



Analog I/O Module

HE559MIX977
8 Input Channels
4 Sourcing Output Channels
±5V / ±10V / 4-20mA / ±20mA
CsCAN

SmartStix

Refer to SmartStix Analog Programming Guide (MAN0703) at www.HornerOCS.com.

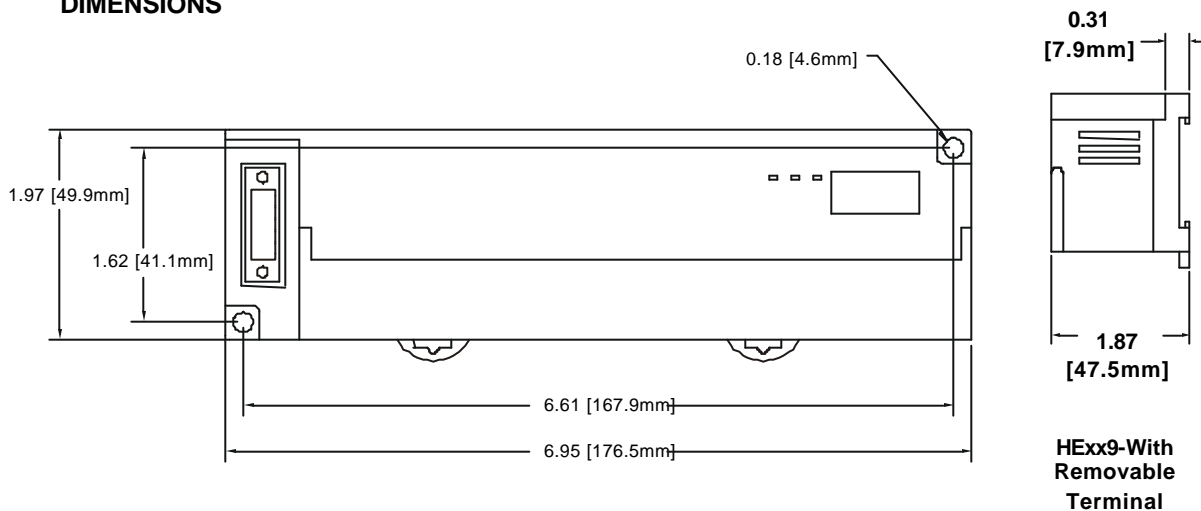
1 SPECIFICATIONS

| ANALOG IN | | | |
|--|--|--|---|
| Number of input points | 8 | Conversion Time | 10ms for all Channels |
| Input Ranges | ±5V, ±10V DC 4-20mA, ±20mA DC | Isolation | 1000V DC IEC61010-1 300V RMS |
| Resolution | 14 bits | Isolation Method | Magnetic |
| | | Additional error for temperatures other than 25°C | 0.01% / °C |
| Accuracy, 25°C | 0.1% | Maximum Continuous Overload | ±10V: 150VAC ±20mA: ±30mA, Clamped at ±6V |
| Input Impedance | V: 1 Megohm mA: 150 Ohms | Programmable Filter Time Constants | 0.01 to 1.28 Seconds |
| Register Value for Nominal Full Scale | ±32000 | Filter Modes | Running Average or Adaptive |
| ANALOG OUT | | | |
| Number of output points | 4 | Isolation | 1000V DC IEC61010-1 300V RMS |
| Output Ranges | ±5, ±10V DC 4-20mA, ±20mA DC | Isolation Method | Magnetic |
| Resolution | 14 bits | Output Clamp | ±12V, 600Wpk |
| Accuracy, 25°C | 0.1% | Register Value for Nominal Full Scale | ±32000 |
| Load Resistance | V: 600 Min mA: 500 Max | Output Characteristic | Sourcing |
| GENERAL | | | |
| Required Power (Steady State) | 3.6W (150ma @ 24VDC) | Operating Temperature | 0° to 55° C |
| Required Power (Inrush) | 8A @ 24VDC for 1ms | Operating and Storage Humidity | 5 to 95% Non-condensing |
| Storage Temperature | -25° to 70° C | Altitude for use | Up to 2,000m |
| Atmosphere | Free from corrosive gases and excessive dust | Pollution degree | 2 or lower |
| Cooling method | Self-cooling | Weight | 9 oz. (256g) |

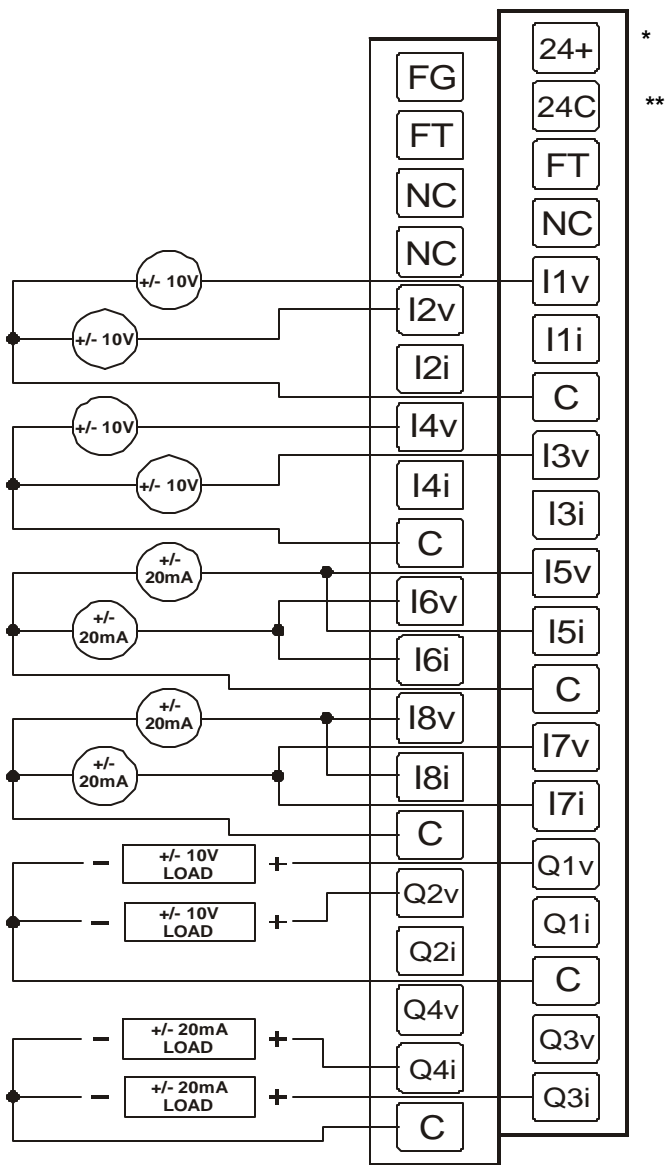
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| Vibration | | | | |
|--------------------------------|-----------------------------|--|--------------------------------------|---|
| Occasional Vibration | | | | |
| Frequency | Acceleration | Amplitude | Sweep Count | |
| 10 ≤ f < 57 Hz | - | 0.075 mm | 10 times in each direction for X,Y,Z | |
| 57 ≤ f ≤ 150 Hz | 9.8 m/s ² {1G} | - | | |
| Continuous Vibration | | | | |
| Frequency | Acceleration | Amplitude | Sweep Count | |
| 10 ≤ f < 57 Hz | - | 0.035 mm | 10 times in each direction for X,Y,Z | |
| 57 ≤ f ≤ 150 Hz | 4.9 m/s ² {0.5G} | - | | |
| Shocks | | | | |
| Maximum shock acceleration | | 147 m/s ² {15G} | | |
| Duration Time | | 11 ms. | | |
| Pulse Wave | | Half sine wave pulse (3 times in each of X, Y, Z directions) | | |
| Noise Immunity | | | | |
| Square wave impulse noise | | AC: ± 1,500VDC DC: ± 900VDC | | |
| Electrostatic Discharge | | Voltage: 4kV (contact discharge) | | |
| Radiated electromagnetic field | | 27 – 500MHz, 10V/m | | |
| Fast Transient Burst Noise | Severity level | All power modules | Digital I/Os (Ue ≥ 24V) | Digital I/Os (Ue < 24 V) Analog I/Os Communication I/Os |
| | Voltage | 2 kV | 1 kV | 0.25 kV |

2 DIMENSIONS



3 WIRING



006MIX002

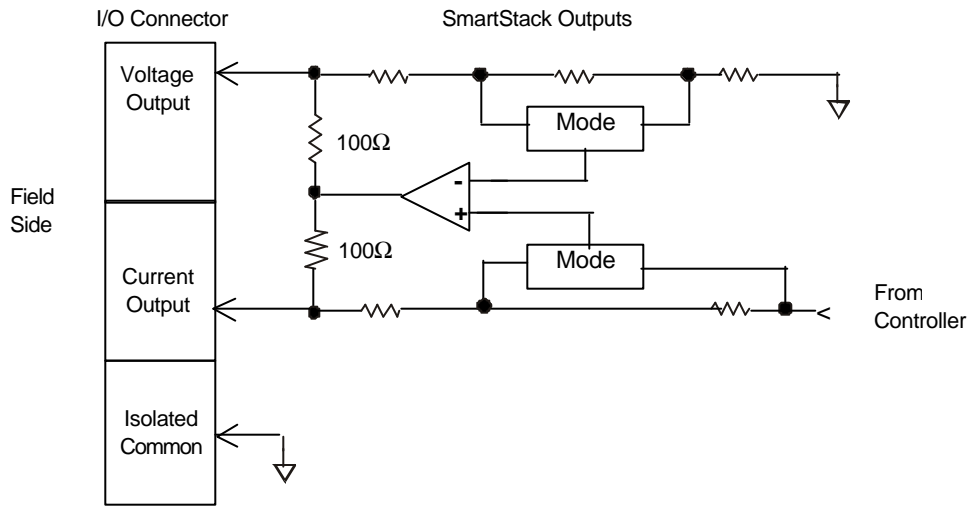
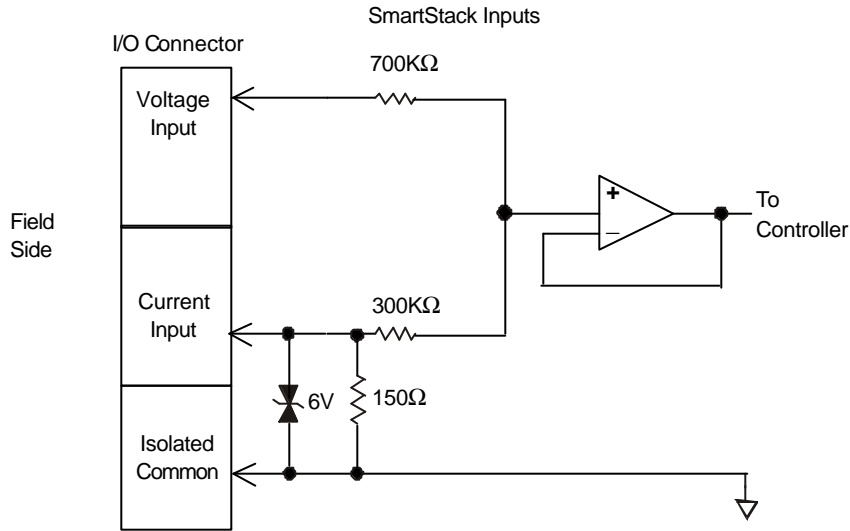
| Mix977 | | Mix977 | |
|--------|-----|--------|--------|
| 2 | FG | 1 | 24+ * |
| 4 | FT | 3 | 24C ** |
| 6 | NC | 5 | FT |
| 8 | NC | 7 | NC |
| 10 | I2v | 9 | I1v |
| 12 | I2i | 11 | I1i |
| 14 | I4v | 13 | C |
| 16 | I4i | 15 | I3v |
| 18 | C | 17 | I3i |
| 20 | I6v | 19 | I5v |
| 22 | I6i | 21 | I5i |
| 24 | I8v | 23 | C |
| 26 | I8i | 25 | I7v |
| 28 | C | 27 | I7i |
| 30 | Q2v | 29 | Q1v |
| 32 | Q2i | 31 | Q1i |
| 34 | Q4v | 33 | C |
| 36 | Q4i | 35 | Q3v |
| 38 | C | 37 | Q3i |

FT: Factory Test, Do Not Connect

C terminals are connected together internally but isolated from bus and power circuits.

* and ** For CsCAN and DeviceNet versions, module power is usually derived from the CAN connector. In that case, +24VDC and 24C are not connected.

4 INTERNAL WIRING



5 Channel Mode, Programmable Filter, and Output Default Configuration

The network supplies configuration information to the HE550MIX977 in the Consumed Directed Digital Data Words sent to the HE550MIX977. In the first word, the low 12 bits, 1 through 12, are channel mode bits. A low mode bit selects $\pm 10V$ and a high mode bit selects $\pm 20mA$. The next three bits, 13 through 15, are input digital filter time constant codes and the high bit, 16, is an adaptive filter enable bit. In the second word, the low 12 bits are channel scale bits. A low scale bit selects $\pm 10V$ or $\pm 20mA$ for the corresponding channel. A high scale bit selects $\pm 5V$ or $4-20mA$. The upper four bits are unused.

| Bit | Channel |
|-----|---------|
| 1 | AI1 |
| 2 | AI2 |
| 3 | AI3 |
| 4 | AI4 |
| 5 | AI5 |
| 6 | AI6 |
| 7 | AI7 |
| 8 | AI8 |
| 9 | AQ1 |
| 10 | AQ2 |
| 11 | AQ3 |
| 12 | AQ4 |

Each analog input on the HE550MIX977 has a single pole 345Hz (461 μ S) cutoff high frequency noise filter. In addition a second digital filter may be specified in the first configuration word with the following time constants.

| Bit | | | Time Constant |
|-----|----|----|--|
| 15 | 14 | 13 | |
| 0 | 0 | 0 | 10 milliseconds (Nominal hardware scan rate) |
| 0 | 0 | 1 | 15 milliseconds |
| 0 | 1 | 0 | 35 milliseconds |
| 0 | 1 | 1 | 75 milliseconds |
| 1 | 0 | 0 | 155 milliseconds |
| 1 | 0 | 1 | 315 milliseconds |
| 1 | 1 | 0 | 635 milliseconds |
| 1 | 1 | 1 | 1.275 seconds |

This digital filter is useful for applications with significant amounts of random noise. The slower time constants, while yielding better noise suppression, take a longer time to settle after step changes and are also sensitive to impulse noise which is treated like Gaussian noise and averaged.

Bit 16 of the first configuration word may be set to specify an adaptive filter algorithm that:

1. Responds much more quickly to large step changes at slower time constants with full filtering of low level noise.
2. Suppresses impulse noise at the expense of slightly slower response at the shortest time constant settings. (Approximately 10 additional milliseconds)

Note that actual system response time is network dependent.

Bits 9 through 12 of the 5th configuration word control the behavior of the analog outputs when network communication is lost. The bit to channel correspondence is the same as for the mode and scale bits. If the corresponding bit is set, the outputs hold the last state. If the corresponding bit is cleared, the outputs are set to the respective value supplied to the HE550MIX977 in the second four words of the Consumed Directed Analog Data sent by the OCS. The other bits of the 5th configuration word are unused.

Refer to SmartStix Analog Programming Guide.

6 INPUT and OUTPUT conversion factors

The following table describes how real-world values are scaled in the controller. For a given physical voltage or current, the register data value may be calculated by using the conversion factor from the table. The following formula is used: **Data = Voltage or Current / Conversion Factor**

Example: The user selects a voltage range of $\pm 10V$:

1. The physical voltage is 6 Volts.
2. Using the table, the conversion factor for the voltage range of $\pm 10V$ is .0003125.
3. To determine the data value, the formula is used: $\text{Data} = V / \text{Conversion Factor}$
 $19200 = 6 \text{ VDC} / 0.0003125$

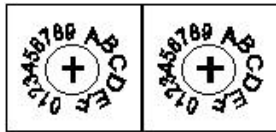
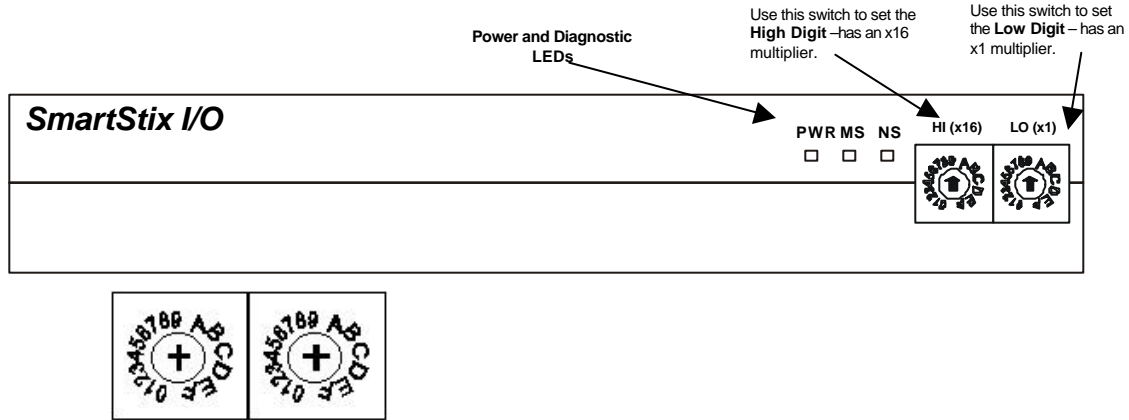
| Conversion between Physical Values and Register Values | | | |
|--|------------|---------------|-------------------|
| Selected Range | Volts / mA | Register Data | Conversion Factor |
| $\pm 5.00 \text{ V}$ | > +5.11 | 32767 | 0.00015625 |
| | +5.00 | 32000 | |
| | 0.00 | 0 | |
| | -5.00 | -32000 | |
| | < -5.11 | -32768 | |
| $\pm 10.00 \text{ V}$ | > +10.23 | 32767 | 0.0003125 |
| | +10.00 | 32000 | |
| | 0.00 | 0 | |
| | -10.00 | -32000 | |
| | < -10.23 | -32768 | |
| * 4 to 20 mA | < +20.37 | 32767 | 0.0005 |
| | +20.00 | 32000 | |
| | +4.00 | 0 | |
| | -12.00 | -32000 | |
| | > -12.38 | -32768 | |
| $\pm 20.00 \text{ mA}$ | > +20.47 | 32767 | 0.0006250 |
| | +20.00 | 32000 | |
| | 0 | 0 | |
| | -20.00 | -32000 | |
| | < -20.47 | -32768 | |

* For the 4 to 20mA range, the offset, 4mA, must first be subtracted from the physical output value before dividing by the scale factor to yield the register data value.

7 SETTING ID SWITCHES

CsCAN Network IDs are set using the hexadecimal number system from 01 to FD. The decimal equivalent is 1-253. Refer to following Conversion Table, which shows the decimal equivalent of hexadecimal numbers. Set a unique Network ID by inserting a small Phillips screwdriver into the two *identical* switches.

Note: The CsCAN Baud Rate for SmartStix I/O is fixed at 125KBaud



Close-up of Switches

| Decimal (Dec) to Hexadecimal (Hex) Conversion | | | | | | | | | | | | | | | | |
|---|-----|----|-----|-----|----|-----|-----|----|-----|-----|-----|-----|----|-----|-----|----|
| Dec | Hex | | Dec | Hex | | Dec | Hex | | Dec | Hex | Dec | Hex | | Dec | Hex | |
| | HI | LO | | HI | LO | | HI | LO | | | | HI | LO | | HI | LO |
| | | | 54 | 3 | 6 | 108 | 6 | C | 162 | A | 2 | 216 | D | 8 | | |
| 1 | 0 | 1 | 55 | 3 | 7 | 109 | 6 | D | 163 | A | 3 | 217 | D | 9 | | |
| 2 | 0 | 2 | 56 | 3 | 8 | 110 | 6 | E | 164 | A | 4 | 218 | D | A | | |
| 3 | 0 | 3 | 57 | 3 | 9 | 111 | 6 | F | 165 | A | 5 | 219 | D | B | | |
| 4 | 0 | 4 | 58 | 3 | A | 112 | 7 | 0 | 166 | A | 6 | 220 | D | C | | |
| 5 | 0 | 5 | 59 | 3 | B | 113 | 7 | 1 | 167 | A | 7 | 221 | D | D | | |
| 6 | 0 | 6 | 60 | 3 | C | 114 | 7 | 2 | 168 | A | 8 | 222 | D | E | | |
| 7 | 0 | 7 | 61 | 3 | D | 115 | 7 | 3 | 169 | A | 9 | 223 | D | F | | |
| 8 | 0 | 8 | 62 | 3 | E | 116 | 7 | 4 | 170 | A | A | 224 | E | 0 | | |
| 9 | 0 | 9 | 63 | 3 | F | 117 | 7 | 5 | 171 | A | B | 225 | E | 1 | | |
| 10 | 0 | A | 64 | 4 | 0 | 118 | 7 | 6 | 172 | A | C | 226 | E | 2 | | |
| 11 | 0 | B | 65 | 4 | 1 | 119 | 7 | 7 | 173 | A | D | 227 | E | 3 | | |
| 12 | 0 | C | 66 | 4 | 2 | 120 | 7 | 8 | 174 | A | E | 228 | E | 4 | | |
| 13 | 0 | D | 67 | 4 | 3 | 121 | 7 | 9 | 175 | A | F | 229 | E | 5 | | |
| 14 | 0 | E | 68 | 4 | 4 | 122 | 7 | A | 176 | B | 0 | 230 | E | 6 | | |
| 15 | 0 | F | 69 | 4 | 5 | 123 | 7 | B | 177 | B | 1 | 231 | E | 7 | | |
| 16 | 1 | 0 | 70 | 4 | 6 | 124 | 7 | C | 178 | B | 2 | 232 | E | 8 | | |
| 17 | 1 | 1 | 71 | 4 | 7 | 125 | 7 | D | 179 | B | 3 | 233 | E | 9 | | |
| 18 | 1 | 2 | 72 | 4 | 8 | 126 | 7 | E | 180 | B | 4 | 234 | E | A | | |
| 19 | 1 | 3 | 73 | 4 | 9 | 127 | 7 | F | 181 | B | 5 | 235 | E | B | | |
| 20 | 1 | 4 | 74 | 4 | A | 128 | 8 | 0 | 182 | B | 6 | 236 | E | C | | |
| 21 | 1 | 5 | 75 | 4 | B | 129 | 8 | 1 | 183 | B | 7 | 237 | E | D | | |
| 22 | 1 | 6 | 76 | 4 | C | 130 | 8 | 2 | 184 | B | 8 | 238 | E | E | | |
| 23 | 1 | 7 | 77 | 4 | D | 131 | 8 | 3 | 185 | B | 9 | 239 | E | F | | |
| 24 | 1 | 8 | 78 | 4 | E | 132 | 8 | 4 | 186 | B | A | 240 | F | 0 | | |
| 25 | 1 | 9 | 79 | 4 | F | 133 | 8 | 5 | 187 | B | B | 241 | F | 1 | | |
| 26 | 1 | A | 80 | 5 | 0 | 134 | 8 | 6 | 188 | B | C | 242 | F | 2 | | |
| 27 | 1 | B | 81 | 5 | 1 | 135 | 8 | 7 | 189 | B | D | 243 | F | 3 | | |
| 28 | 1 | C | 82 | 5 | 2 | 136 | 8 | 8 | 190 | B | E | 244 | F | 4 | | |
| 29 | 1 | D | 83 | 5 | 3 | 137 | 8 | 9 | 191 | B | F | 245 | F | 5 | | |
| 30 | 1 | E | 84 | 5 | 4 | 138 | 8 | A | 192 | C | 0 | 246 | F | 6 | | |
| 31 | 1 | F | 85 | 5 | 5 | 139 | 8 | B | 193 | C | 1 | 247 | F | 7 | | |
| 32 | 2 | 0 | 86 | 5 | 6 | 140 | 8 | C | 194 | C | 2 | 248 | F | 8 | | |
| 33 | 2 | 1 | 87 | 5 | 7 | 141 | 8 | D | 195 | C | 3 | 249 | F | 9 | | |
| 34 | 2 | 2 | 88 | 5 | 8 | 142 | 8 | E | 196 | C | 4 | 250 | F | A | | |
| 35 | 2 | 3 | 89 | 5 | 9 | 143 | 8 | F | 197 | C | 5 | 251 | F | B | | |
| 36 | 2 | 4 | 90 | 5 | A | 144 | 9 | 0 | 198 | C | 6 | 252 | F | C | | |
| 37 | 2 | 5 | 91 | 5 | B | 145 | 9 | 1 | 199 | C | 7 | 253 | F | D | | |
| 38 | 2 | 6 | 92 | 5 | C | 146 | 9 | 2 | 200 | C | 8 | | | | | |
| 39 | 2 | 7 | 93 | 5 | D | 147 | 9 | 3 | 201 | C | 9 | | | | | |
| 40 | 2 | 8 | 94 | 5 | E | 148 | 9 | 4 | 202 | C | A | | | | | |
| 41 | 2 | 9 | 95 | 5 | F | 149 | 9 | 5 | 203 | C | B | | | | | |
| 42 | 2 | A | 96 | 6 | 0 | 150 | 9 | 6 | 204 | C | C | | | | | |
| 43 | 2 | B | 97 | 6 | 1 | 151 | 9 | 7 | 205 | C | D | | | | | |
| 44 | 2 | C | 98 | 6 | 2 | 152 | 9 | 8 | 206 | C | E | | | | | |
| 45 | 2 | D | 99 | 6 | 3 | 153 | 9 | 9 | 207 | C | F | | | | | |
| 46 | 2 | E | 100 | 6 | 4 | 154 | 9 | A | 208 | D | 0 | | | | | |
| 47 | 2 | F | 101 | 6 | 5 | 155 | 9 | B | 209 | D | 1 | | | | | |
| 48 | 3 | 0 | 102 | 6 | 6 | 156 | 9 | C | 210 | D | 2 | | | | | |
| 49 | 3 | 1 | 103 | 6 | 7 | 157 | 9 | D | 211 | D | 3 | | | | | |
| 50 | 3 | 2 | 104 | 6 | 8 | 158 | 9 | E | 212 | D | 4 | | | | | |
| 51 | 3 | 3 | 105 | 6 | 9 | 159 | 9 | F | 213 | D | 5 | | | | | |
| 52 | 3 | 4 | 106 | 6 | A | 160 | A | 0 | 214 | D | 6 | | | | | |
| 53 | 3 | 5 | 107 | 6 | B | 161 | A | 1 | 215 | D | 7 | | | | | |

8 LEDS

SmartStix I/O Modules provide diagnostic and status LED indicators.

a. Diagnostic LED Indicators

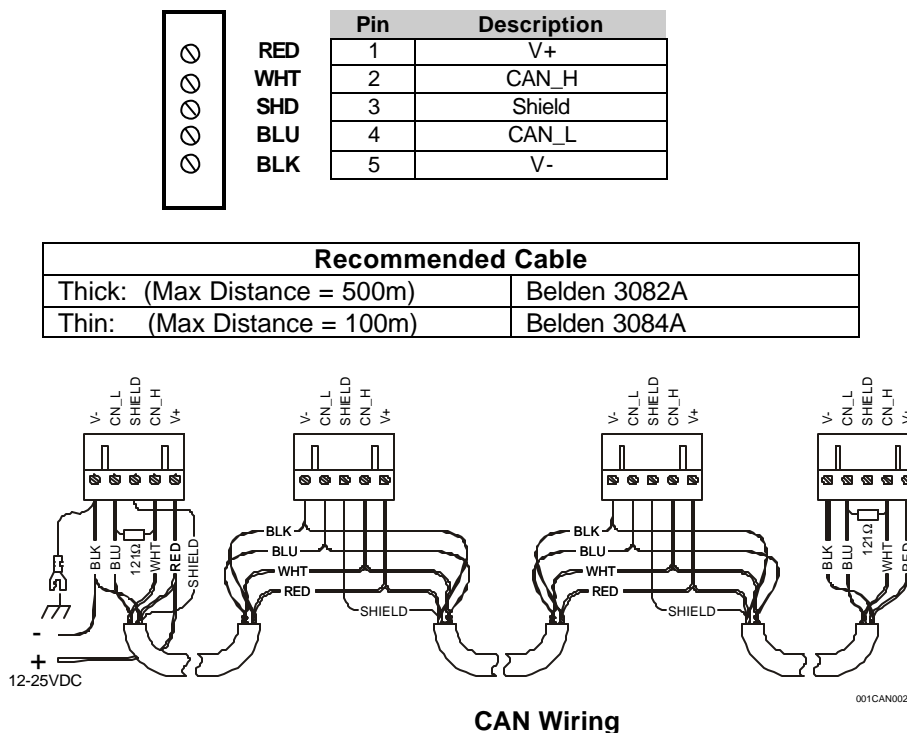
| Diagnostic LED | State | Meaning |
|--|----------------|--|
| MS (indicates fault status of the Module) | Solid Red | RAM or ROM test failed |
| | Blinking Red | I/O test failed |
| | Blinking Green | Module is in power-up state |
| | Solid Green | Module is running normally |
| NS (indicates fault status of the Network) | Solid Red | Network Ack or Dup ID test failed |
| | Blinking Red | Network ID test failed |
| | Blinking Green | Module is in Life Expectancy default state |
| | Solid Green | Network is running normally |

b. Status LED Indicators

The Power Status LED illuminates Red when power is applied to the module. There are I/O Status LED indicators for each of the Digital I/O points, which illuminate Red when an I/O point is ON.

9 NETWORK CABLE

For detailed wiring information, refer to Chapter Two in the **Control Station Hardware Manual** (MAN0227). A handy checklist is provided that covers panel box layout requirements and minimum clearances.



Note: 12 - 24VDC must be supplied to the network.

10 INSTALLATION / SAFETY

- a. All applicable codes and standards need to be followed in the installation of this product.
- b. For I/O wiring (discrete), use the following wire type or equivalent: Belden 8441 or equivalent.
- c. For detailed installation information, refer to Chapter Two in the Control Station Hardware Manual (MAN0227). A handy checklist is provided that covers panel box layout requirements and minimum clearances.



Warning: Consult user documentation.



Warning: Electrical Shock Hazard.

11 TECHNICAL ASSISTANCE

For assistance, contact Technical Support at the following locations:

North America:

(317) 916-4274
www.heapg.com

Europe:

(+) 353-21-4321-266
www.horner-apg.com