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
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)

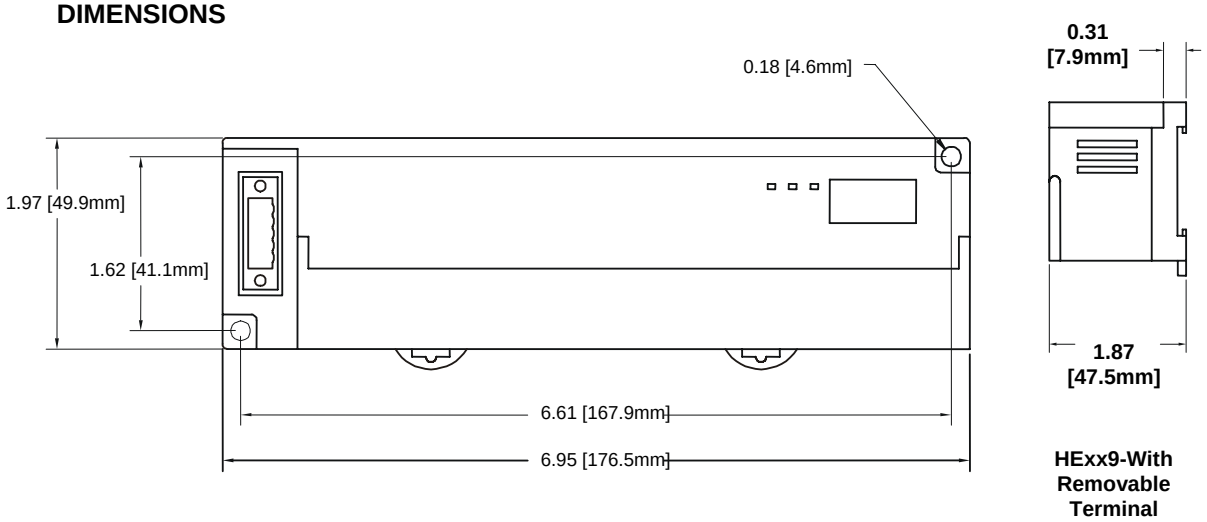
All information subject to change without notice.

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)

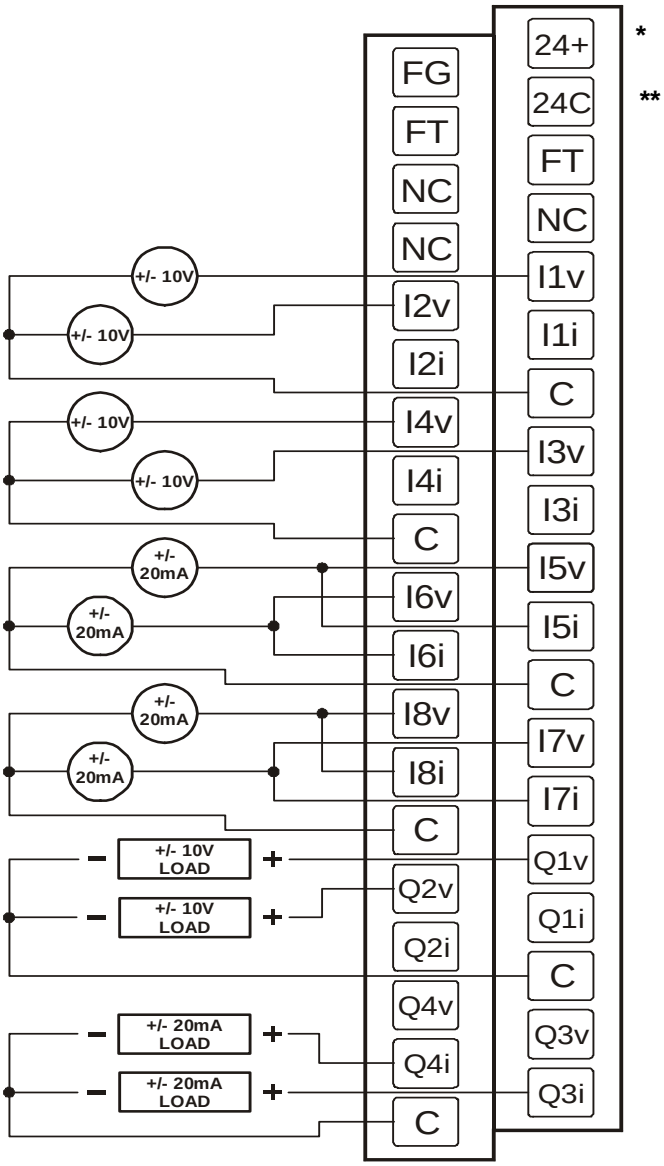
Noise Immunity				
Square wave impulse noise	AC: ± 1,500VDC DC: ± 900VDC			
Electrostatic Discharge	Voltage: 4kV (contact discharge)			
Radiated electromagnetic field	27 – 500MHz, 10V/m			
Fast Transient Burst Noise	**Severity level**	All power modules	Digital I/Os (Ue ≥24V)	Digital I/Os (Ue < 24 V) Analog I/Os Communication I/Os
	Voltage	2 kV	1 kV	0.25 kV

2 DIMENSIONS



HExx9-With Removable Terminal

3 WIRING



006MIX002

Mix977	
2	FG
4	FT
6	NC
8	NC
10	I2v
12	I2i
14	I4v
16	I4i
18	C
20	I6v
22	I6i
24	I8v
26	I8i
28	C
30	Q2v
32	Q2i
34	Q4v
36	Q4i
38	C

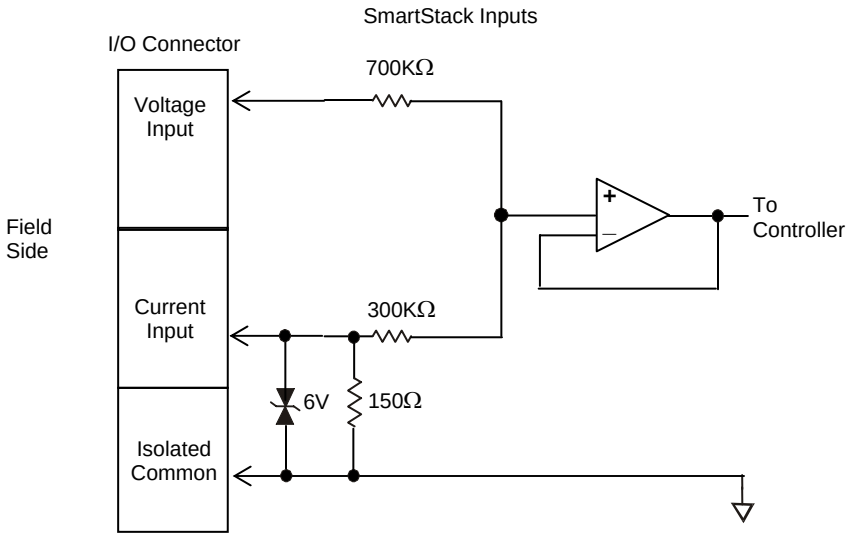
Mix977	
1	24+ *
3	24C **
5	FT
7	NC
9	I1v
11	I1i
13	C
15	I3v
17	I3i
19	I5v
21	I5i
23	C
25	I7v
27	I7i
29	Q1v
31	Q1i
33	C
35	Q3v
37	Q3i

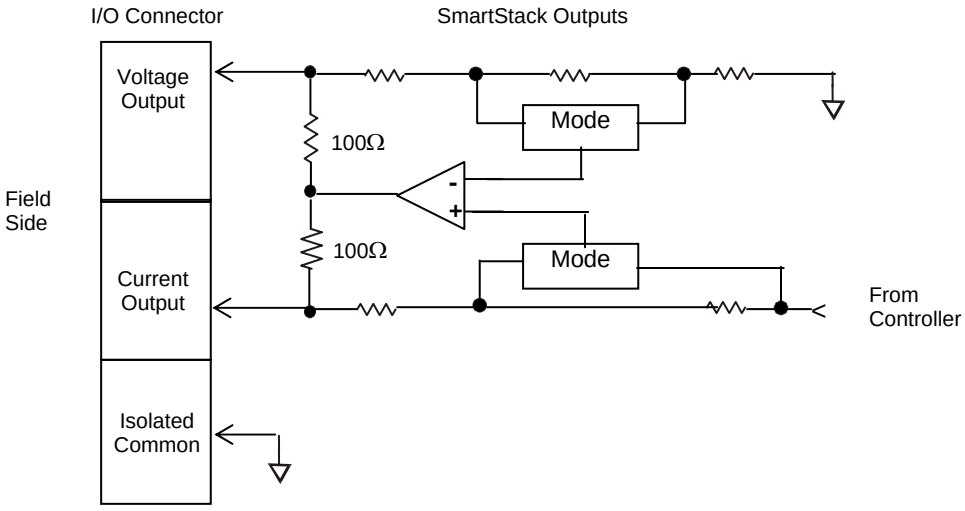
FT: Factory Test, Do Not Connect

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 <u>not</u> 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 ±10V and a high mode bit selects ±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 ±10V or ±20mA for the corresponding channel. A high scale bit selects ±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 ±10V:

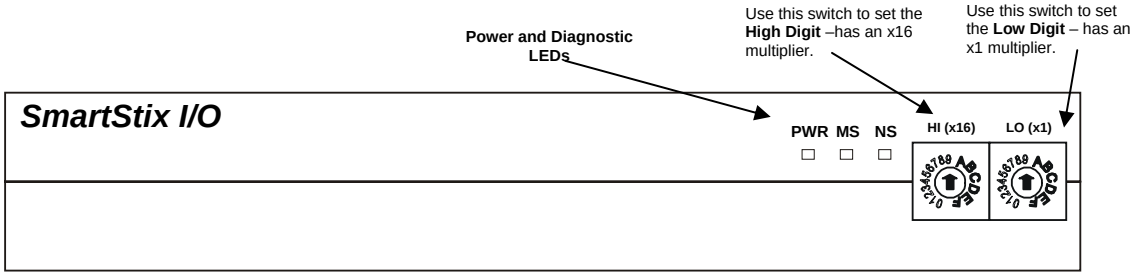
1. The physical voltage is 6 Volts.
2. Using the table, the conversion factor for the voltage range of ±10V is .0003125.
3. To determine the data value, the formula is used: Data = V / Conversion Factor
   19200 = 6 VDC / 0.0003125

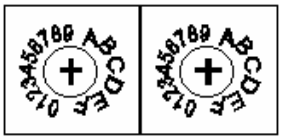
Conversion between Physical Values and Register Values			
Selected Range	**Volts / mA**	**Register Data**	**Conversion Factor**
±5.00 V	> 5.11	32767	0.00015625
	5.00	32000	
	0.00	0	
	-5.00	-32000	
	< -5.11	-32768	
±10.00 V	> 10.23	32767	0.0003125
	10.00	32000	
	0.00	0	
	-10.00	-32000	
	< -10.23	-32768	
* 4 to 20 mA	< 20.37	32767	0.0005
	20.00	32000	
	4.00	0	
	-12.00	-32000	
	> -12.38	-32768	
±20.00 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**			**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

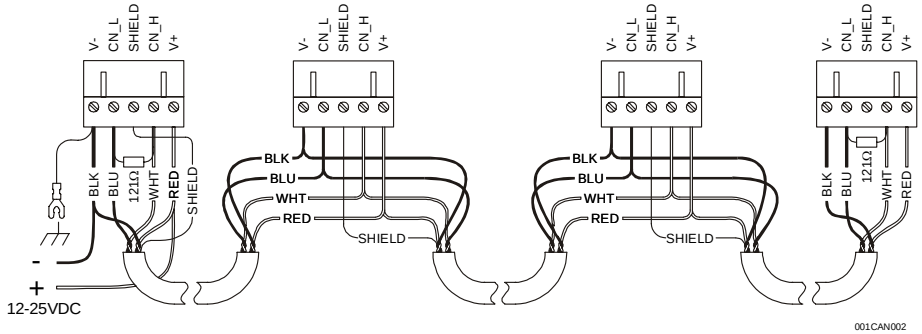
The Power Status LED illuminates Red when power is applied to the module. There are I/O Status LED indicators for each of the Digital I/O points, which illuminate Red when an I/O point is ON.

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.

	Pin	Description
RED	1	V+
WHT	2	CAN_H
SHD	3	Shield
BLU	4	CAN_L
BLK	5	V-

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



CAN Wiring

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