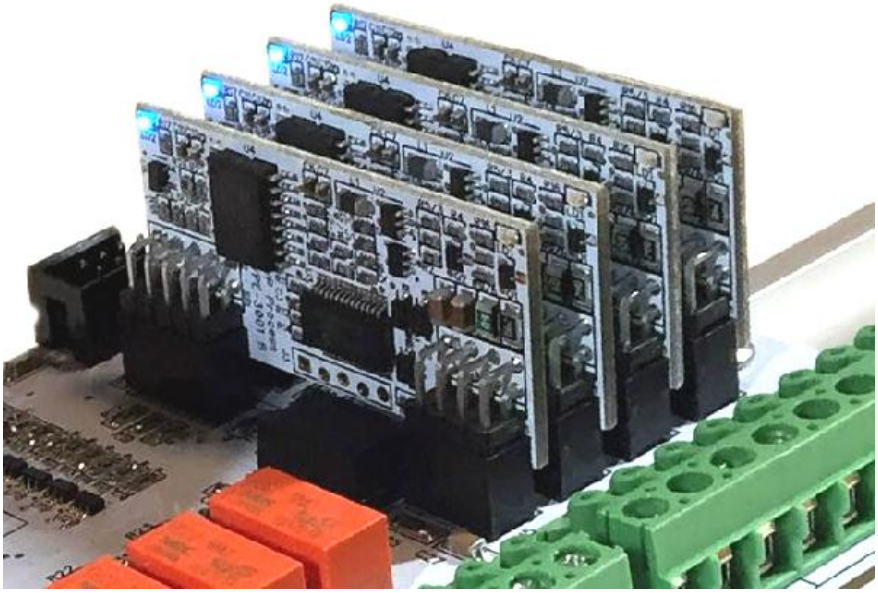
VP PROCESS INC.

MODEL: SDAFE™-X55
ISOLATED
SOFTWARE DEFINED ANALOG FRONT END



Version 1.0
Model: SDAFE-X55
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VP Process Inc.
www.vpprocess.com
info@vpprocess.com

Distribution
Widgetlords Electronics
www.widgetlords.com
info@widgetlords.com

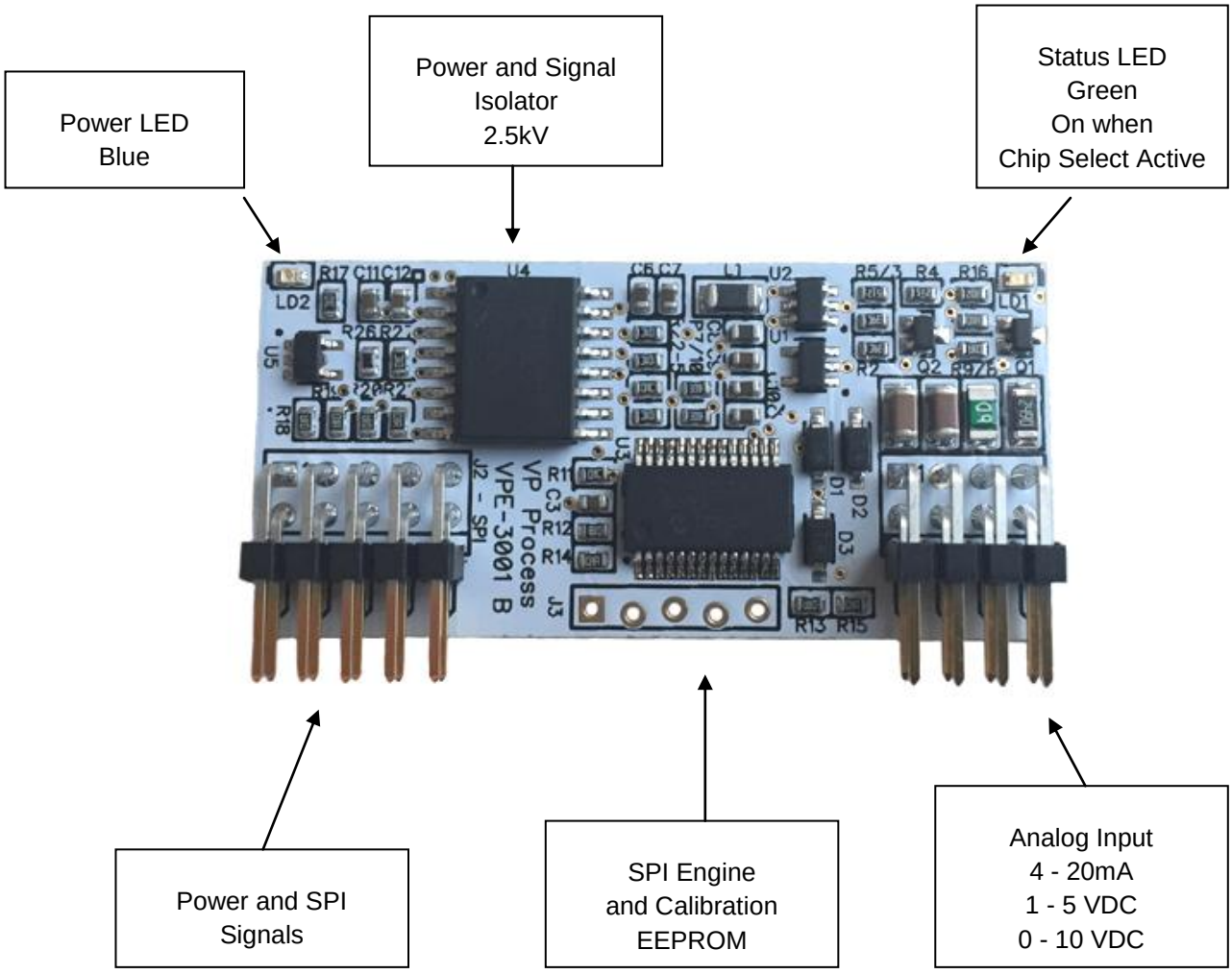
DESCRIPTION

The SDAFE™-X55 is an isolated analog signal conditioner. Inputs can be software selected to be either mA or VDC in various ranges and unit types. Signal and power isolation based on the Analog Devices, Inc., iCoupler® technology,

The Isolator Integrated Circuit carries the following Safety and Regulatory Approvals:

- UL recognition
- 2500 V rms for 1 minute per UL 1577
- CSA Component Acceptance Notice #5A
- VDE certificate of conformity (pending)
- IEC 60747-5-2 (VDE 0884, Part 2)
- VIORM= 560 V peak

The SDAFE™ communicates via SPI, and is powered from a single +3.3VDC or +5VDC source.



SIGNAL INPUT TYPES

INPUT	TYPE	RANGE	SCALER	RAW AD COUNTS
20 mA	1	0.000 - 20.000 mA 0 - 20000	1000	0 to 32,511 AD Counts
	2	0.00 - 100.00 % (0 - 20 mA) 0 - 10000	100	0 to 32,511 AD Counts
	3	0.00 - 100.00 % (4 - 20 mA) 0 - 10000	100	0 to 32,511 AD Counts
5 VDC	4	0.000 - 5.000 VDC 0 - 5000	1000	0 to 32,511 AD Counts
	5	0.00 - 100.00 % (0 - 5 VDC) 0 - 10000	100	0 to 32,511 AD Counts
	6	0.00 - 100.00 % (1 - 5 VDC) 0 -10000	100	0 to 32,511 AD Counts
10 VDC	7	0.000 - 10.000 VDC 0 - 10000	1000	0 to 32,511 AD Counts
	8	0.00 - 100.00 % (0 - 10 VDC) 0 - 10000	100	0 to 32,511 AD Counts
	9	0.00 - 100.00 % (2 - 10 VDC) 0 - 10000	100	0 to 32,511 AD Counts

SPECIFICATIONS

Power: 3.3VDC or 5.0VDC (Raspberry Pi and Arduino Compatible)

SPI:

MISO	Data Input, Active High
MOSI	Data Output, Active High During Chip Select, Open Collector Output
SCK	Clock
/CS	Chip Select, Active Low
Speed	Up to 100KHz

Input:

	Type 1: (Default)	0 - 20 mA	0 - 20000	Units: mA
	Type 2:	0 - 20 mA	0 - 10000	%
	Type 3:	4 - 20 mA	0 - 10000	%
:	Type 4: (Default)	0 - 5 VDC	0 - 5000	Units: VDC
	Type 5:	0 - 5 VDC	0 - 10000	%
	Type 6:	1 - 5 VDC	0 - 10000	%
	Type 7: (Default)	0 - 10 VDC	0 - 10000	Units: VDC
	Type 8:	0 - 10 VDC	0 - 10000	%
	Type 9:	2 - 10 VDC	0 - 10000	%

AD Converter: Resolution: 15 bits

Conversion: 15 SPS (Samples per Second)

Accuracy: +/- .005 reading for mA and VDC Types 1, 4 and 7
+/- .01 reading for mA and VDC Types 2, 3, 5, 6, 8 and 9

Over Range: Inputs have up to 25% Over Range per input type

Error Status: Status Register: Over Range Detection when input greater than 125%
Reverse Polarity Detection

Indicators:

Blue LED:	Power ON
Green LED:	ON When Chip Select Active (Low)

Connections:

J2	Non-Isolated Side	J1	Isolated Side
Pin 1:	+V (+3.3VDC or +5VDC)	Pin 1:	no connection
Pin 2:	0V (Common)	Pin 2:	no connction
Pin 3:	MOSI	Pin 3:	Common
Pin 4:	CLK	Pin 4:	Common
Pin 5:	/SS	Pin 5:	Signal Input mA or VDC
Pin 6:	MISO	Pin 6:	Signal Input mA or VDC
Pin 7:	no connection	Pin 7:	Common
Pin 8:	no connection	Pin 8:	Common
Pin 9:	no connection		
Pin 10:	no connection		

Dimensions: 1.95" x 0.95"
Headers on standard 0.1" spacing

READ INPUT VALUES

SPI Communication Protocol **NOTE: Send a Byte, Receive a Byte**

TRANSMIT STRING

```
buf[0] = 0x03;    // Read Function
buf[1] = 0x00;    // dummy byte
buf[2] = 0x00;    // dummy byte
buf[3] = 0x00;    // dummy byte
buf[4] = 0x00;    // dummy byte
buf[5] = 0x00;    // dummy byte
buf[6] = 0x00;    // dummy byte
buf[7] = 0x00;    // dummy byte
buf[8] = 0x00;    // dummy Byte
buf[9] = 0x00;    // dummy Byte
```

RESPONSE (RECEIVE STRING)

```
buf[0] = 0x55;    // SDAFE™ PRODUCT CODE - ANALOG INPUT MODEL:    SDAFE™-X55
buf[1] = 0xxx;    // Type mA, VDC, etc and Range (0x01 thru 0x09)
buf[2] = 0xxx;    // Scaled and Ranged Reading High Byte
buf[3] = 0xxx;    // Scaled and Ranged Reading Low Byte
buf[4] = 0xxx;    // Scaler High Byte
buf[5] = 0xxx;    // Scaler Low Byte
buf[6] = 0xxx;    // Raw AD Counts High Byte
buf[7] = 0xxx;    // Raw AD Counts Low Byte
buf[8] = 0xxx;    // Status Byte (0x00=OK, 0x01=Polarity Error, 0x02=Over Range Error
buf[9] = 0x55;    // SDAFE PRODUCT CODE - ANALOG INPUT MODEL:     SDAFE-X55
```

ERROR CODES

1. Communication Error - Reading the Receive String
   If the first byte (buf[0]) received does not match the SDAFE Product code 0x55 (Hex) or 85 (Decimal), the rest of the receive string should be ignored and the communication treated as an error

2. Normal Operation: Status Byte = 0x00

3. Polarity Error: Status Byte = 0x01
   Check the wiring for reverse polarity

4. Over Range Error: Status Byte = 0x02
   The input signal has reached or exceeded the operating limit of the A/D Converter
   Typically the signal is greater than 125% of full scale ie 24mA. or 6 VDC or 12 VDC

SAMPLE CODE

The following sample code is written in "C" for the Raspberry Pi and tested on a RPi 3. Program the input type to be either mA or VDC. This is used to initialize the SDAFE module and should be called at the start of the program. During program execution, if the module is removed and re-inserted, it will default to Type 1 (mA).

SET INPUT TYPE

```
#include <wiringPi.h>
#include <wiringPiSPI.h>
#define  CS_SDAFE_1     7     // define the chip select RPi pin

wiringPiSPISetup(1, 100000);  // Initialize the wiringPi SPI for port 1

void Program_SDAFE_Type(unsigned char type)     // type = 1 thru 9
{
      unsigned char buf[6];
      buf[0] = 6;             // Function 6 = Program Type
      buf[1] = type;          // type
      buf[2] = 0;             // Dummy Byte
      buf[3] = 0;             // Dummy Byte
      digitalWrite(CS_SDAFE_1, LOW);
      wiringPiSPIDataRW(1,buf,4);
      digitalWrite(CS_SDAFE_1, HIGH);

}
```

READ SDAFE VALUES

```
void Get_Sdafe_Readings(void) // Received bytes in rx_buf
{
      int i;
      unsigned char rx_buf[32], tx_buf[32];
      tx_buf[0] = 3;          // Function Read

      for(i=0; i<10; i++)
      {
            buf[i] = 0;       // dummy Bytes
      }

      digitalWrite(CS_SDAFE_1, LOW);
      wiringPiSPIDataRW(1,buf,10);
      digitalWrite(CS_SDAFE_1, HIGH);

      for(i=0; i<10; i++)
      {
            rx_buf[i] = buf[i];
      }
}
```