gateway be considered current.

| ⚠ CAUTION |
|---|
| To ensure communications integrity between the Multigard 5000 System and the ICC ETH-1000 gateway the communications status register must be monitored and logically implemented as a watchdog function by the end user. Failure to implement the watchdog function can result in the presentation of outdated data. |

## 5.0 Multigard System Data Table Addresses

The most useful MultiGard 5000 System data will be defined in Tables 2 through 8 along with corresponding Modbus/TCP addresses. These addresses will allow for the presentation of gas detection information and other status.

**Table 2: Sensor Gas Levels**

| Point # | Sensor 1 | | Sensor 2 | | Sensor 3 | | Sensor 4 | |
|---|---|---|---|---|---|---|---|---|
| **1** | 40001 | 40002 | 40065 | 40066 | 40129 | 40130 | 40193 | 40194 |
| **2** | 40003 | 40004 | 40067 | 40069 | 40131 | 40132 | 40195 | 40196 |
| **3** | 40005 | 40006 | 40069 | 40070 | 40133 | 40134 | 40197 | 40198 |
| **4** | 40007 | 40008 | 40071 | 40072 | 40135 | 40136 | 40199 | 40200 |
| **5** | 40009 | 40010 | 40073 | 40074 | 40137 | 40138 | 40201 | 40202 |
| **6** | 40011 | 40012 | 40075 | 40076 | 40139 | 40140 | 40203 | 40204 |
| **7** | 40013 | 40014 | 40077 | 40078 | 40141 | 40142 | 40205 | 40206 |
| **8** | 40015 | 40016 | 40079 | 40080 | 40143 | 40144 | 40207 | 40208 |
| **9** | 40017 | 40018 | 40081 | 40082 | 40145 | 40146 | 40209 | 40210 |
| **10** | 40019 | 40020 | 40083 | 40084 | 40147 | 40148 | 40211 | 40212 |
| **11** | 40021 | 40022 | 40085 | 40086 | 40149 | 40150 | 40213 | 40214 |
| **12** | 40023 | 40024 | 40087 | 40088 | 40151 | 40152 | 40215 | 40216 |
| **13** | 40025 | 40026 | 40089 | 40090 | 40153 | 40154 | 40217 | 40218 |
| **14** | 40027 | 40028 | 40091 | 40092 | 40155 | 40156 | 40219 | 40220 |
| **15** | 40029 | 40030 | 40093 | 40094 | 40157 | 40158 | 40221 | 40222 |
| **16** | 40031 | 40032 | 40095 | 40096 | 40159 | 40160 | 40223 | 40224 |
| **17** | 40033 | 40034 | 40097 | 40098 | 40161 | 40162 | 40225 | 40226 |
| **18** | 40035 | 40036 | 40099 | 40100 | 40163 | 40164 | 40227 | 40228 |
| **19** | 40037 | 40038 | 40101 | 40102 | 40165 | 40166 | 40229 | 40230 |
| **20** | 40039 | 40040 | 40103 | 40104 | 40167 | 40168 | 40231 | 40232 |
| **21** | 40041 | 40042 | 40105 | 40106 | 40169 | 40170 | 40233 | 40234 |
| **22** | 40043 | 40044 | 40107 | 40108 | 40171 | 40172 | 40235 | 40236 |
| **23** | 40045 | 40046 | 40109 | 40110 | 40173 | 40174 | 40237 | 40238 |
| **24** | 40047 | 40048 | 40111 | 40112 | 40175 | 40176 | 40239 | 40240 |
| **25** | 40049 | 40050 | 40113 | 40114 | 40177 | 40178 | 40241 | 40242 |
| **26** | 40051 | 40052 | 40115 | 40116 | 40179 | 40180 | 40243 | 40244 |
| **27** | 40053 | 40054 | 40117 | 40118 | 40181 | 40182 | 40245 | 40246 |
| **28** | 40055 | 40056 | 40119 | 40120 | 40183 | 40184 | 40247 | 40248 |
| **29** | 40057 | 40058 | 40121 | 40122 | 40185 | 40186 | 40249 | 40250 |
| **30** | 40059 | 40060 | 40123 | 40124 | 40187 | 40188 | 40251 | 40252 |
| **31** | 40061 | 40062 | 40125 | 40126 | 40189 | 40190 | 40253 | 40254 |
| **32** | 40063 | 40064 | 40127 | 40128 | 40191 | 40192 | 40255 | 40256 |

Gas sensor levels for each point among the active sensors use a pair of consecutive addresses. They are compliant with the IEEE 754 Floating Point format that is 32 bit single precision. One decimal place is passed through the gateway.

## Table 3: Points 1-32 Alarm States

| | | Sensor 1 | | | Sensor 2 | | | Sensor 3 | | | Sensor 4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Point # | Trouble | Warning | Alarm | Trouble | Warning | Alarm | Trouble | Warning | Alarm | Trouble | Warning | Alarm |
| 1 | 14098 | 14099 | 14100 | 14610 | 14611 | 14612 | 15122 | 15123 | 15124 | 15634 | 15635 | 15636 |
| 2 | 14130 | 14131 | 14132 | 14642 | 14643 | 14644 | 15154 | 15155 | 15156 | 15666 | 15667 | 15668 |
| 3 | 14162 | 14163 | 14164 | 14674 | 14675 | 14676 | 15186 | 15187 | 15188 | 15698 | 15699 | 15700 |
| 4 | 14194 | 14195 | 14196 | 14706 | 14707 | 14708 | 15218 | 15219 | 15220 | 15730 | 15731 | 15732 |
| 5 | 14226 | 14227 | 14228 | 14738 | 14739 | 14740 | 15250 | 15251 | 15252 | 15762 | 15763 | 15764 |
| 6 | 14258 | 14259 | 14260 | 14770 | 14771 | 14772 | 15282 | 15283 | 15284 | 15794 | 15795 | 15796 |
| 7 | 14290 | 14291 | 14292 | 14802 | 14803 | 14804 | 15314 | 15315 | 15316 | 15826 | 15827 | 15828 |
| 8 | 14322 | 14323 | 14324 | 14834 | 14835 | 14836 | 15346 | 15347 | 15348 | 15858 | 15859 | 15860 |
| 9 | 14354 | 14355 | 14356 | 14866 | 14867 | 14868 | 15378 | 15379 | 15380 | 15890 | 15891 | 15892 |
| 10 | 14386 | 14387 | 14388 | 14898 | 14899 | 14900 | 15410 | 15411 | 15412 | 15922 | 15923 | 15924 |
| 11 | 14418 | 14419 | 14420 | 14930 | 14931 | 14932 | 15442 | 15443 | 15444 | 15954 | 15955 | 15956 |
| 12 | 14450 | 14451 | 14452 | 14962 | 14963 | 14964 | 15474 | 15475 | 15476 | 15986 | 15987 | 15988 |
| 13 | 14482 | 14483 | 14484 | 14994 | 14995 | 14996 | 15506 | 15507 | 15508 | 16018 | 16019 | 16020 |
| 14 | 14514 | 14515 | 14516 | 15026 | 15027 | 15028 | 15538 | 15539 | 15540 | 16050 | 16051 | 16052 |
| 15 | 14546 | 14547 | 14548 | 15058 | 15059 | 15060 | 15570 | 15571 | 15572 | 16082 | 16083 | 16084 |
| 16 | 14578 | 14579 | 14580 | 15090 | 15091 | 15092 | 15602 | 15603 | 15604 | 16114 | 16115 | 16116 |
| 17 | 16146 | 16147 | 16148 | 16658 | 16659 | 16660 | 17170 | 17171 | 17172 | 17682 | 17683 | 17684 |
| 18 | 16178 | 16179 | 16180 | 16690 | 16691 | 16692 | 17202 | 17203 | 17204 | 17714 | 17715 | 17716 |
| 19 | 16210 | 16211 | 16212 | 16722 | 16723 | 16724 | 17234 | 17235 | 17236 | 17746 | 17747 | 17748 |
| 20 | 16242 | 16243 | 16244 | 16754 | 16755 | 16756 | 17266 | 17267 | 17268 | 17778 | 17779 | 17780 |
| 21 | 16274 | 16275 | 16276 | 16786 | 16787 | 16788 | 17298 | 17299 | 17300 | 17810 | 17811 | 17812 |
| 22 | 16306 | 16307 | 16308 | 16818 | 16819 | 16820 | 17330 | 17331 | 17332 | 17842 | 17843 | 17844 |
| 23 | 16338 | 16339 | 16340 | 16850 | 16851 | 16852 | 17362 | 17363 | 17364 | 17874 | 17875 | 17876 |
| 24 | 16370 | 16371 | 16372 | 16882 | 16883 | 16884 | 17394 | 17395 | 17396 | 17906 | 17907 | 17908 |
| 25 | 16402 | 16403 | 16404 | 16914 | 16915 | 16916 | 17426 | 17427 | 17428 | 17938 | 17939 | 17940 |
| 26 | 16434 | 16435 | 16436 | 16946 | 16947 | 16948 | 17458 | 17459 | 17460 | 17970 | 17971 | 17972 |
| 27 | 16466 | 16467 | 16468 | 16978 | 16979 | 16980 | 17490 | 17491 | 17492 | 18002 | 18003 | 18004 |
| 28 | 16498 | 16499 | 16500 | 17010 | 17011 | 17012 | 17522 | 17523 | 17524 | 18034 | 18035 | 18036 |
| 29 | 16530 | 16531 | 16532 | 17042 | 17043 | 17044 | 17554 | 17555 | 17556 | 18066 | 18067 | 18068 |
| 30 | 16562 | 16563 | 16564 | 17074 | 17075 | 17076 | 17586 | 17587 | 17588 | 18098 | 18099 | 18100 |
| 31 | 16594 | 16595 | 16596 | 17106 | 17107 | 17108 | 17618 | 17619 | 17620 | 18130 | 18131 | 18132 |
| 32 | 16626 | 16627 | 16628 | 17138 | 17139 | 17140 | 17650 | 17651 | 17652 | 18162 | 18163 | 18164 |

Each register will present either a “0” or “1”. Where, 0 = Normal and 1 = Condition Exists!

**Table 4: Flow Status**

| Point # | System A | | System B | |
|---|---|---|---|---|
| | Sample | Bypass | Sample | Bypass |
| 1 | 18193 | 18257 | 18321 | 18353 |
| 2 | 18194 | 18258 | 18322 | 18354 |
| 3 | 18195 | 18259 | 18323 | 18355 |
| 4 | 18196 | 18260 | 18324 | 18356 |
| 5 | 18197 | 18261 | 18325 | 18357 |
| 6 | 18198 | 18262 | 18326 | 18358 |
| 7 | 18199 | 18263 | 18327 | 18359 |
| 8 | 18200 | 18264 | 18328 | 18360 |
| 9 | 18201 | 18265 | 18329 | 18361 |
| 10 | 18202 | 18266 | 18330 | 18362 |
| 11 | 18203 | 18267 | 18331 | 18363 |
| 12 | 18204 | 18268 | 18332 | 18364 |
| 13 | 18205 | 18269 | 18333 | 18365 |
| 14 | 18206 | 18270 | 18334 | 18366 |
| 15 | 18207 | 18271 | 18335 | 18367 |
| 16 | 18208 | 18272 | 18336 | 18368 |
| 17 | 18225 | 18289 | | |
| 18 | 18226 | 18290 | | |
| 19 | 18227 | 18291 | | |
| 20 | 18228 | 18292 | | |
| 21 | 18229 | 18293 | | |
| 22 | 18230 | 18294 | | |
| 23 | 18231 | 18295 | | |
| 24 | 18232 | 18296 | | |
| 25 | 18233 | 18297 | | |
| 26 | 18234 | 18298 | | |
| 27 | 18235 | 18299 | | |
| 28 | 18236 | 18300 | | |
| 29 | 18237 | 18301 | | |
| 30 | 18238 | 18302 | | |
| 31 | 18239 | 18303 | | |
| 32 | 18240 | 18304 | | |

Each register will present either a “0” or “1”. Where, 0 = Normal and 1 = Condition Exists!

**Table 5: Miscellaneous**

| | Address | Comments |
|---|---|---|
| **System A Position:** | 40525 | Integer value = Point # |
| **System B Position:** | 40526 | Integer value = Point # |
| **System A Operation Mode:** | 40527 | 0 = Sampling<br>1 = Manual Calibration<br>2 = Auto-Standardization |
| **System B Operation Mode:** | 40528 | 0 = Sampling<br>1 = Manual Calibration<br>2 = Auto-Standardization |
| **Factory Defaults Forced:** | 18848 | 0 = Normal 1 = Forced! |
| **Sensor 1 Gas Level:** | 40529 40530 * | Uncorrected, scaled, continuous |
| **Sensor 2 Gas Level:** | 40531 40532 * | Uncorrected, scaled, continuous |
| **Sensor 3 Gas Level:** | 40533 40534 * | Uncorrected, scaled, continuous |
| **Sensor 4 Gas Level:** | 40535 40536 * | Uncorrected, scaled, continuous |

* Gas sensor levels for each point among the active sensors use a pair of consecutive addresses. They are compliant with the IEEE 754 Floating Point format that is 32 bit single precision. One decimal place is passed through the gateway.

**Table 6: Common Alarming**

| | System A | System B | |
|---|---|---|---|
| **Horn Relay Image:** | 18584 | 18612 | Fixed/Non-failsafe<br>0=Open 1=Closed |
| **Trouble Relay Image:** | 18577 | 18609 | Fixed/failsafe<br>0=Closed 1=Open |
| **Warning Relay Image:** | 18578 | 18610 | Default Non-failsafe*<br>0=Open 1=Closed |
| **Alarm Relay Image:** | 18579 | 18611 | Default Non-failsafe*<br>0=Open 1=Closed |

* User Changeable Parameter - State may need to be reversed depending on usage.

**Table 7: Horn & Condition Acknowledges**

| | Sequencer (A) | Sequencer B | Comments |
|---|---|---|---|
| **Horn Acknowledge:** (Push Button) | 08906 | 08941 | Coil - Write (Momentary action is necessary.) |
| **Condition Acknowledge:** (Push Button) | 08656 | 08683 | Coil - Write (Momentary action is necessary.) |

**Table 8: User Configured Output (UCO) Relay Images**

| Output # | UCO#1 | UCO#2 | Output # | UCO#1 | UCO#2 |
|---|---|---|---|---|---|
| **1** | 18705 | 18769 | **17** | 18737 | 18801 |
| **2** | 18706 | 18770 | **18** | 18738 | 18802 |
| **3** | 18707 | 18771 | **19** | 18739 | 18803 |
| **4** | 18708 | 18772 | **20** | 18740 | 18804 |
| **5** | 18709 | 18773 | **21** | 18741 | 18805 |
| **6** | 18710 | 18774 | **22** | 18742 | 18806 |
| **7** | 18711 | 18775 | **23** | 18743 | 18807 |
| **8** | 18712 | 18776 | **24** | 18744 | 18808 |
| **9** | 18713 | 18777 | **25** | 18745 | 18809 |
| **10** | 18714 | 18778 | **26** | 18746 | 18810 |
| **11** | 18715 | 18779 | **27** | 18747 | 18811 |
| **12** | 18716 | 18780 | **28** | 18748 | 18812 |
| **13** | 18717 | 18781 | **29** | 18749 | 18813 |
| **14** | 18718 | 18782 | **30** | 18750 | 18814 |
| **15** | 18719 | 18783 | **31** | 18751 | 18815 |
| **16** | 18720 | 18784 | **32** | 18752 | 18816 |

In the table above: 0 = Open 1 = Closed (Default Non-failsafe*)
* User Changeable Parameter - State may need to be reversed depending on usage.

**Table 9: Particulate Status for AQGard**

| | Sequencer (A) | Comments |
|---|---|---|
| **Particulate Status:** | 40561 | AQGard Users Only |

0 = Normal , 1 = Flow Ok, Laser Bad, 2 = Flow Bad, Laser Ok, 3 = Flow Bad, Laser Bad, 4 = Error