



**24VDC Bipolar Digital In**  
**3AMP Relay Digital Out**  
**Thermistor/5V/20ma In**  
**10VDC/20mA Analog Out**  
**HE800MIX905 / HE-MIX905\***



\* HE- denotes plastic case.

This datasheet also covers products starting with IC300.

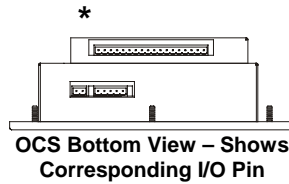
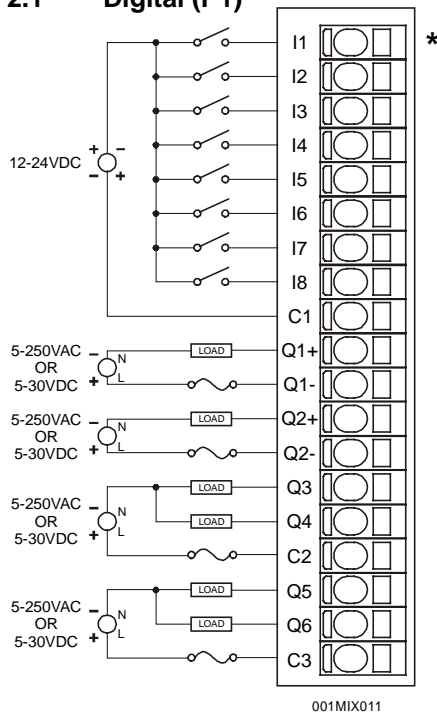
**1 SPECIFICATIONS**

| ANALOG INPUT                           |  | MIX905  |  | MIX905          |   |
|--|--|---|--|-----------------|---|
| Number of Channels                     | 4  | Input Points Required                             | 4  | Input Impedance | 4 |
| Input Ranges<br>(including over-range) |  | Thermistor Current Voltage                        | 10K Ohms = 25°C<br>250 Ohms<br>1 Megohm        |                 |   |
| Thermistor Current Voltage             | -37 to 115°C (-35°F to 240°F)<br>Nominal: 0-20.47 mA<br>0-5.11 VDC |   | < 12VDC, Clamped @ 12VDC, 35mA Max. Continuous |                 |   |
| Resolution                             | 12-Bits  | Converter Type                                    | Successive Approximation                       |                 |   |
| Conversion Time (PLC Update Rate)      | 4 Channels per PLC Scan  | Additional error for temperatures other than 25°C | 0.01% / °C (except Thermistors)                |                 |   |
| Maximum Error at 25°C                  |  | Maximum Over-Current                              | 35mA   |                 |   |
| Thermistor Current Voltage             | ±1.8°F (±1°C)<br>±0.1%<br>±0.1%                                    |   |  |                 |   |
| DIGITAL INPUT                          |  | MIX905  |  | MIX905          |   |
| Inputs per Module                      | 8  | Input Characteristics                             | Bidirectional                                  |                 |   |
| Commons per Module                     | 1  | Input Impedance                                   | 10K Ohms                                       |                 |   |
| Input Voltage Range                    | 12-24VDC   | Minimum ON Current                                | 1mA  |                 |   |
| Peak Voltage                           | 35VDC Max.   | Maximum OFF Current                               | 200µA  |                 |   |
| Isolation (Channel to Ground)          | 500VDC   | OFF to ON Response                                | 1ms + 1 scan                                   |                 |   |
| ON Voltage Level                       | 9VDC   | ON to OFF Response                                | 1ms + 1 scan                                   |                 |   |
| OFF Voltage Level                      | 3VDC   |   |  |                 |   |
| ANALOG OUTPUT                          |  | MIX905  |  | MIX905          |   |
| Number of Channels                     | 2  | Output Points Required                            | 2  |                 |   |
| Output Ranges                          | 0-10.23V<br>0-20.47mA  | Additional error for temperatures other than 25°C | 0.01%/°C                                       |                 |   |
| Resolution                             | 12 Bits  | Maximum Error at 25°C                             | 0.2% for 0-10 Scale<br>0.1% of 0 to 20mA Scale |                 |   |
| Maximum 20mA Output Voltage            | Clamped at -0.5 and +33VDC   | Maximum Error (%AQ=0)                             | 0.5%   |                 |   |
| 20mA Output Compliance                 | 4-30VDC  | 10V Load Impedance                                | 2K Ohms Minimum                                |                 |   |
| Conversion Time                        | 2 Channels per PLC Scan  | 20mA Load Impedance                               | 1K ohms @ 24VDC Loop Voltage                   |                 |   |
|  |  | 10V Load Capacitance                              | 0.01µF Maximum                                 |                 |   |

| DIGITAL OUTPUT                | MIX905  | MIX905                 | MIX905                                       |
|-------------------------------|---|------------------------|--|
| Outputs per Module            | 6 Relays  | Maximum Inrush Current | 5A   |
| Commons per Module            | 4   | Minimum Load           | None   |
| Contact Voltage               | 250VAC / 30VDC Max.   | OFF to ON Response     | 8 ms + 1 scan                                |
| Maximum Load Current          | 3A  | ON to OFF Response     | 4 ms + 1 scan                                |
| Contact On Voltage            | 0.2V  | Contact Life           | See derating charts                          |
| Relay Coil Power              | Internal  | Output Protection      | Transient Voltage Suppressor across contacts |
| Isolation                     | 500VAC  |                        |  |
| General Specifications        |   |                        |  |
|                               | MIX905  |                        | MIX905                                       |
| Required Power (Steady State) | 0.96W (40mA @ 24VDC)  | Operating Temperature  | 0° to 60° Celsius                            |
| Required Power (Inrush)       | Negligible  | Terminal Type          | Spring Clamp, Removable                      |
| Relative Humidity             | 5 to 95% Non-condensing   | Weight                 | 9.5 oz. (270 g)                              |
| CE                            | See Compliance Table at <a href="http://www.heapg.com/Support/compliance.htm">http://www.heapg.com/Support/compliance.htm</a> |                        |  |
| UL                            |   |                        |  |

## 2 WIRING

### 2.1 Digital (P1)



**Warning:** To protect the module and associated wiring from load faults, use external fuses.

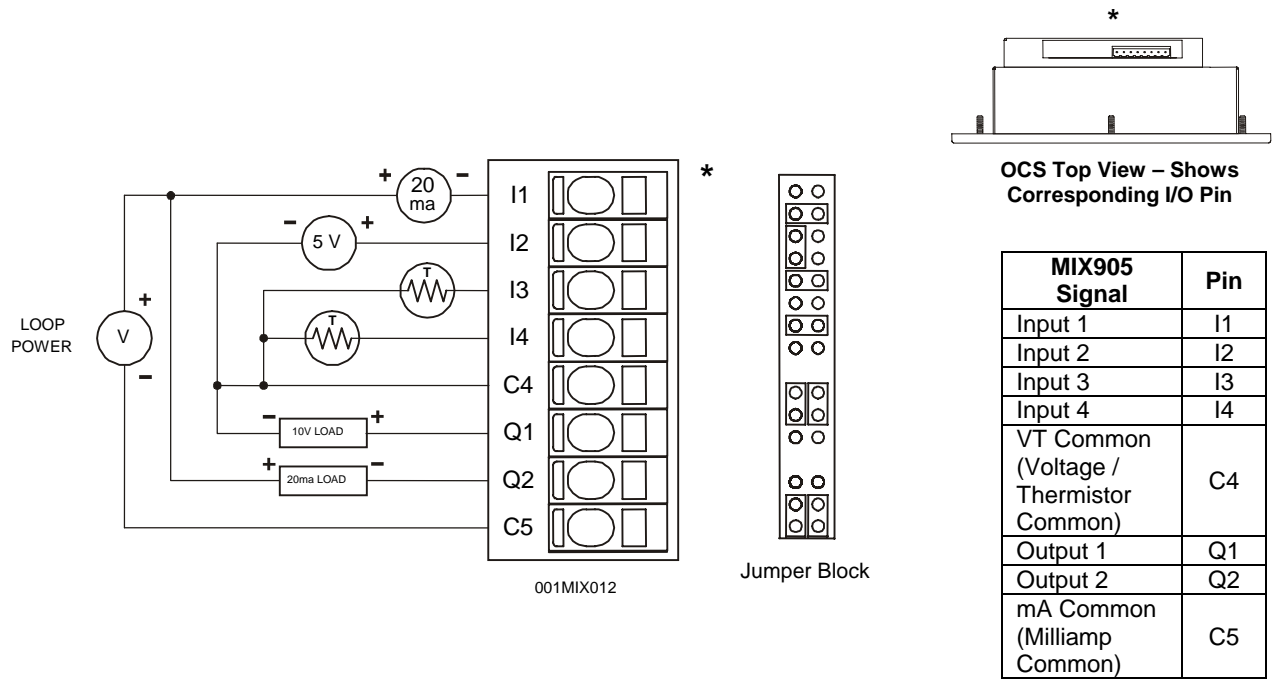
**Q1: 3A**  
**Q2: 3A**  
**C2: 6A**  
**C3: 6A**

| MIX905 Signal           | Pin |
|-------------------------|-----|
| Input 1                 | I1  |
| Input 2                 | I2  |
| Input 3                 | I3  |
| Input 4                 | I4  |
| Input 5                 | I5  |
| Input 6                 | I6  |
| Input 7                 | I7  |
| Input 8                 | I8  |
| Input common (isolated) | C1  |
| Output 1                | Q1+ |
| Output                  | Q1- |
| Output 2                | Q2+ |
| Output 2                | Q2- |
| Output 3                | Q3  |
| Output 4                | Q4  |
| Output 3,4 common       | C2  |
| Output 5                | Q5  |
| Output 6                | Q6  |
| Output 5, 6 common      | C3  |

**Warning:** Connecting high voltage to any I/O pin may cause high voltage to appear at other I/O pins.

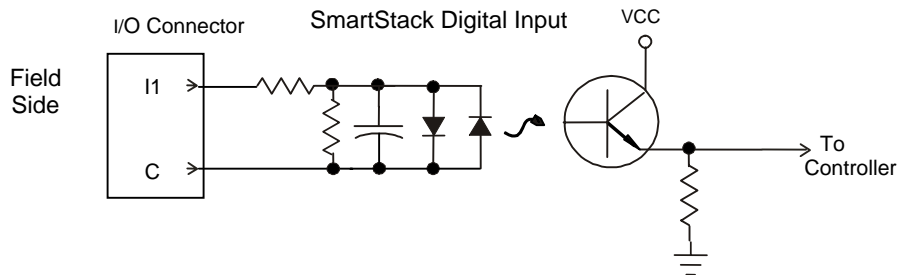
**Warning:** Wiring the line side of the AC source to loads connected to outputs 1 through 6 and the neutral side of the AC source to the output common(s) would create a Negative Logic condition, which may be considered an unsafe practice.

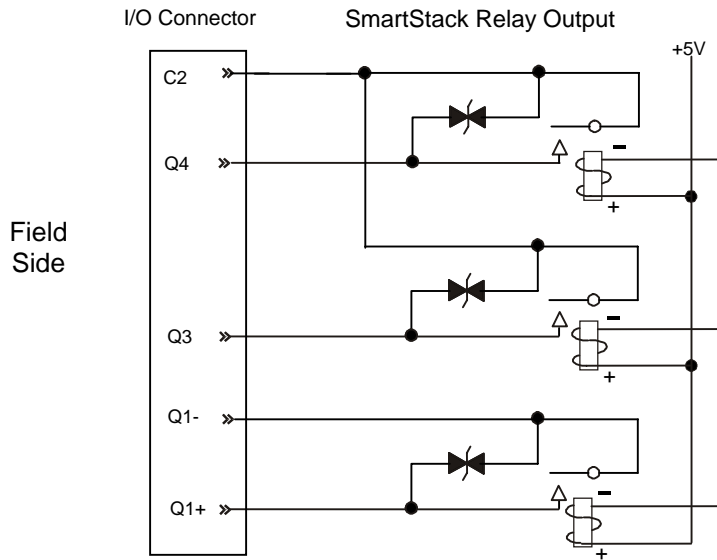
## 2.2 Analog Wiring (P2)



The jumper block indicates the correct jumper positions for the wiring shown above. For more information, refer to Section 4.2, *Hardware Configuration*.

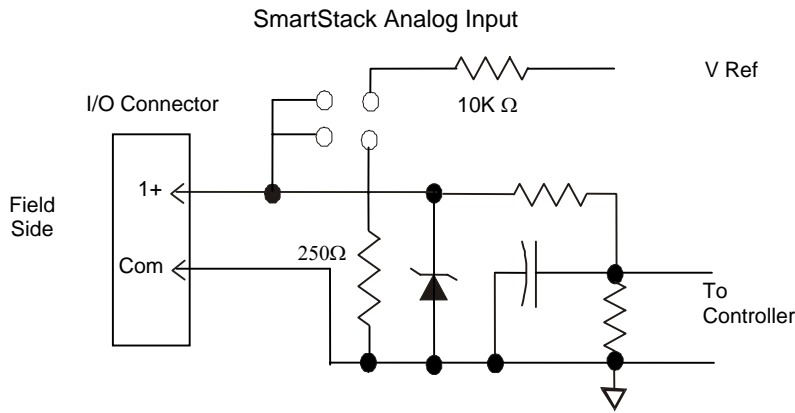
## 3 INTERNAL SCHEMATIC DRAWING

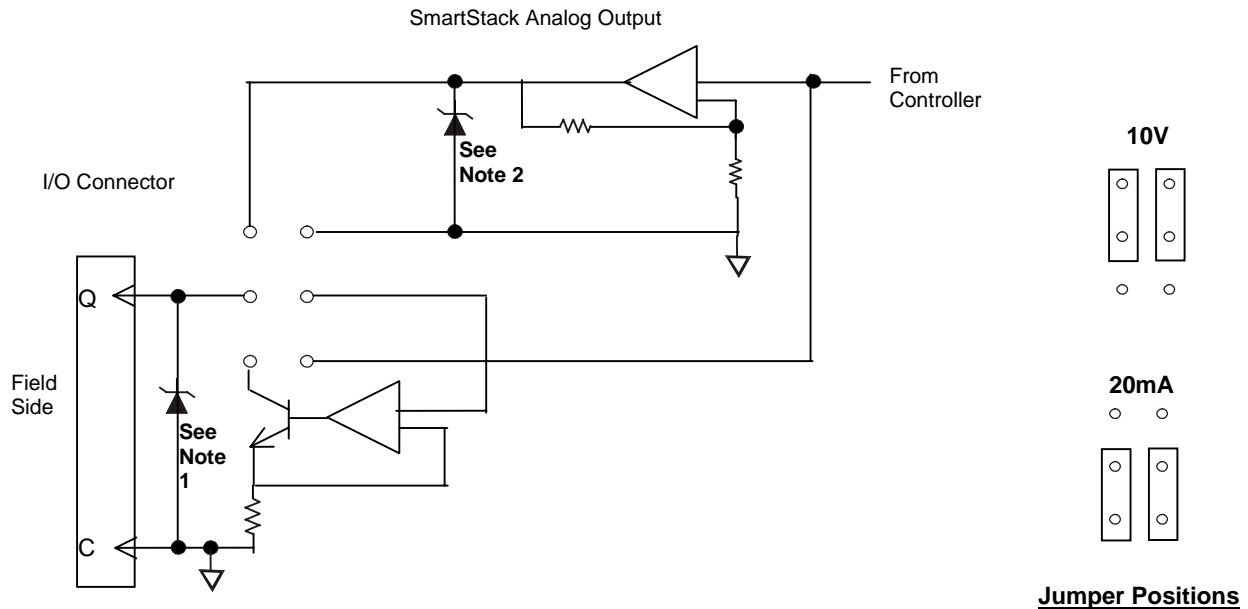




Specification for transient voltage suppressors used on output circuitry is 400VDC, bi-directional 400 watts.

Electro-mechanical relays comply with IEC1131-2.





**Note 1:** Specification for transient voltage suppressors used on output circuitry is 30V, 300W.

**Note 2:** Specification for transient voltage suppressors used on output circuitry is 11V, 400W.

## 4 CONFIGURATION

**Note:** The status of the I/O can be monitored in Cscape Software.

Preliminary configuration procedures that apply to SmartStack™ Modules are contained in the hardware manual of the controller you are using. Refer to the **Additional References** section in this data sheet for a listing of hardware manuals.

### Module Setup Tab

The **Module Setup** is used in applications where it is necessary to change the default states or values of the outputs when the controller (e.g., OCS100) enters idle/stop mode.

**1. For Digital Outputs:** The default turns the outputs OFF when the controller enters idle/stop mode. By selecting the Module Setup tab, each output can be set to either turn ON, turn OFF or to hold the last state. Generally, most applications use the default settings.

**Warning:** The default turns the digital outputs OFF when the controller enters idle/stop mode. To avoid injury of personnel or damages to equipment, exercise extreme caution when changing the default settings.

**2. For Analog Outputs:** The default sets the output values to zero when the controller enters idle/stop mode. By selecting the Module Setup tab, each output can be set to a specific value or hold the last value. Generally, most applications use the default settings.

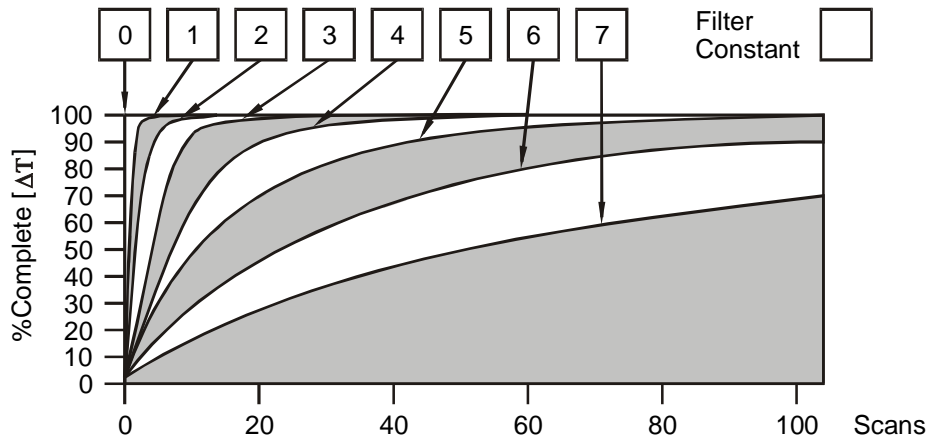
**Warning:** The default sets the output values to zero when the controller enters idle/stop mode. To avoid injury of personnel or damages to equipment, exercise extreme caution when changing the default setting using the **Module Setup** tab.

### **3. For Analog Inputs:**

Filter Constant sets the level of digital filtering according to the following chart.

### **I/O Map Tab**

The I/O Map describes which I/O registers are assigned to a specific SmartStack™ Module and where the module is located in the point map. The I/O Map is determined by the model number and location within the SmartStack™. The I/O Map is not edited by the user.



**Digital Filtering.** The illustration above demonstrates the effect of digital filtering (set with Filter Constant) on module response to a temperature change.

## 4.2 Hardware Configuration

### a. Analog Inputs

The analog inputs are referenced to the bus common. Each of the inputs can be jumper-selected for one of the three input types. Behind each of the input pins is a corresponding group of four jumper pins with a programming plug.

- a. To select 5V input: Connect the two pins nearest the connector.
- b. To select thermistor input 1: Connect the two pins nearest input 1.
- c. To select 20mA input: Connect the two pins nearest input 4.

**Note:** It is also necessary to specify the input channel type in Cscape along with the temperature format.

| Thermistor Curve for PreCon TYPE III (Model 3) |       |            |             |      |            |             |       |            |
|--|-------|------------|-------------|------|------------|-------------|-------|------------|
| Temperature                                    |       | Resistance | Temperature |      | Resistance | Temperature |       | Resistance |
| °F   | °C    |            | °F          | °C   |            | °F          | °C    |            |
| -35  | -37.2 | 203.6K     | 60          | 15.6 | 14.78K     | 155         | 68.3  | 2.098K     |
| -30  | -34.4 | 173.6K     | 65          | 18.3 | 13.15K     | 160         | 71.1  | 1.920K     |
| -25  | -31.7 | 148.3K     | 70          | 21.1 | 11.72K     | 165         | 73.9  | 1.759K     |
| -20  | -28.9 | 127.1K     | 75          | 23.9 | 10.46K     | 170         | 76.7  | 1.614K     |
| -15  | -26.1 | 109.2K     | 80          | 26.7 | 9.354K     | 175         | 79.4  | 1.482K     |
| -10  | -23.3 | 94.07K     | 85          | 29.4 | 8.378K     | 180         | 82.2  | 1.362K     |
| -5   | -20.6 | 81.23K     | 90          | 32.2 | 7.516K     | 185         | 85.0  | 1.254K     |
| 0  | -17.8 | 70.32K     | 95          | 35.0 | 6.754K     | 190         | 87.8  | 1.156K     |
| 5  | -15.0 | 61.02K     | 100         | 37.8 | 6.078K     | 195         | 90.6  | 1.066K     |
| 10   | -12.2 | 53.07K     | 105         | 40.6 | 5.479K     | 200         | 93.3  | 984.0      |
| 15   | -9.4  | 46.27K     | 110         | 43.3 | 4.947K     | 205         | 96.1  | 909.8      |
| 20   | -6.7  | 40.42K     | 115         | 46.1 | 4.472K     | 210         | 98.9  | 841.9      |
| 25   | -3.9  | 35.39K     | 120         | 48.9 | 4.049K     | 215         | 101.7 | 779.8      |
| 30   | -1.1  | 31.06K     | 125         | 51.7 | 3.671K     | 220         | 104.4 | 723.0      |
| 35   | 1.7   | 27.31K     | 130         | 54.4 | 3.333K     | 225         | 107.2 | 671.0      |
| 40   | 4.4   | 24.06K     | 135         | 57.2 | 3.031K     | 230         | 110.0 | 623.3      |
| 45   | 7.2   | 21.24K     | 140         | 60.0 | 2.759K     | 235         | 112.8 | 579.5      |
| 50   | 10.0  | 18.79K     | 145         | 62.8 | 2.515K     | 240         | 115.6 | 539.4      |
| 55   | 12.8  | 16.65K     | 150         | 65.6 | 2.296K     |             |       |            |

**b. Analog Outputs**

Each **output** can be independently programmed for 0 to 10 volts or 0 to 20mA. There are two jumpers to be set for each output. Six jumper pins in two rows of three are associated with each output. For voltage output, out of each group of six, the two pins nearest connector pin 1 (marked with \* - refer to Section 2.2, [p2]) in each row are to be jumpered. For current output, out of each group of six, the two pins in each row near connector pin 8 are to be jumpered. The mode for each output must also be specified in the module setup in Cscape.

**5 CONVERSION FACTORS (ANALOG INPUT and OUTPUT)**

**5.1 Input Conversion Factor**

The following table describes how real-world inputs are scaled into the controller. Given a known input current, the data value is configured by using the conversion factor from the table. The following formula is used: **Data = Input Current (mA) / Conversion Factor**

**Example:** The user selects a current range of 0 to +20mA:

1. The known input current is 14mA.
2. Using the table, the conversion factor for the current range of 0 to +20mA is 0.000625.
3. To determine the data value, the formula is used:  

$$\text{Data} = \text{Input Current (mA)} / \text{Conversion Factor}$$

$$22400 = 14\text{mA} / 0.000625$$

| Conversion of Real-World Inputs into Controller |                      |          |                   |
|---|----------------------|----------|-------------------|
| Selected Voltage Range                          | Voltage In (Vin) VDC | Data Out | Conversion Factor |
| 0 to +5.00 VDC                                  | +5.11                | 32704    | 0.00015625        |
|   | +5.00                | 32000    |                   |
|   | 0                    | 0        |                   |
|   | NA                   | NA       |                   |
|   | NA                   | NA       |                   |
| 0 to +20mA                                      | +20.47               | 32736    | 0.000625          |
|   | +20.00               | 32000    |                   |
|   | 0                    | 0        |                   |
|   | NA                   | NA       |                   |
|   | NA                   | NA       |                   |
| °C  | +115                 | 1150     | 0.1               |
|   | 0                    | 0        |                   |
|   | -37                  | -370     |                   |
| °F  | +240                 | 2400     | 0.1               |
|   | 0                    | 0        |                   |
|   | -35                  | -350     |                   |

## 5.2 Output Conversion Factor

The following table describes how program data values are scaled to real-world analog voltage outputs by the module. Given a desired output current, the data value is converted by using the conversion factor from the table. The following formula is used: **Data = Output Current (mA) / Conversion Factor**

**Example:** The user selects a current range of 0 to +20mA:

- The desired output current is 12mA.
- Using the table, the conversion factor for the current range of 0 to +20 mA is 0.000625.
- To determine the data value, the formula is used:  

$$\text{Data} = \text{Output Current (mA)} / \text{Conversion Factor}$$

$$19200 = 12\text{mA} / 0.000625$$

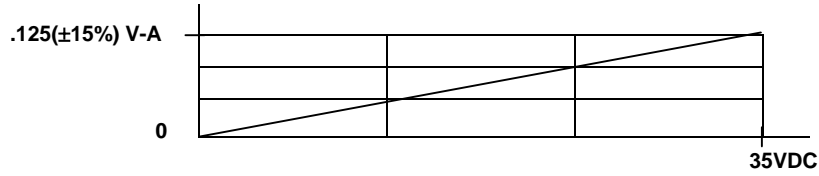
| Conversion of Real-World Outputs into Controller |                     |       |                   |
|--|---------------------|-------|-------------------|
| Selected Current Range                           | Output Current (mA) | Data  | Conversion Factor |
| 0 to +20mA                                       | +20.47              | 32752 | 0.000625          |
|  | +20.00              | 32000 |                   |
|  | 0                   | 0     |                   |
| Selected Voltage Range                           | Output Voltage (V)  | Data  | Conversion Factor |
| 0 to +10V  | 10.23               | 32736 | 0.0003125         |
|  | 10.00               | 32000 |                   |
|  | 0                   | 0     |                   |



## 6 DIGITAL INPUT / OUTPUT CHARACTERISTICS

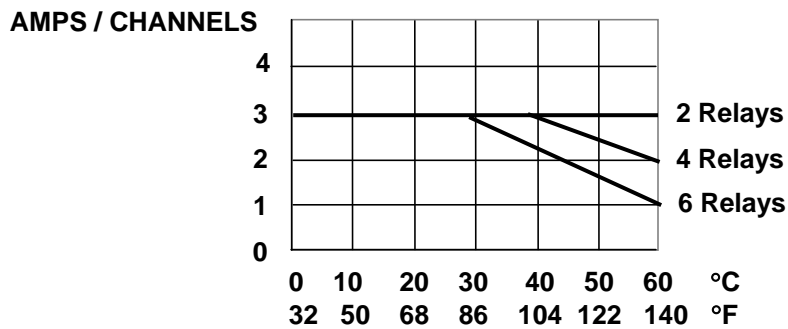
### 6.1 Digital Input

Digital Input Chart



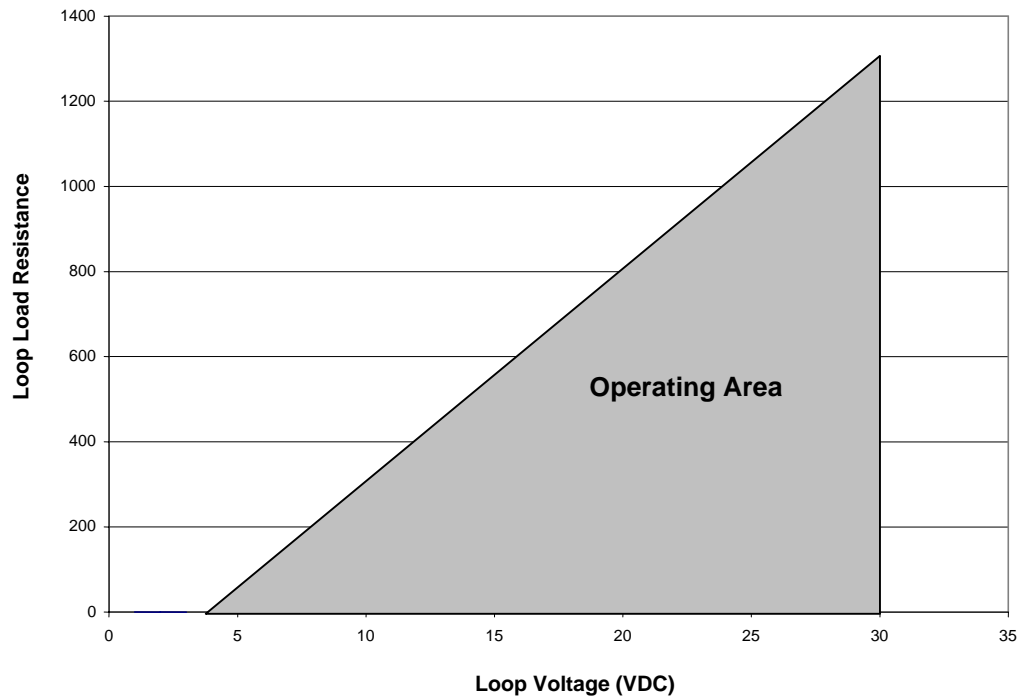
### 6.2 Digital Output

Derating Output Chart



| Typical Relay Life  |              |       |       |
|---------------------|--------------|-------|-------|
| Voltage (Resistive) | Load Current |       |       |
|                     | 1 Amp        | 2 Amp | 3 Amp |
| 30VDC               | 600K         | 250K  | 125K  |
| 125VAC              | 750K         | 300K  | 150K  |
| 250VAC              | 500K         | 200K  | 100K  |

## 7 ANALOG OUTPUT CHARACTERISTICS IN 20mA OPERATING MODE



## 8 INSTALLATION / SAFETY

**Warning:** Remove power from the OCS controller, CAN port, and any peripheral equipment connected to this local system before adding or replacing this or any module.

- All applicable codes and standards should be followed in the installation of this product.
- Shielded, twisted-pair wiring should be used for best performance (Analog I/O).
- Shields may be terminated at the module terminal strip.
- In severe applications, shields should be tied directly to the ground block within the panel.
- Use the following wire type or equivalent: Belden 8917, 16 AWG or larger for digital I/O and Belden 8441 for Analog I/O.

When found on the product, the following symbols specify:



**Warning:** Consult user documentation.



**Warning:** Electrical Shock Hazard.

For detailed installation and a [handy checklist](#) that covers panel box layout requirements and minimum clearances, refer to the hardware manual of the controller you are using. (See the **Additional References** section in this document.)

## 9 ADDITIONAL REFERENCES

For detailed installation, configuration and other information, refer to the hardware manual of the controller you are using. See the **Technical Support** section in this document for the web site address to download references and to obtain revised editions.

| Additional References   |               |
|---|---------------|
| Controller  | Manual Number |
| <b>Operator Control Station Hardware</b> (OCS, OCX)<br>e.g., OCS1XX / 2XX; Graphic OCS250               | MAN0227       |
| <b>Remote Control Station Hardware</b> (RCS [except RCS116], RCX)<br>e.g., RCS210, RCS250               |               |
| <b>Color Touch OCS Hardware</b><br>e.g., OCS300, OCS301, OCS350, OCS351<br>e.g., OCS451, OCS551, OCS651 | MAN0465       |
| <b>OCS LX Series Hardware</b><br>e.g., LX280 / LX300; RCS116  | MAN0755       |
| <b>MiniOCS / MiniRCS / MiniOCX / MiniRCX Hardware</b><br>e.g., HE500OCSxxx                              | MAN0305       |
| Other Useful References   |               |
| Cscape Programming and Reference  | MAN0313       |
| DeviceNet™ Implementation   | SUP0326       |
| Wiring Accessories and Spare Parts Manual   | MAN0347       |

## 10 TECHNICAL SUPPORT

For assistance and manual up-dates, contact Technical Support at the following locations:

**North America:**  
(317) 916-4274  
[www.heapg.com](http://www.heapg.com)

**Europe:**  
(+) 353-21-4321-266  
[www.horner-apg.com](http://www.horner-apg.com)

NOTES