

# Model GMPID - Graphite PID Module



- DEDICATED SINGLE AND DUAL PID MODULES FOR THE GRAPHITE PRODUCTS
- FULLY ISOLATED DESIGN PROVIDES RELIABLE OPERATION
- PID CONTROL WITH REDUCED OVERSHOOT
- UNIVERSAL INPUTS ACCEPT TC, RTD, 0-10 V and 0/4-20 mA SIGNALS
- ON DEMAND AUTO-TUNING OF PID SETTINGS
- DC ANALOG OUTPUT (OPTIONAL, GMP1 ONLY)
- HEATER CURRENT INPUT (OPTIONAL) ENSURES DETECTION OF HEATER CIRCUIT FAILURE
- CONFIGURED USING CRIMSON® SOFTWARE (VERSION 3.0 OR LATER)



FOR USE IN HAZARDOUS LOCATIONS:  
 Class I, Division 2, Groups A, B, C, and D  
 T4



II 3 G Ex nA IIC T4 Gc  
 -40°C ≤ T<sub>AMB</sub> ≤ 75°C  
 DEMKO 14 ATEX 1387X  
 IECEx UL 15.0035X



**For Model No. GMP1SA00, GMP1SM00, GMP2S000, and GMP2SM00 Only**

**For Model No. GMP1SA00, GMP1SM00, GMP2S000, and GMP2SM00 Only**

## GENERAL DESCRIPTION

The Model GMPID modules are full featured PID controllers designed for use with the Graphite® products. The GMP1 is a single loop controller, while the GMP2 is a dual loop controller. The design of the system provides a true modular PID control platform for multi-zone control applications. The modules can accept a wide range of thermocouple, RTD, 0-10 V, 0/4-20 mA signals. With multiple discrete outputs, plus an optional analog output (GMP1 only), the GMPID modules can perform virtually any combination of time-proportioning or linear control for heat, cool, or heat/cool applications. The discrete outputs may also be assigned to one of seven internal soft alarms. The GMP1's optional linear output can be assigned to transmit virtually any internal variable.

The modules connect and communicate via proprietary USB connection to the various Graphite host devices. The Graphite host devices, equipped with serial ports as well as an Ethernet port(s), allows the system to share data with PCs, PLCs, and SCADA systems. The maximum number of modules varies for each Graphite host device, see specific models for details.

Once programmed, the module will continue to operate/control independent of the Graphite host device as long as power is applied. Remove power from the host device before installing or replacing any modules.

The GMPID modules are available with various discrete output combinations, including relays, and open drain MOSFETs. For applications requiring large loads to be controlled, several DIN rail mount relays are available.

The modules can operate in On/Off, P, PI, or PID control mode, and use an on-demand Auto-Tune that establishes the tuning constants. The PID constants may be fine-tuned through the serial or Ethernet interface. The modules employ a unique overshoot suppression feature, which allows the quickest response without excessive overshoot. The modules can also be operated in manual mode, providing the operator with direct control of the output.

## CONFIGURATION

The Graphite is configured with Windows® compatible Crimson® software. The software is an easy to use, graphical interface which provides a means of configuration and commissioning of new systems, as well as routine module re-calibration.

## ALARMS

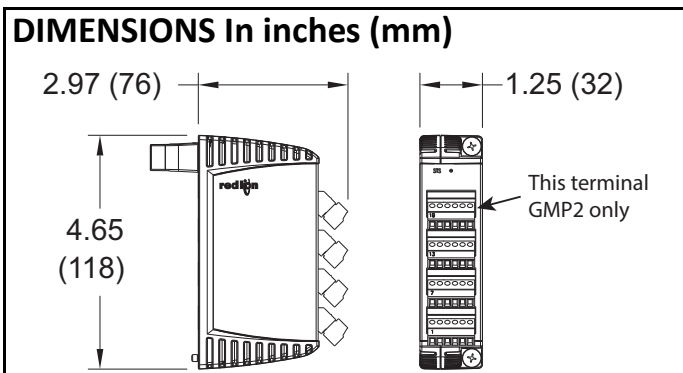
Each loop within the modules has seven internal "soft" alarms, which can be assigned to trigger any output. This includes four process alarms, two heater current, and one input fault alarm.

## ANALOG OUTPUT OPTION (GMP1 ONLY)

The optional DC Analog Output (10 V or 20 mA) can be independently configured and scaled for control or re-transmission purposes.

## HEATER CURRENT MONITOR OPTION

The optional Heater Current Monitor input is useful for early warning of heater degradation, or heater circuit failure. The input connects to a current transformer with an output of 100 mA AC to ensure that proper heater current is present when the control output is on, and that little or no current is present when the output is off. This provides immediate warning of a circuit short or open, instead of waiting for a high or low temperature shutdown alarm.



## SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in this literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the unit.



**CAUTION: Risk of Danger.**

Read complete instructions prior to installation and operation of the unit.



WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR AREA IS KNOWN TO BE NON-HAZARDOUS.



WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

## SPECIFICATIONS

1. **POWER:** Power will be supplied by the Graphite host device. Some modules, depending on usage may consume high levels of power. This may limit the total number of modules that can be installed on a single Graphite host. Check the Graphite module and Graphite host data sheets for specific usage and power

**GMPID1 Max Power:** 3.3 W

**GMPID2 Max Power:** 2.7 W

2. **LEDs\*:**

STS - Status LED shows module condition.

OP1, OP2, OP3, OP4 - Indicate status of outputs 1, 2, 3, and 4

ALM, or AL1 and AL2 - Alarm LEDs are lit during any internal alarm condition

\* Default configuration.

3. **MEMORY:** Non-volatile memory retains all programmable parameters.

4. **INPUT:**

**GENERAL:**

Sample Time: 50 msec (20 Hz)

Common Mode Rejection: >110 dB, 50/60 Hz

Normal Mode Rejection: >50 dB, 50/60 Hz

Temperature Coefficient: 0.01%/°C

Step Response Time: 100 msec typ., 200 msec max

**THERMOCOUPLE INPUTS:**

Types: T, E, J, K, R, S, B, N, C

Input Impedance: 20 M Ω

Lead Resistance Effect: 0.25 μV/Ω

Cold Junction Compensation: Less than ±1 °C typical (±1.5 °C max) over -40 to 75 °C ambient temperature

Resolution: 0.1°

TYPE	MEASUREMENT RANGE	WIRE COLOR	
		ANSI	BS 1843
T	-200 to +400 °C -328 to +752 °F	(+) Blue (-) Red	(+) White (-) Blue
E	-200 to +730 °C -328 to +1346 °F	(+) Violet (-) Red	(+) Brown (-) Blue
J	-200 to +760 °C -328 to +1400 °F	(+) White (-) Red	(+) Yellow (-) Blue
K	-200 to +1350 °C -328 to +2462 °F	(+) Yellow (-) Red	(+) Brown (-) Blue
R	0 to +1768 °C +32 to +3214 °F	No Standard	(+) White (-) Blue
S	0 to +1768 °C +32 to +3214 °F	No Standard	(+) White (-) Blue
B	+149 to +1820 °C +300 to +3308 °F	No Standard	No Standard
N	-200 to +1300 °C -328 to +2372 °F	(+) Orange (-) Red	(+) Orange (-) Blue
C	0 to +2315 °C +32 to +4199 °F	No Standard	No Standard
W5/W6	0 to +2315 °C +32 to +4199 °F	No Standard	No Standard
mV	0 mV to 50 mV	N/A	N/A

**RTD INPUTS:**

Type: 2 or 3 wire

Excitation: 150 μA

Lead Resistance: 15 Ω Max

Resolution: 1 or 0.1°

TYPE	INPUT TYPE	RANGE
385	100 Ω platinum, Alpha = .00385	-200 to +600°C -328 to +1100°F
392	100 Ω platinum, Alpha = .003919	-200 to +600°C -328 to +1100°F
672	120 Ω nickel, Alpha = .00672	-80 to +215°C -112 to +419°F

**PROCESS INPUT:**

INPUT RANGE	ACCURACY	IMPEDANCE	MAX CONTINUOUS OVERLOAD	RESOLUTION
10 V	0.1% span	1 M Ohm	50 V	16 bit
20 mA	0.1% span	10 Ohm	100 mA	16 bit

5. **PROBE BREAK RESPONSE:** Upscale drive, Input Fault Alarm bit set high, ALx LED illuminates.

6. **TEMPERATURE INDICATION ACCURACY:** ± (0.3% of span, +1 °C). Includes NIST conformity, cold junction effect, A/D conversion errors, temperature coefficient and linearization conformity at 23 °C after 20 minute warm up.

7. **ISOLATION LEVEL:** 500 Vrms @ 50/60 Hz for 1 minute between the following:

OP1

OP2

OP3

OP4

Linear Output (GMP1 only)

Signal Input 1 and HCM

Signal Input 2 and HCM (GMP2 only)

Power Supply Input

8. **COMMUNICATIONS:** Provided by the Graphite host device

9. **A/D CONVERTER:** 16 bit resolution

10. **DISCRETE OUTPUTS:**

**GMP1:** Outputs 1 and 2 available as Solid State NFET or Form A relay. Output 3 is an SSR NFET or Form C relay.

**GMP2:** Outputs 1 through 4 available as Form A relay or Solid State NFET.

**Solid State Output:**

Type: Switched DC, N Channel open drain MOSFET

Current Rating: 1 A max

VDS ON: 0.3 V @ 1 A

VDS MAX: 30 VDC

Offstate Leakage Current: 0.5 mA max

**Form A Relay Output:**

Type: N.O.

Current Rating: 3 Amps @ 125 VAC or 30 VDC (resistive load)  
1/10 HP @ 125 VAC

Life Expectancy: 200,000 cycles at maximum load rating. (Decreasing load, increasing cycle time, and use of surge suppression such as RC snubbers increases life expectancy.)

**Form C Relay Output:**

Type: SPDT

Current Rating: 5 Amps @ 125 VAC or 28 VDC (resistive load)  
1/8 HP @ 125 VAC

Life Expectancy: 100,000 cycles at maximum load rating. (Decreasing load, increasing cycle time, and use of surge suppression such as RC snubbers increases life expectancy.)

11. **CONTROL MODES:**

Control: On/Off, P, PI, or PID

Output: Time proportioning or linear (GMP1 only)

Cycle Time: Programmable from 0.0 to 60.0 sec

Auto-Tune: When selected, sets proportional band, integral time, derivative time values, and output dampening time

Probe Break Action: Programmable response

Sensor Fail Response: Upscale

**12.ALARMS:**

Modes:

- Manual
- Absolute High Acting
- Absolute Low Acting
- Deviation High Acting
- Deviation Low Acting
- Inside Band Acting
- Outside Band Acting

Reset Action: Programmable; automatic or latched

Standby Mode: Programmable; enable or disable

Hysteresis: Programmable

Sensor Fail Response: Upscale

**13.ANALOG DC OUTPUT (optional, GMP1 only):**

Selectable/programmable for 0-10 VDC, 0-20 mA, or 4-20 mA

Resolution:

- Voltage: 500  $\mu$ V
- Current: 1  $\mu$ A

Accuracy:

- 0.1% of full scale (18 to 28 °C)
- 0.2% of full scale (-40 to 75 °C)

Update Time: 0.0 to 60.0 sec

Compliance (for current output only): 500  $\Omega$  max.

Minimum load (voltage output only): 10 K $\Omega$  min.

Outputs are software selectable for either 10 V or 20 mA. The output range may be field calibrated to yield approximate 10% overrange and a small underrange (negative) signal.

**14.HEATER CURRENT MONITOR INPUT (optional):**

Type: 300 V max, 50 A max. Single phase, full wave monitoring of load currents

Input: 100 mA max. input for use with external current transformers

Input Resistance: 5  $\Omega$

Accuracy:  $\pm$ 3.0% full scale, 5 to 100% of range

Frequency: 50 to 400 Hz

Minimum output on time for break alarm: 350 msec

*Note: To ensure isolation to SELV circuits, use a UL Listed current transformer.*

**15.ENVIRONMENTAL CONDITIONS:**

Operating Temperature Range:

- GMP1RA00, GMP1RM00, GMP2R000, and GMP2RM00: -40 to 70 °C
- GMP1SA00, GMP1SM00, GMP2S000, and GMP2SM00: -40 to 75 °C

Operating temperature is limited to lowest range among equipment used in your Graphite system. Consult the user manual or [www.redlion.net/OpTemp](http://www.redlion.net/OpTemp) for further details.

Storage Temperature Range: -40 to +85 °C

Shock to IEC 68-2-27: Operational 40 g (10 g, modules w/relays)

Operating and Storage Humidity: 0 to 85% max. Relative humidity, non-condensing.

Altitude: Up to 2000 meters

**16.CERTIFICATIONS AND COMPLIANCES:**

**CE Approved**

EN 61326-1 Immunity to Industrial Locations

IEC/EN 61010-1

RoHS Compliant

**ATEX Approved (GMP1SA00, GMP1SM00, GMP2S000, and GMP2SM00 only)**

Ⓜ II 3 G Ex nA IIC T4 Gc

DEMKO 14 ATEX 1387X

EN 60079-0, -15

**IECEX Approved (GMP1SA00, GMP1SM00, GMP2S000, and GMP2SM00 only)**

Ex nA IIC T4 Gc

IECEX UL 15.0035X

IEC 60079-0, -15

**UL Listed:** File #E302106

**UL Hazardous:** File #E317425 (GMP1SA00, GMP1SM00, GMP2S000, and GMP2SM00 only)

**ABS Type Approval for Shipboard Applications**

17.**CONSTRUCTION:** Case body is all metal construction.

18.**CONNECTIONS:** Removable wire clamp screw terminal blocks

Wire Gage: 28-16 AWG (0.32 mm - 1.29 mm) terminal gage wire

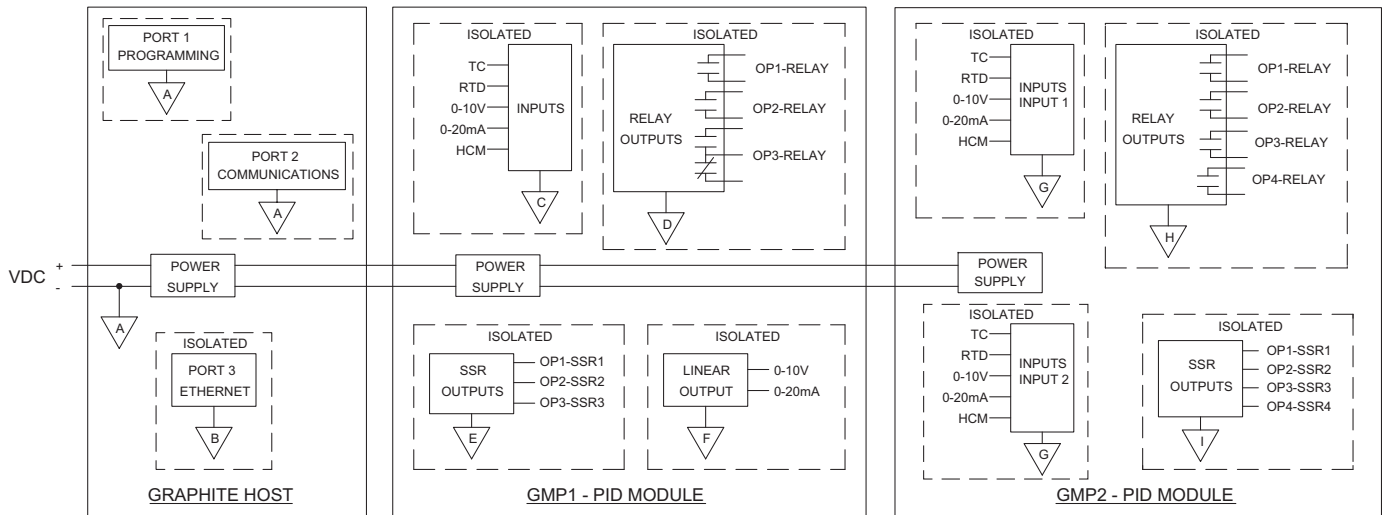
Torque: 1.95-2.21 inch-lbs (0.22-0.25 N-m)

19.**MOUNTING:** Screws to host

20.**WEIGHT:** GMP1: 8 oz (224 g)

GMP2: 8 oz (224 g)

**Block Diagram**



## EMC INSTALLATION GUIDELINES

Although Red Lion Controls products are designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into a unit may be different for various installations. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed are some EMI guidelines for a successful installation in an industrial environment.

1. A unit should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded cables for all Signal and Control inputs. The shield connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
  - a. Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
  - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors, feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run through metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
4. Long cable runs are more susceptible to EMI pickup than short cable runs.
5. In extremely high EMI environments, the use of external EMI suppression devices such as Ferrite Suppression Cores for signal and

control cables is effective. The following EMI suppression devices (or equivalent) are recommended:

Fair-Rite part number 0443167251 (Red Lion Controls #FCOR0000)

Line Filters for input power cables:

Schaffner # FN2010-1/07 (Red Lion Controls #LFIL0000)

6. To protect relay contacts that control inductive loads and to minimize radiated and conducted noise (EMI), some type of contact protection network is normally installed across the load, the contacts or both. The most effective location is across the load.

- a. Using a snubber, which is a resistor-capacitor (RC) network or metal oxide varistor (MOV) across an AC inductive load is very effective at reducing EMI and increasing relay contact life.

- b. If a DC inductive load (such as a DC relay coil) is controlled by a transistor switch, care must be taken not to exceed the breakdown voltage of the transistor when the load is switched. One of the most effective ways is to place a diode across the inductive load. Most Red Lion products with solid state outputs have internal zener diode protection. However external diode protection at the load is always a good design practice to limit EMI. Although the use of a snubber or varistor could be used.

Red Lion part numbers: Snubber: SNUB0000

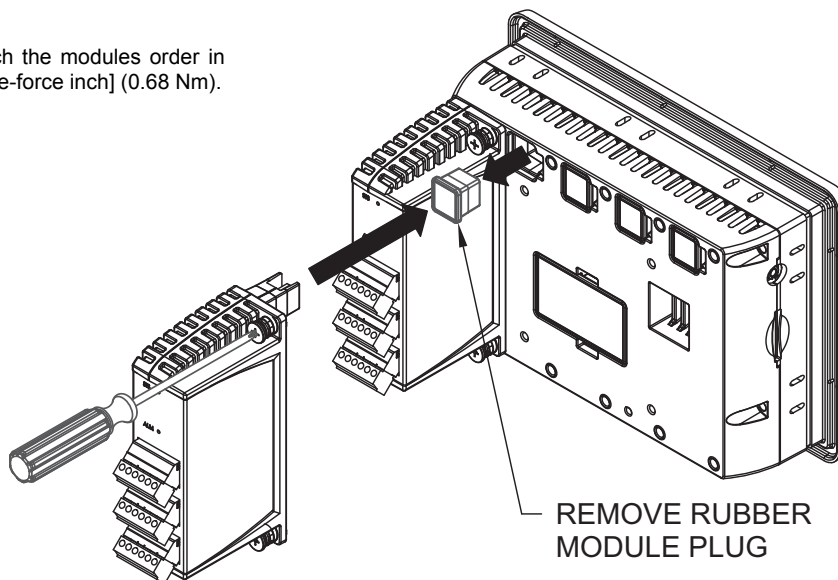
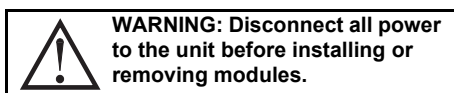
Varistor: ILS11500 or ILS23000

7. Care should be taken when connecting input and output devices to the instrument. When a separate input and output common is provided, they should not be mixed. Therefore a sensor common should NOT be connected to an output common. This would cause EMI on the sensitive input common, which could affect the instrument's operation.

Visit [www.redlion.net/emi](http://www.redlion.net/emi) for more information on EMI guidelines, Safety and CE issues as they relate to Red Lion products.

## HARDWARE INSTALLATION

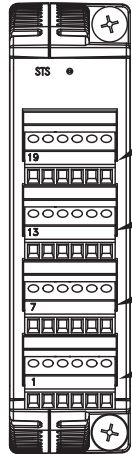
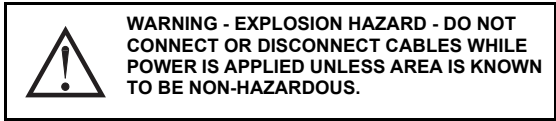
The physical order of all installed modules must match the modules order in Crimson. Torque screws to 6.0 pound-force inch [96 ounce-force inch] (0.68 Nm).



# WIRING

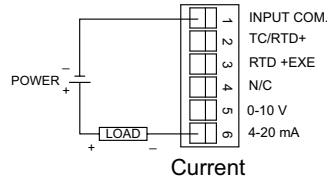
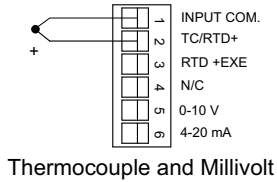
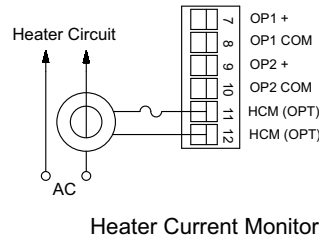
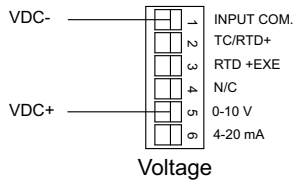
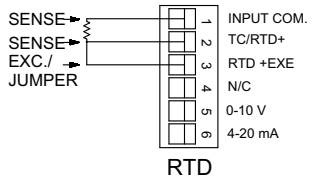
## WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also, cabling should conform to appropriate standards of good installation, local codes and regulations and be suitably rated for the temperatures of the environment to which it is being installed. When wiring the module, use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" (6 mm) of bare wire exposed. Insert the wire into the terminal, and tighten.

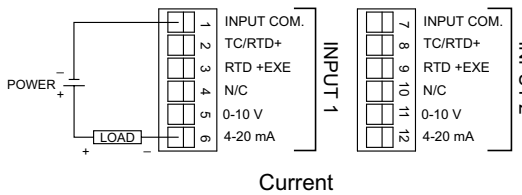
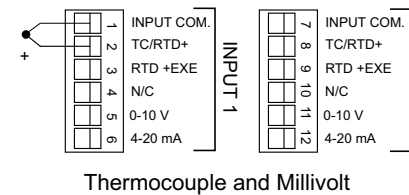
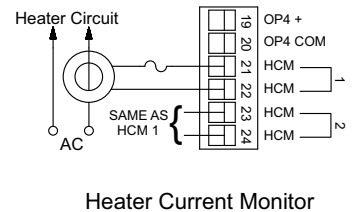
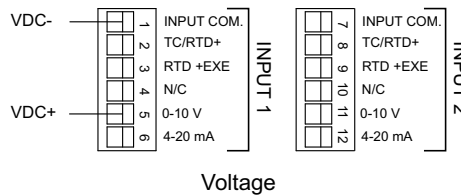
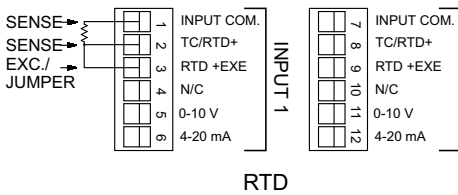


- Terminals 19 to 24 (GMP2 Only)
- Terminals 13 to 18
- Terminals 7 to 12
- Terminals 1 to 6

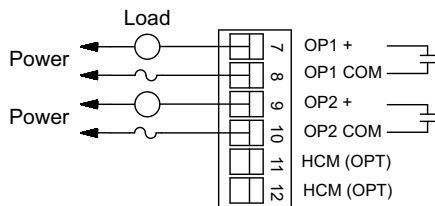
## GMP1 INPUT CONNECTIONS



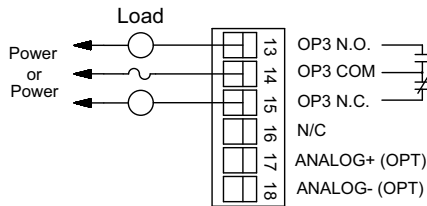
## GMP2 INPUT CONNECTIONS



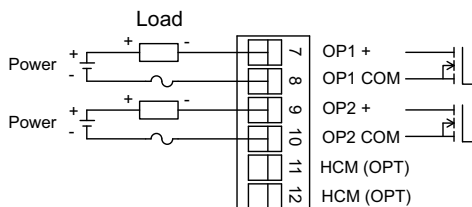
**GMP1 OUTPUT CONNECTIONS**



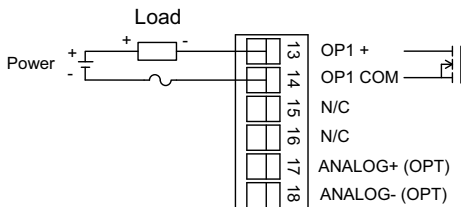
Outputs 1 and 2 - Relay Version



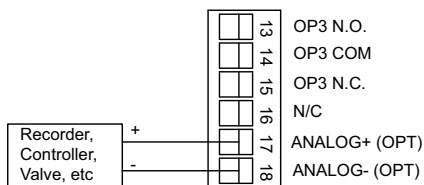
Output 3 - Relay Version



Outputs 1 and 2 - Solid State Version

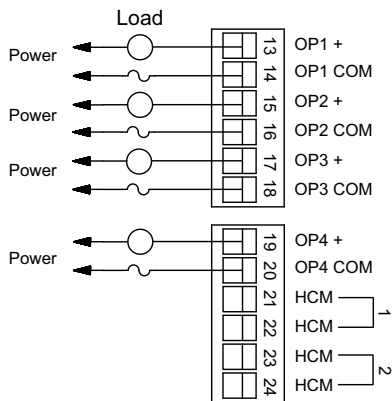


Output 3 - Solid State Version

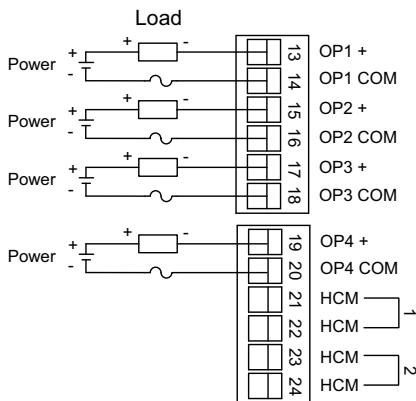


Analog Output

**GMP2 OUTPUT CONNECTIONS**



Outputs 1- 4 - Relay Version



Outputs 1- 4 - Solid State Version



## LEDs

### STS – STATUS LED

The Status LED is a green LED that provides information regarding the state of the module. This includes indication of the various stages of the start-up routine (power-up), as well as any errors that may occur.

#### Startup Routine

Off	Module is currently running the boot loader and/or being flash upgraded by Crimson.
Flashing Green	Module switching to configuration.
Green	Module performing normally.

#### Error States

Flashing Green	Module is controlling properly, but has lost communication with the Host.
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### OP1, OP2, OP3, OP4\* – Output Status LED

The OP1, OP2, OP3, and OP4\* LEDs are factory configured to indicate the status of the outputs. The LEDs turn on when the output is active.

These LEDs may be remapped to various other module properties.

\*GMP2 only

### ALM or AL1 & AL2 – Alarm LED

The Alarm LEDs are factory configured to indicate the presence of an alarm. Whenever one of the seven alarms is active, the LED turns on.

These LEDs may be remapped to various other module properties.

## FIRMWARE UPGRADE

The module's firmware is stored in flash memory so that software/hardware conflicts are avoided, and so features can be added in the future.

During a download, Crimson compares its own library of firmware files with those stored in the module. If they do not match, Crimson will download the necessary firmware.

## CONFIGURATION

Programming is done via Crimson® software, a Windows® compatible configuration interface. Please see the Crimson manual for more information.

## GRAPHITE TROUBLESHOOTING

If for any reason you have trouble operating, connecting, or simply have questions concerning your new Graphite unit, contact Red Lion's technical support.

Email: [support@redlion.net](mailto:support@redlion.net)

Website: [www.redlion.net](http://www.redlion.net)

Inside US: +1 (877) 432-9908

Outside US: +1 (717) 767-6511

## ORDERING INFORMATION

TYPE	DESCRIPTION	PART NUMBER
Input Modules	Graphite Module, Single PID, Relay and Analog Outputs <sup>1</sup>	GMP1RA00
	Graphite Module, Single PID, Relay and Heater Current Monitor <sup>1</sup>	GMP1RM00
	Graphite Module, Single PID, SSR and Analog Outputs	GMP1SA00
	Graphite Module, Single PID, SSR and Heater Current Monitor	GMP1SM00
	Graphite Module, Dual PID, Relay Outputs <sup>1</sup>	GMP2R000
	Graphite Module, Dual PID, Relay and Heater Current Monitor <sup>1</sup>	GMP2RM00
	Graphite Module, Dual PID, SSR Outputs	GMP2S000
	Graphite Module, Dual PID, SSR and Heater Current Monitor	GMP2SM00
Accessories	50 Amp Current Transformer (For Heater Current Models) UL Recognized component, Instrument Transformers, Inc. Part #2SFT500-0.1	CT005001

A listing of the entire Graphite family of products and accessories can be found at [www.redlion.net](http://www.redlion.net).

<sup>1</sup> Module is not suitable for use in hazardous locations.

#### LIMITED WARRANTY

(a) Red Lion Controls Inc. (the "Company") warrants that all Products shall be free from defects in material and workmanship under normal use for the period of time provided in "Statement of Warranty Periods" (available at [www.redlion.net](http://www.redlion.net)) current at the time of shipment of the Products (the "Warranty Period"). **EXCEPT FOR THE ABOVE- STATED WARRANTY, COMPANY MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE PRODUCTS, INCLUDING ANY (A) WARRANTY OF MERCHANTABILITY; (B) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; OR (C) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Customer shall be responsible for determining that a Product is suitable for Customer's use and that such use complies with any applicable local, state or federal law.

(b) The Company shall not be liable for a breach of the warranty set forth in paragraph (a) if (i) the defect is a result of Customer's failure to store, install, commission or maintain the Product according to specifications; (ii) Customer alters or repairs such Product without the prior written consent of Company.

(c) Subject to paragraph (b), with respect to any such Product during the Warranty Period, Company shall, in its sole discretion, either (i) repair or replace the Product; or (ii) credit or refund the price of Product provided that, if Company so requests, Customer shall, at Company's expense, return such Product to Company.

(d) **THE REMEDIES SET FORTH IN PARAGRAPH (c) SHALL BE THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDY AND COMPANY'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN PARAGRAPH (a).**