



SmartStix DeviceNet Analog I/O Modules

1 SCOPE

This user manual covers the functionality of various SmartStix DeviceNet Analog I/O modules. The devices extend I/O capabilities via a DeviceNet network. The following products are covered:

HE409ADC970 / HE459ADC970
HE409DAC207 / HE459DAC207
HE409MIX977 / HE459MIX970

2 OVERVIEW

Product features include:

- Group 2 only server
- Predefined master/slave connection set
- Explicit connection
- Polled connection
- 125k, 250k, and 500k baud rate support
- Mac IDs 0-63 available
- Two bi-colored LEDs; (Module Status and Network Status)

In order to make use of the I/O capabilities provided by DeviceNet SmartStix devices, a user needs a system that has DeviceNet Master capability that supports the predefined master/slave connection set. Using the explicit and polled connections available within the DeviceNet SmartStix modules, a DeviceNet master can monitor and control the I/O points provided by the SmartStix modules. I/O and configuration data is mapped into polled command and response messages. Configuration and status data is also read/set through the explicit connection.

Note: It is assumed that the user has working knowledge of the DeviceNet protocol. It is not the intent of this manual to cover the DeviceNet protocol.

3 SPECIFICATIONS

3a. ADC970

Table 1 - ADC970 Specifications			
ANALOG IN			
Number of input points	12	Additional error for temperatures other than 25°C	0.01% / °C
Input Ranges	±5, ±10V DC 4-20, ±20mA DC	Isolation	1000V DC IEC61010-1 300V RMS
Resolution	14 bits	Isolation Method	Magnetic
Accuracy, 25°C	0.1%	Maximum Continuous Overload	±10V: 150VAC ±20mA: ±30mA, Clamped at ±6V
Input Impedance	V: 1 Megohm mA: 150 Ohms		
Register Value for Nominal Full Scale	32000	Programmable Filter Time Constants	0.01 to 1.28 Seconds
Conversion Time	10ms for all Channels	Filter Modes	Running Average or Adaptive
GENERAL			
Required Power (Steady State)	1.8W (75mA @ 24VDC)	Pollution degree	2 or lower
Required Power (Inrush)	8A @ 24VDC for 5ms	Operating Temperature	0° to 55° C
Atmosphere	Free from corrosive gases and excessive dust	Storage Temperature	-25° to 70° C
Cooling method	Self-cooling	Operating and Storage Humidity	5 to 95% Non-condensing
Altitude for use	Up to 2,000m	Weight	8.0 oz. (227 g)

3b. DAC207

Table 2- DAC207 Specifications			
ANALOG OUT			
Number of output points	8	Isolation	1000V DC IEC61010-1 300V RMS
Output Ranges	0-5V, 0-10V DC 4-20mA, 0-20mA DC	Isolation Method	Magnetic
Resolution	14 bits	Output Clamp	±12V, 600Wpk
Accuracy, 25°C	0.1%	Output Type	Sourcing
Load Resistance	V: 600 ohms Min mA: 500 ohms Max	Register Value for Nominal Full Scale	32000
GENERAL			
Required Power (Steady State)	3.6W (150mA @ 24VDC)	Cooling method	Self-cooling
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
Operating Temperature	0° to 55° C	Pollution degree	2 or lower
Atmosphere	Free from corrosive gases and excessive dust	Weight	9 oz. (256g)

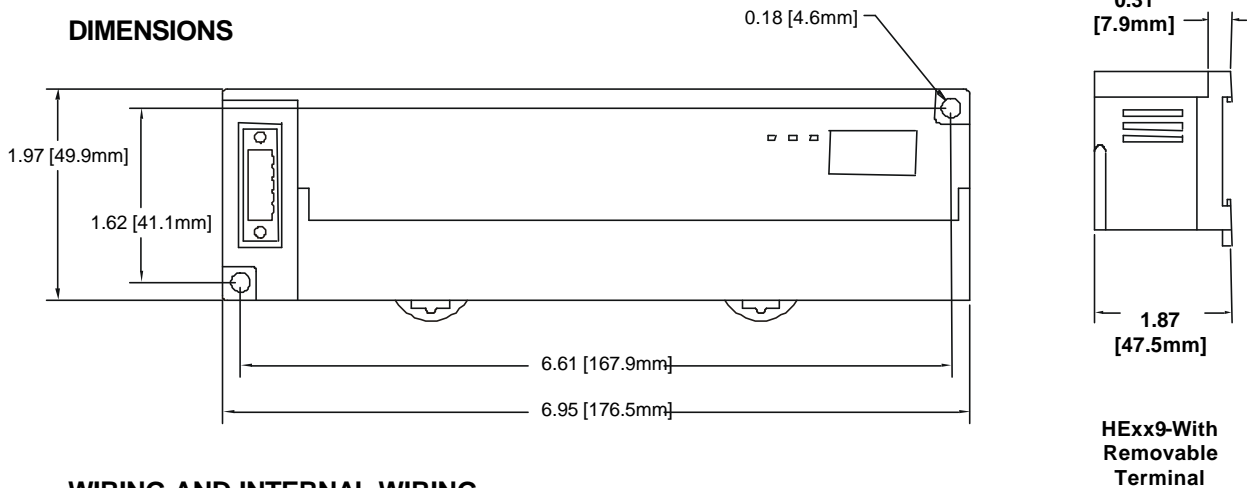
3c. MIX977

Table 3 - MIX977 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)

3d. Common SmartStix Specifications (All Models)

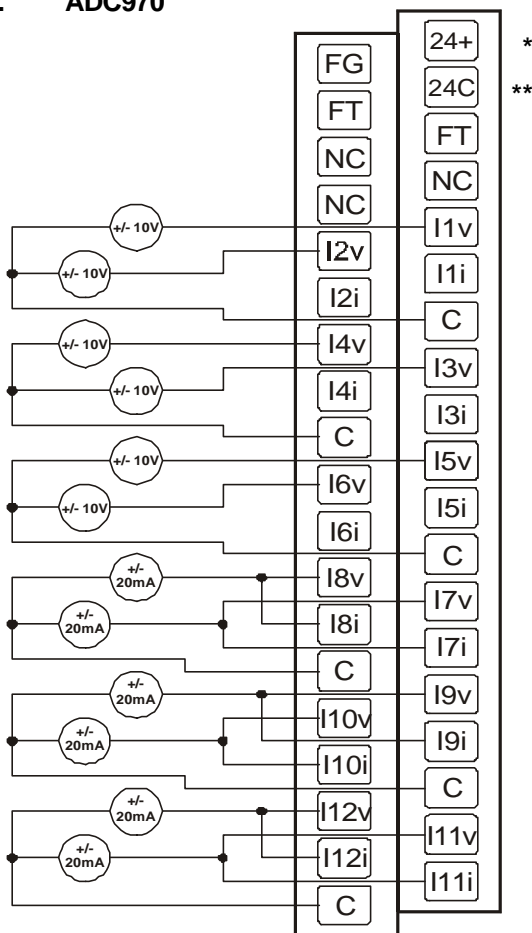
Table 4- Common SmartStix Specifications (Applies to ALL DeviceNet Analog Modules in this manual)				
Vibration				
Occasional Vibration				
Frequency	Acceleration	Amplitude		Sweep Count
$10 \leq f < 57$ Hz	-	0.075 mm		10 times in each direction for X,Y,Z
$57 \leq f \leq 150$ Hz	$9.8 \text{ m/s}^2 \{1G\}$	-		
Continuous Vibration				
Frequency	Acceleration	Amplitude		Sweep Count
$10 \leq f < 57$ Hz	-	0.035 mm		10 times in each direction for X,Y,Z
$57 \leq f \leq 150$ Hz	$4.9 \text{ m/s}^2 \{0.5G\}$	-		
Shocks				
Maximum shock acceleration		147 $\text{m/s}^2 \{15G\}$		
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: $\pm 1,500\text{VDC}$ DC: $\pm 900\text{VDC}$		
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 ($U_e \geq 24\text{V}$) Analog I/Os Communication I/Os
		Voltage	2 kV	1 kV 0.25 kV
CE		See Compliance Table at http://www.heapg.com/Support/compliance.htm Note: Requires HE200CRF005 for Touch Screen OCS models		
UL		See Compliance Table at http://www.heapg.com/Support/compliance.htm		

4 DIMENSIONS



5 WIRING AND INTERNAL WIRING

5a. ADC970



ADC970		ADC970	
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	I10v	29	I9v
32	I10i	31	I9i
34	I12v	33	C
36	I12i	35	I11v
38	C	37	I11i

FT: Factory Test, Do Not Connect

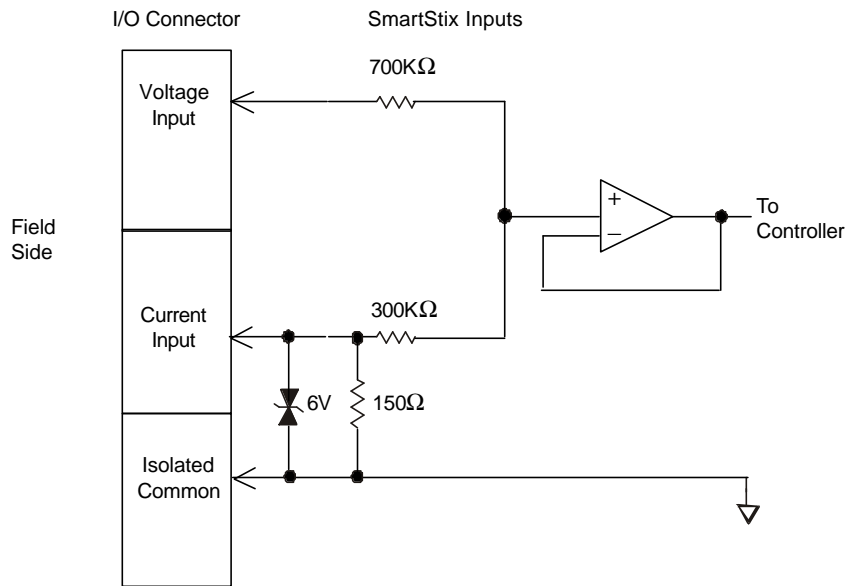
006ADC002

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

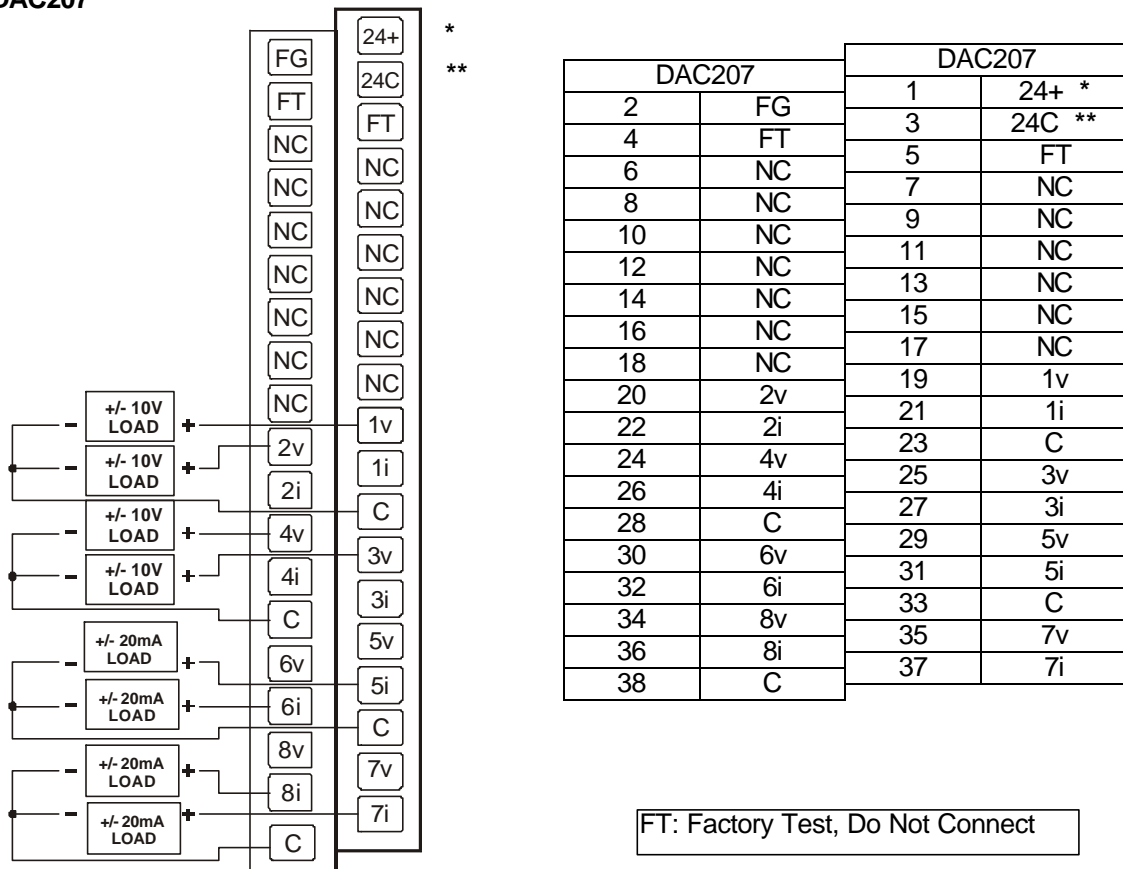
* and ** For CsCAN and DeviceNet versions, module power is usually derived from the CAN connector. In that case, +24VDC and 24C are not connected.

5a. ADC970 continued

ADC970 Internal Wiring



5b. DAC207



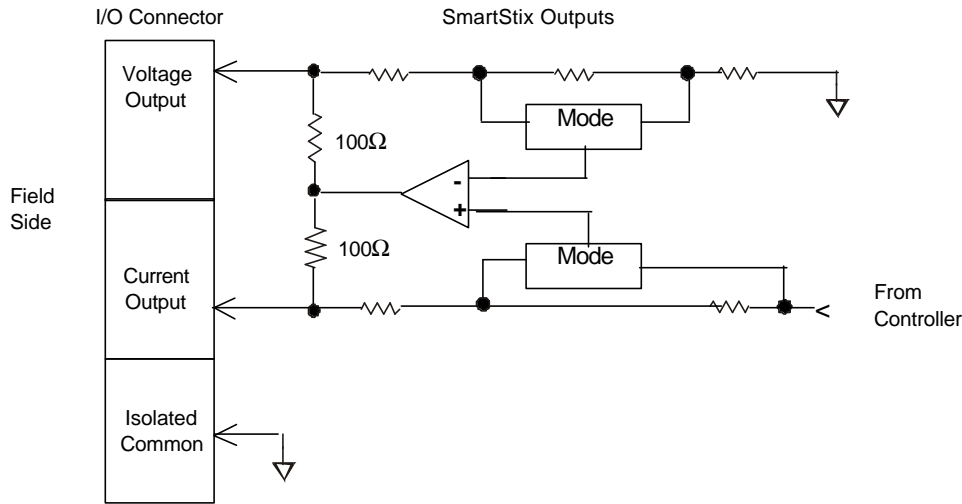
006DAC002

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

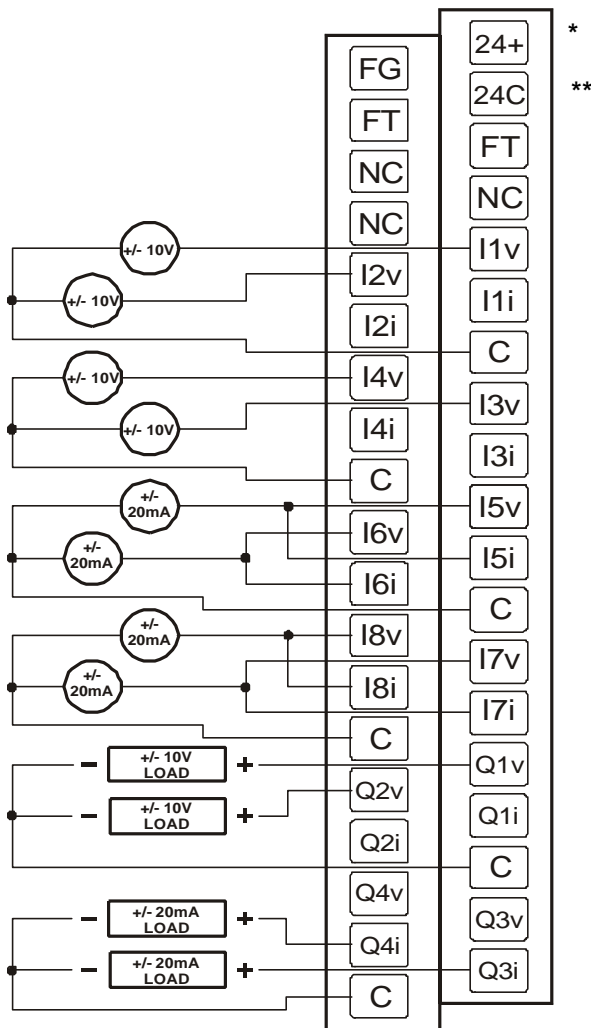
* and ** For CsCAN and DeviceNet versions, module power is usually derived from the CAN connector. In that case, +24VDC and 24C are not connected.

5b. DAC207 continued

DAC207 Internal Wiring



5c. MIX977



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

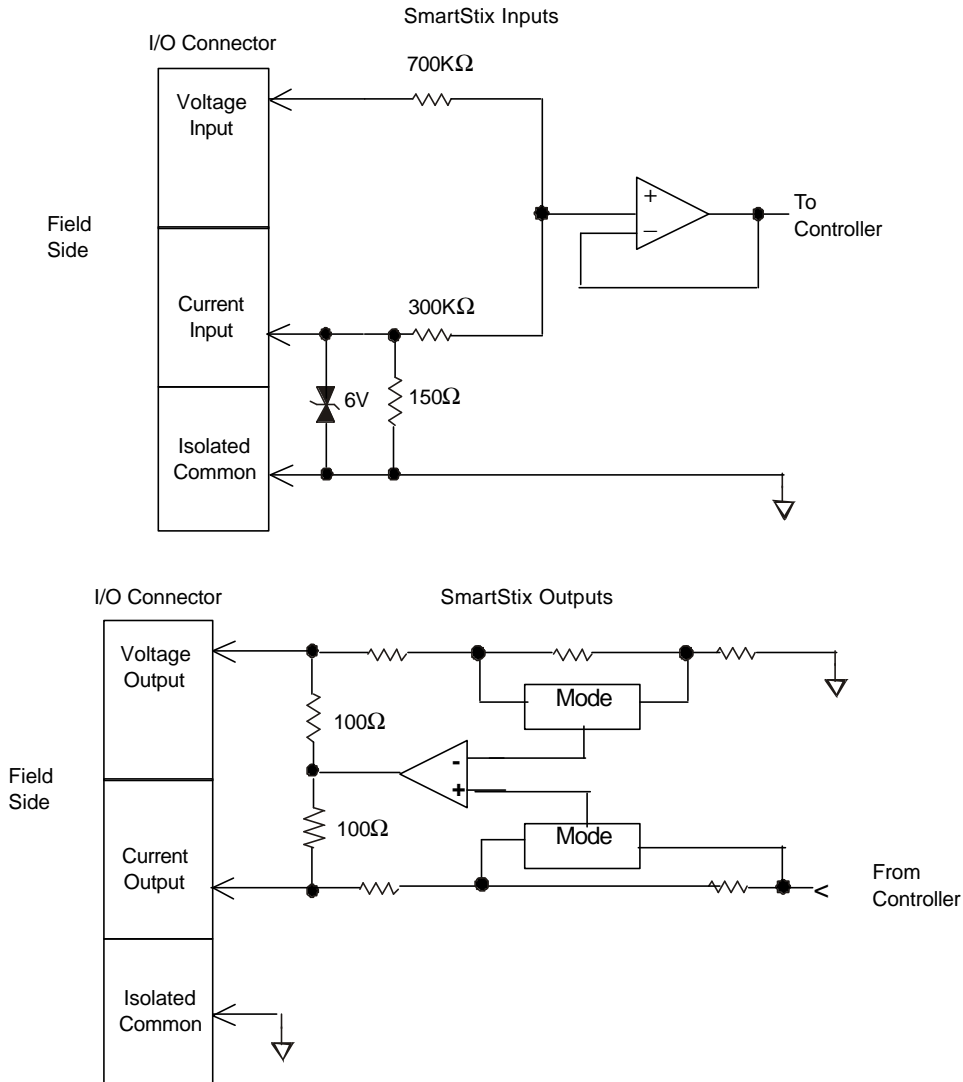
FT: Factory Test, Do Not Connect

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.

5c. MIX977 continued

MIX977 Internal Wiring



6 MAC ID SWITCHES

DeviceNet Network IDs are set using the hexadecimal number system from 00 to 3F. The decimal equivalent is 0-63. Any ID outside the range of 0-63 is considered an invalid Mac ID within DeviceNet. When the Mac ID is invalid, the module is not operational, and the module status (MS) LED blinks red. Changing the ID while the module has power causes the module to reset after a period of 5 seconds (for de-bouncing). Refer to the following 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.

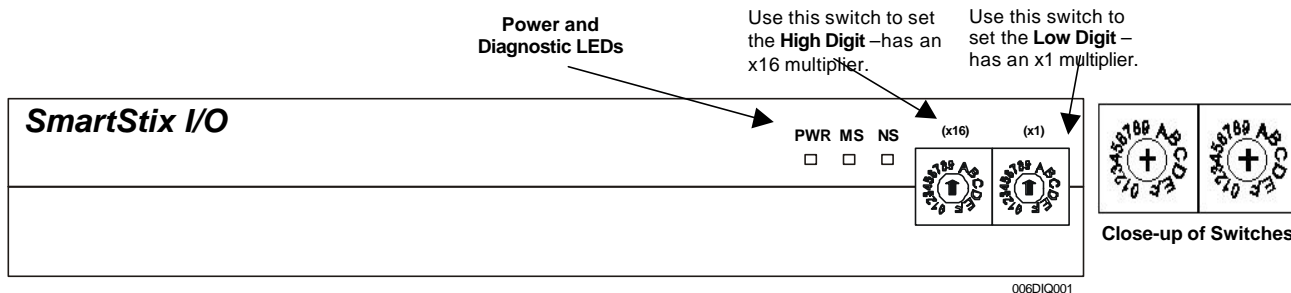


Table 5 - Mac ID Conversion Table

Dec.	Hex		Dec.	Hex		Dec.	Hex		Dec.	Hex		Dec.	Hex	
	x16	x1		x16	x1		x16	x1		x16	x1		x16	x1
0	0	0	13	0	D	26	1	A	39	2	7	52	3	4
1	0	1	14	0	E	27	1	B	40	2	8	53	3	5
2	0	2	15	0	F	28	1	C	41	2	9	54	3	6
3	0	3	16	1	0	29	1	D	42	2	A	55	3	7
4	0	4	17	1	1	30	1	E	43	2	B	56	3	8
5	0	5	18	1	2	31	1	F	44	2	C	57	3	9
6	0	6	19	1	3	32	2	0	45	2	D	58	3	A
7	0	7	20	1	4	33	2	1	46	2	E	59	3	B
8	0	8	21	1	5	34	2	2	47	2	F	60	3	C
9	0	9	22	1	6	35	2	3	48	3	0	61	3	D
10	0	A	23	1	7	36	2	4	49	3	1	62	3	E
11	0	B	24	1	8	37	2	5	50	3	2	63	3	F
12	0	C	25	1	9	38	2	6	51	3	3			

7 Baud Rate Selection

The baud rate is encoded into the rotary switches. Baud rates supported include:

- 125k
- 250k
- 500k

Baud rate encoding is as follows:

- Rotary values of 0x00 → 0x3F are macids 0-63 (respectively), running at 125k
- Rotary values of 0x40 → 0x7F are macids 0-63 (respectively), running at 250k
- Rotary values of 0x80 → 0xBF are macids 0-63 (respectively), running at 500k

8 LED INDICATORS

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

Diagnostic LED Indicators:

Table 6 – Diagnostic LEDs		
Diagnostic LED	State	Meaning
MS (indicates Module status)	Solid Red	N/A
	Blinking Red	Invalid Mac ID or Dup ID test failed
	Blinking Green	N/A
	Solid Green	Module is running normally
NS (indicates Network status)	Solid Red	Dup ID test failed
	Blinking Red	I/O Connection timed out
	Blinking Green	No connections in established state
	Solid Green	One or more connection(s) are in the established state

Status LED Indicators:

The Power Status LED illuminates Red when power is applied to the module.

9 NETWORK CONNECTION

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.

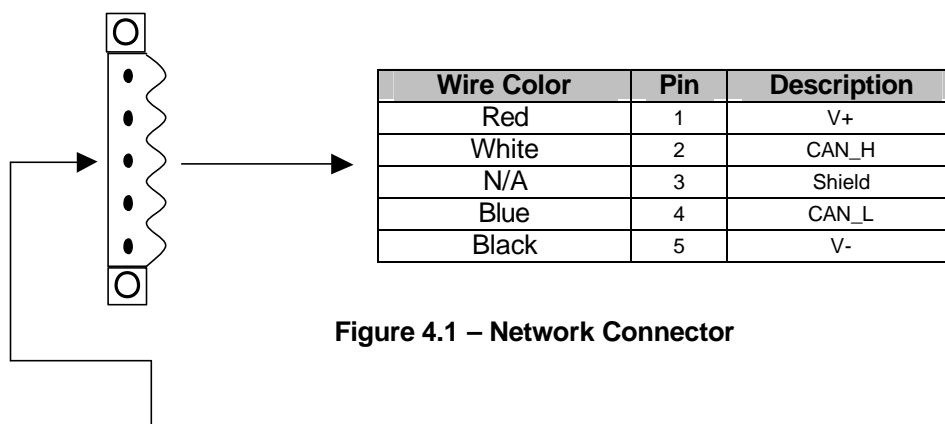


Figure 4.1 – Network Connector

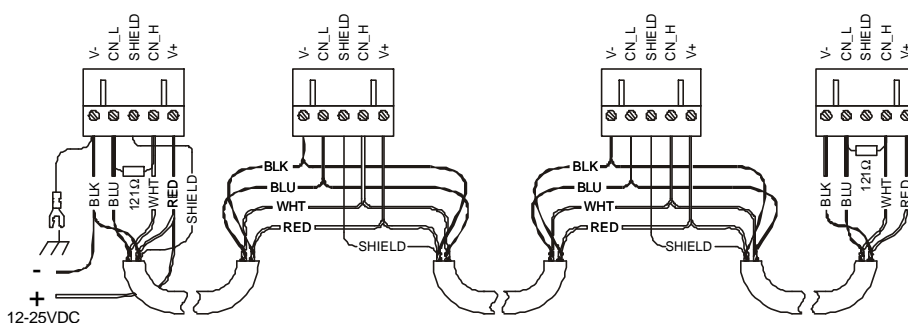


Figure 4.2 – CAN Wiring

001CAN002

Table 7 - Recommended Cable	
Thick: (Max Distance = 500m)	Belden 3082A
Thin: (Max Distance = 100m)	Belden 3084A

Note: 24VDC must be supplied to the network.

10 MODULE DATA

10a. Mode / Input filter control:

Voltage / Current mode and input filter control (16 bits)															
A1	F3	F2	F1	M12	M11	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1
M16	M15	M14	M13												

M16...M1 → Mode bits. A low mode bit (0) selects *voltage* mode for the corresponding channel and a high mode bit (1) selects *current* mode for the corresponding channel.

F3...F1 → Filter bits. Input digital filter time constant codes for analog input modules.

Table 8 – Input filter time constants			
F3	F2	F1	Time Constant
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

A1 → Adaptive filter enable bit for analog input modules.

Each analog input has a single pole 345Hz (461uS) cutoff high frequency noise filter. This filter is useful for applications with significant amounts of random (Gaussian) noise. The slower time constants, while yielding better noise suppression, take a longer time to settle after step changes and are also somewhat sensitive to impulse noise and averaged in.

Set A1 to a 1 to specify an adaptive filter algorithm that:

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

Note: Only modules with analog inputs use F1-F3 and A1 in place of M13-M16.

10b. Scaling:

Scale bits (16 bits)															
S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1

S16...S1 → Scale bits. A low scale bit (0) selects $\pm 10V$ (When running in *voltage* mode) or $\pm 20mA$ (When running in *current* mode) for the corresponding channel. A high scale bit (1) selects $\pm 5V$ (When running in *voltage* mode) or $4-20mA$ (When running in *current* mode) for the corresponding channel.

10c. Default state of outputs:

Default state of outputs (16 bits)															
H8	H7	H6	H5	H4	H3	H2	H1								

H8...H1 → Determines the default state of the analog outputs (If any) when the polled connection is *not* in established state. If an H bit is 1, its corresponding analog output holds its last state. If an H bit is 0, its corresponding analog output is forced to the value contained in the associated default analog output word.

10d. Device ID:

Device identification status data (8 bits)
Device Class Number = 0 to 255

8	HE559ADC970
9	HE559MIX977
10	HE559DAC207
11	HE559MIX577

10e. Firmware version:

Firmware revision status data (8 bits)
Version Number = 0 to 255 (0.00 → 2.55)

10f. Analog inputs:

Analog input channel data (16 bits per channel)
Value = 0 to 65535

10g. Analog outputs:

Analog output channel data (16 bits per channel)
Value = 0 to 65535

10h. Analog output default values:

Default output channel data (16 bits per channel)
Value = 0 to 65535

The default output data is used to specify the value of analog outputs when the polled connection is not in the *established* state. These values are only used when the corresponding Hx bit (From the Default state of outputs word, previously described) is zero.

11 DATA MAPPING**11a. ADC970**

The ADC970 is a 12 channel analog input module. The following tables show the analog channel mapping within the: Mode/Input Filter control register and scaling register.

Table 9 - ADC970 – Mode / Input Filter Control	
M1	Input Channel 1
M2	Input Channel 2
M3	Input Channel 3
M4	Input Channel 4
M5	Input Channel 5
M6	Input Channel 6
M7	Input Channel 7
M8	Input Channel 8
M9	Input Channel 9
M10	Input Channel 10
M11	Input Channel 11
M12	Input Channel 12
F1	See Table 8
F2	See Table 8
F3	See Table 8
A1	Adaptive Filter Enable

Table 10 - ADC970 – Scaling	
S1	Input Channel 1
S2	Input Channel 2
S3	Input Channel 3
S4	Input Channel 4
S5	Input Channel 5
S6	Input Channel 6
S7	Input Channel 7
S8	Input Channel 8
S9	Input Channel 9
S10	Input Channel 10
S11	Input Channel 11
S12	Input Channel 12
S13	Not used
S14	Not used
S15	Not used
S16	Not used

ADC970 is an input only module, so in this case the default state of outputs register is not applicable, and thus not used.

11.b HE550DAC207

The HE550DAC207 is an 8 channel analog output module. The following tables show the analog channel mapping within the: Mode/Input Filter control register, scaling register, and default state of outputs register.

Table 11 DAC207 – Mode / Input Filter Control	
M1	Not used
M2	Not used
M3	Not used
M4	Not used
M5	Not used
M6	Not used
M7	Not used
M8	Not used
M9	Output Channel 1
M10	Output Channel 2
M11	Output Channel 3
M12	Output Channel 4
M13	Output Channel 5
M14	Output Channel 6
M15	Output Channel 7
M16	Output Channel 8

Table 12 DAC207 – Scaling	
S1	Not used
S2	Not used
S3	Not used
S4	Not used
S5	Not used
S6	Not used
S7	Not used
S8	Not used
S9	Output Channel 1
S10	Output Channel 2
S11	Output Channel 3
S12	Output Channel 4
S13	Output Channel 5
S14	Output Channel 6
S15	Output Channel 7
S16	Output Channel 8

Table 13 - DAC207 – Default State of Outputs	
H1	Output Channel 1
H2	Output Channel 2
H3	Output Channel 3
H4	Output Channel 4
H5	Output Channel 5
H6	Output Channel 6
H7	Output Channel 7
H8	Output Channel 8

11c. MIX977

The MIX977 is an 8 channel analog input / 4 channel analog output module. The following tables show the analog channel mapping within the: Mode/Input Filter control register, scaling register, and default state of outputs register.

M1	Input Channel 1
M2	Input Channel 2
M3	Input Channel 3
M4	Input Channel 4
M5	Input Channel 5
M6	Input Channel 6
M7	Input Channel 7
M8	Input Channel 8
M9	Output Channel 1
M10	Output Channel 2
M11	Output Channel 3
M12	Output Channel 4
F1	See Table 8
F2	See Table 8
F3	See Table 8
A1	Adaptive Filter Enable

S1	Input Channel 1
S2	Input Channel 2
S3	Input Channel 3
S4	Input Channel 4
S5	Input Channel 5
S6	Input Channel 6
S7	Input Channel 7
S8	Input Channel 8
S9	Output Channel 1
S10	Output Channel 2
S11	Output Channel 3
S12	Output Channel 4
S13	Not used
S14	Not used
S15	Not used
S16	Not used

H1	Output Channel 1
H2	Output Channel 2
H3	Output Channel 3
H4	Output Channel 4
H5	Not used
H6	Not used
H7	Not used
H8	Not used

12 SmartStix DeviceNet Object

DeviceNet SmartStix modules contain a product line specific object that can be accessed through DeviceNet. The following explains the object and how to access it.

SmartStix DeviceNet Object Class Code: 64 (hex) or 100 (decimal)

Note: See Module Data Section (starting on page 11) for an explanation of data fields.

Table 17 - Instance Attributes		
Attribute ID	Description of Attribute	Size (In bits)
1	Mode / Input Filter Control	16
2	Scale Factor	16
3	Default State for Analog Outputs	16
4	Device Class	8
5	Firmware Version	8
6	Count of 16 bit words of consumed analog data	16
7	Consumed Analog Data	(Value of Attribute #6) x 16
8	Count of 16 bit words of produced analog data	16
9	Produced Analog Data	(Value of Attribute #8) x 16

Table 18 - Common Services	
Code	Service
0E (hex) or 14 (decimal)	Get Attribute Single
10 (hex) or 16 (decimal)	Set Attribute Single

Table 19 - Attribute Access Rules	
Attribute ID	Access
1	Get Attribute Single / Set Attribute Single
2	Get Attribute Single / Set Attribute Single
3	Get Attribute Single / Set Attribute Single
4	Get Attribute Single
5	Get Attribute Single
6	Get Attribute Single
7	Get Attribute Single
8	Get Attribute Single
9	Get Attribute Single

When accessing an attribute of this object the user must use an instance value of 1. An explicit connection must exist between the DeviceNet master and the SmartStix module before access to this object is possible. Access this object through the explicit connection using an explicit message. The explicit message should contain the following information:

Table 20 - Getting Data	
Service	0E (hex) or 14 (decimal)
Class	64 (hex) or 100 (decimal)
Instance	1
Attribute	1 - 9

Table 21 - Setting Data	
Service	10 (hex) or 16 (decimal)
Class	64 (hex) or 100 (decimal)
Instance	1
Attribute	1 - 3
Data	Service Data (Within the size of the attribute)

13 Polled Connection Data

Note: See Module Data Section (starting on page 11) for an explanation of data fields.

The polled connection provides an interface to the analog I/O data as well as mode/input filter control data for input modules only. Analog output points are mapped into polled command messages coming from a DeviceNet master, and analog input points are mapped into polled response messages going back to the master. The following sections explain the produced and consumed polled connection message formats.

13a. ADC970 – 12 Channel Analog Input Module

Note: See Module Data Section (starting on page 11) for an explanation of data fields.

Table 22-Produced Polled Data (16 bits each)
Analog Input Channel 1 Data
Analog Input Channel 2 Data
Analog Input Channel 3 Data
Analog Input Channel 4 Data
Analog Input Channel 5 Data
Analog Input Channel 6 Data
Analog Input Channel 7 Data
Analog Input Channel 8 Data
Analog Input Channel 9 Data
Analog Input Channel 10 Data
Analog Input Channel 11 Data
Analog Input Channel 12 Data

Table 23-Consumed Polled Data (16 bits each)
Mode / Input Filter Control

13b. DAC207 – 8 Channel Analog Output Module

Note: See Module Data Section (starting on page 11) for an explanation of data fields.

Since this is an output only module, there is no produced data for the polled connection.

Table 24-Consumed Polled Data (16 bits each)
Analog Output Channel 1 Data
Analog Output Channel 2 Data
Analog Output Channel 3 Data
Analog Output Channel 4 Data
Analog Output Channel 5 Data
Analog Output Channel 6 Data
Analog Output Channel 7 Data
Analog Output Channel 8 Data
Default Output Channel 1 Data
Default Output Channel 2 Data
Default Output Channel 3 Data
Default Output Channel 4 Data
Default Output Channel 5 Data
Default Output Channel 6 Data
Default Output Channel 7 Data
Default Output Channel 8 Data

13c. MIX977 – 8 Channel Analog Input / 4 Channel Analog Output Module

Note: See Module Data Section (starting on page 11) for an explanation of data fields.

Table 25-Produced Polled Data (16 bits each)
Analog Input Channel 1 Data
Analog Input Channel 2 Data
Analog Input Channel 3 Data
Analog Input Channel 4 Data
Analog Input Channel 5 Data
Analog Input Channel 6 Data
Analog Input Channel 7 Data
Analog Input Channel 8 Data

Table 26-Consumed Polled Data 1 (Default) (16 bits each)
Mode / Input Filter Control
Analog Output Channel 1 Data
Analog Output Channel 2 Data
Analog Output Channel 3 Data
Analog Output Channel 4 Data
Default Output Channel 1 Data
Default Output Channel 2 Data
Default Output Channel 3 Data
Default Output Channel 4 Data

13c. continued

Note: See Module Data Section (starting on page 11) for an explanation of data fields.

Table 27-Consumed Polled Data 2 (16 bits each)	
	Analog Output Channel 1 Data
	Analog Output Channel 2 Data
	Analog Output Channel 3 Data
	Analog Output Channel 4 Data
	Default Output Channel 1 Data
	Default Output Channel 2 Data
	Default Output Channel 3 Data
	Default Output Channel 4 Data

The MIX977 has two available consuming connections: One that contains the mode/filter control data along with the analog data and one that contains the analog data alone. The former is the default. In order to select the connection of only the analog data, an explicit message will have to be sent to the polled instance of the connection object using the following:

Note: See Module Data Section (starting on page 11) for an explanation of data fields.

Table 28-Selecting the Consumed Connection 2	
Service	10 (hex) or 16 (decimal) – Set Attribute Single
Class	5 – Connection Object
Instance	2 – Polled Instance
Attribute	16 – Consumption Connection Path
Data	20, 04, 24, 65, 30, 03 (Path, in hex)

The default connection can then be selected using the following information for an explicit message (However, this is the default so this shouldn't be necessary):

Table 29-Selecting the Consumed Connection 1	
Service	0x10 (hex) or 16 (decimal) – Set Attribute Single
Class	5 – Connection Object
Instance	2 – Polled Instance
Attribute	16 – Consumption Connection Path
Data	20, 04, 24, 67, 30, 03 (Path, in hex)

Note: See Module Data Section (starting on page 11) for an explanation of data fields.

In order to change the consuming connection path, the polled connection must be allocated and in configuring state (Pre-established state). It cannot be changed after the polled connection is in established state. Once the polled connection is released, the consuming connection path will revert back to its default value.

14 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: $\text{Data} = V / \text{Conversion Factor}$
 $19200 = 6 \text{ VDC} / 0.0003125$

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.

15 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 the Control Station Hardware Manual (MAN0227), or MiniOCS Hardware Manual (MAN0305) or Touch Screen OCS Hardware Manual (MAN0465). 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 manual updates or assistance, contact Technical Support at the following locations:

North America:

(317) 916-4274
www.heapg.com
email: techspt@heapg.com

Europe:

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

Notes