



**Analog I/O Module**  
**HE559MIX977**  
**8 Input Channels**  
**4 Sourcing Output Channels**  
**±5V / ±10V / 4-20mA / ±20mA**  
**CsCAN**

*SmartStix*

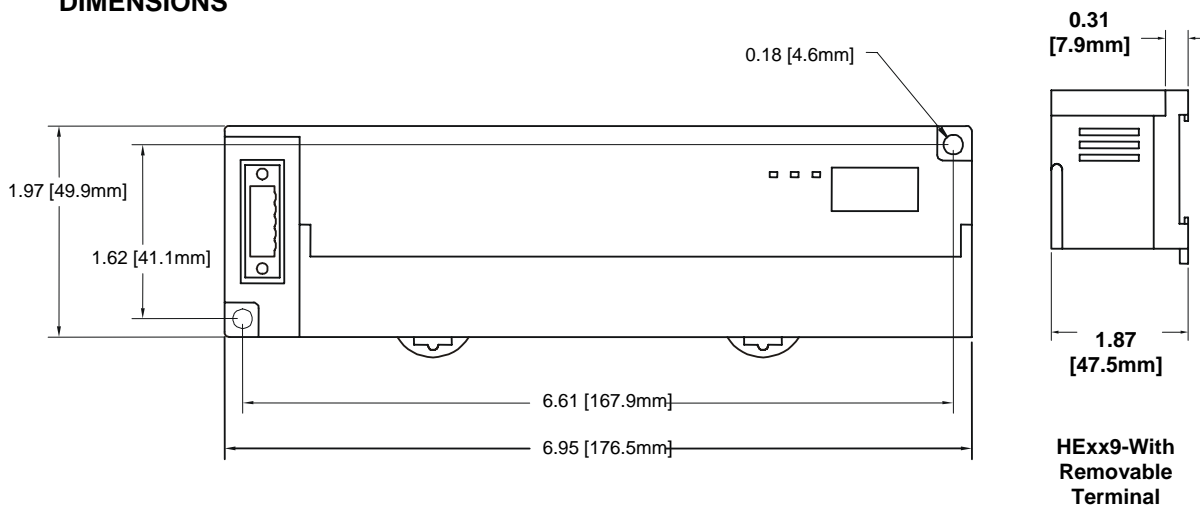
Refer to SmartStix Analog Programming Guide (MAN0703) at [www.HornerOCS.com](http://www.HornerOCS.com).

**1 SPECIFICATIONS**

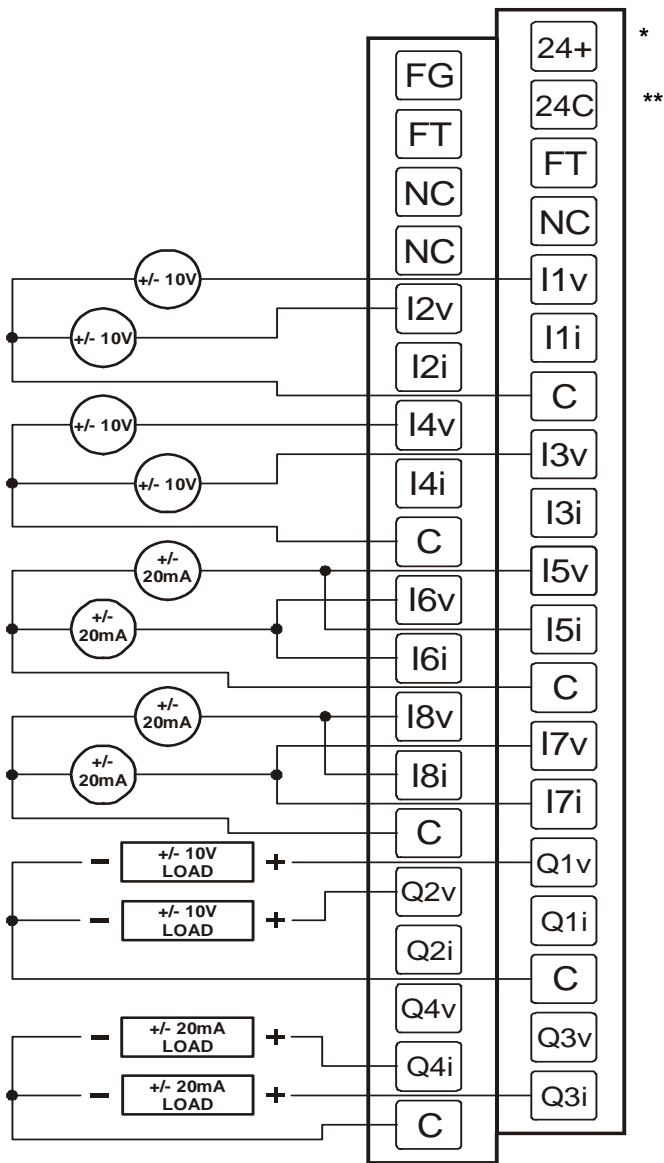
ANALOG IN			
Number of input points	8	Conversion Time	10ms for all Channels
Input Ranges	±5V, ±10V DC 4-20mA, ±20mA DC	Isolation	1000V DC IEC61010-1 300V RMS
Resolution	14 bits	Isolation Method	Magnetic
		Additional error for temperatures other than 25°C	0.01% / °C
Accuracy, 25°C	0.1%	Maximum Continuous 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
Max Output current, mA mode	3 channels driving 20mA max output loads		
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)

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 m/s <sup>2</sup> {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 m/s <sup>2</sup> {0.5G}	-		
Shocks				
Maximum shock acceleration		147 m/s <sup>2</sup> {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: $\pm 1,500$ VDC DC: $\pm 900$ 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 (Ue $\geq 24$ V)	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

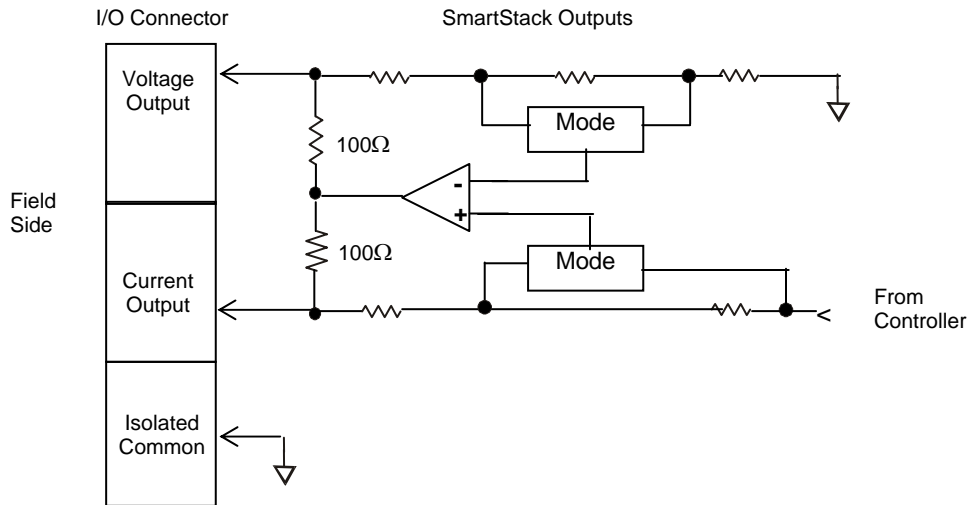
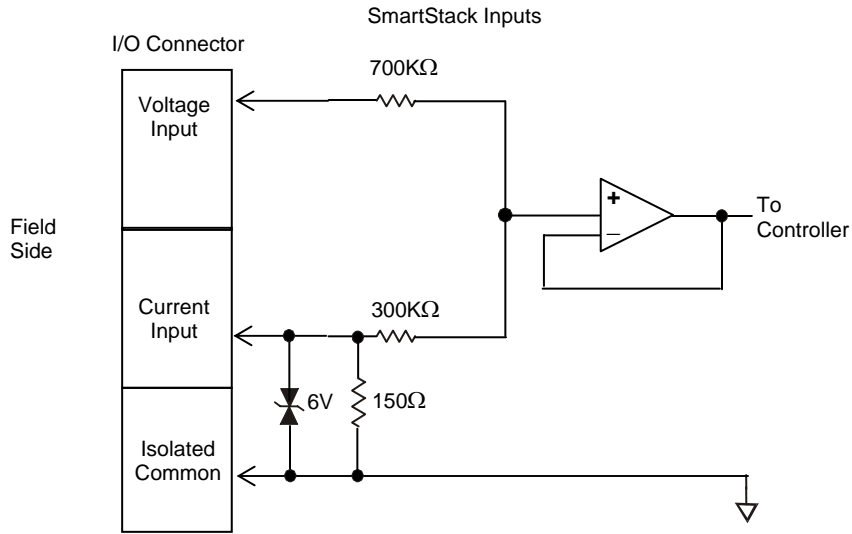
Mix977		Mix977	
2	FG	1	24+ *
4	FT	3	24C **
6	NC	5	FT
8	NC	7	NC
10	I2v	9	I1v
12	I2i	11	I1i
14	I4v	13	C
16	I4i	15	I3v
18	C	17	I3i
20	I6v	19	I5v
22	I6i	21	I5i
24	I8v	23	C
26	I8i	25	I7v
28	C	27	I7i
30	Q2v	29	Q1v
32	Q2i	31	Q1i
34	Q4v	33	C
36	Q4i	35	Q3v
38	C	37	Q3i

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 (461uS) 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:  $\text{Data} = V / \text{Conversion Factor}$   
 $19200 = 6 \text{ VDC} / 0.0003125$

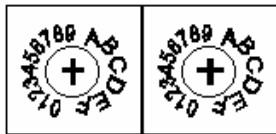
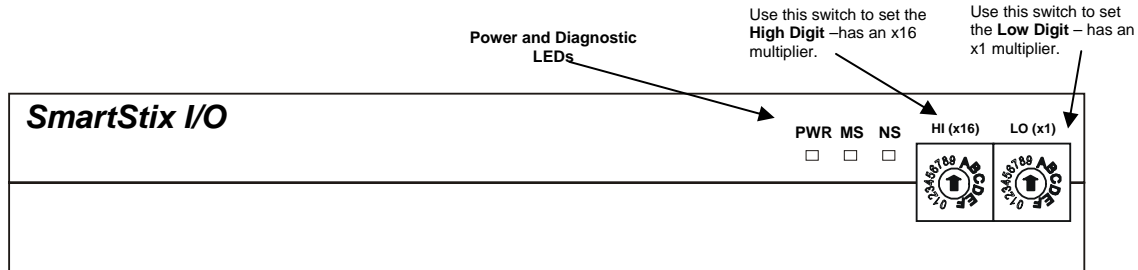
Conversion between Physical Values and Register Values			
Selected Range	Volts / mA	Register Data	Conversion Factor
$\pm 5.00 \text{ V}$	> 5.11	32767	0.00015625
	5.00	32000	
	0.00	0	
	-5.00	-32000	
	< -5.11	-32768	
$\pm 10.00 \text{ V}$	> 10.23	32767	0.0003125
	10.00	32000	
	0.00	0	
	-10.00	-32000	
	< -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
<b>MS</b> (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
<b>NS</b> (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

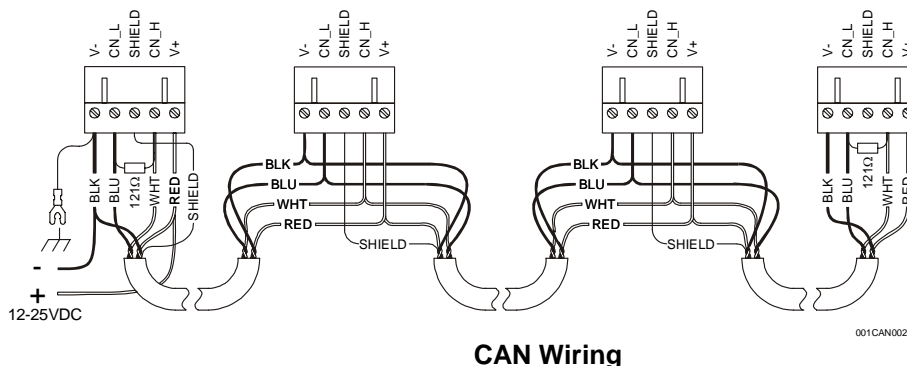
The Power Status LED illuminates Red when power is applied to the module. There are I/O Status LED indicators for each of the Digital I/O points, which illuminate Red when an I/O point is ON.

## 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.

Pin	Description
1	V+
2	CAN_H
3	Shield
4	CAN_L
5	V-

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



**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](http://www.heapg.com)

### Europe:

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