FEATURES

- 100% Staefa Smart II compatible
- Factory can customize for most applications
- Over a hundred different temperature and ranges are available
- Provides pull-up or load resistor for temperature sensors or current transmitters
- Voltage divider for 0 to 10V DC signals

APPLICATIONS

- * Retrofits involving non Staefa sensors
- Narrow temperature ranges for chilled and/or hot water control loops
- Narrowing range of 4-20mA transducers

DESCRIPTION

The Staefa *Smart II* Controller has the flexible feature of being able to receive various analog input signals and have those signals scaled through on-board amplifiers to 0-5V DC to drive the built-in analog-to-digital converters. Staefa provides a number of scaling modules for the *Smart II* sensor family. The purpose of the CRM2 custom range module is to provide additional ranges for Staefa sensors and enable other types of sensors (such as 1K Ω RTD's, AD590's) to be used with the *Smart II* controller.

OPERATION



The input signals are fed through a 10K Ω resistor and filter capacitor on the *Smart II* to the non-inverting input of an amplifier. The CRM2 scaling resistors (unique to the type of sensor and temperature range) sets the level and gain for the amplifier so that the input signal is amplified to 0-5V DC for a 8 bit A/D converter resulting in a 256 count output. Pull-up ordropping resistors on the CRM2 serve as voltage dividers for temperature sensors such as RTD's or AD590's. Because of slight variances in power supply voltages between *Smart II* controllers and variations in 1% resistors it may be necessary to use the "offset-calibrate" feature on the service tool for minor adjustments.



SPECIFICATIONS

SIZE:	1.1" L x .7" W x .4" D
MOUNTING:	8 Pin socket on Smart II
POWER:	Smart II +5V supply
INPUTS:	Staefa Sensors, 1K Ω RTD, 2K Ω RTD, AD590, mA, Voltage
OUTPUTS:	Smart II Amplifier bias voltage
RANGES:	See DPX, Voltage & mA, and Temperature Range Charts

PHYSICAL CONFIGURATION



CRM2/XXX/XXX(X)

Add "A" for RTD 1K t.c..00375 Temperature Range Code (00-110) Sensor Type (AD590, RTD1K, etc.)

(See DPX, Voltage, and Temperature Range Charts)

ATKINSON ELECTRONICS, INC. 14 West Vine Street E Murray, UT 84107 Phone (801) 262-6400, 1-800-261-3602 Fax (801) 261-3796, E-MAIL: cbdaei@atkinsonel.com

CRM2-DPX-5 PRESSURE RANGE CHART

Range Code	IWC Range	SM2 Base/Gain	CRM2 Part Number
DPX13	0 to 0.13"wc	B = 0.0 G= 0.0005	CRM2-DPX.13 SM2-RMD P1-30(12)
DPX50	0 to 0.50"wc	B = 0.0 G = 0.002	CRM2-DPX.50
DPX-1	0 to 1.0"wc	B = 0.0 G = 0.0039	CRM2-DPX-1
DPX-1.3	0 to 1.3"wc	B = 0.0 G = 0.0051	CRM2-DPX1.3
DPX-1.5	0 to 1.5"wc	B = 0.0 G = 0.0059	CRM2-DPX1.5 SM2-RMD P2-30(13)

Range Code	IWC range	SM2 Base/Gain	CRM2 Part Number
DPX-2	0 to 2.0"wc	B = 0.0 G = 0.0078	CRM2-DPX-2
DPX-3	0 to 3.0"wc	B = 0.0 G = 0.0118	CRM2-DPX-3
DPX-4	0 to 4.0"wc	B = 0.0 G = 0.0157	CRM2-DPX-4
DPX-5	0 to 5.0"wc	B = 0.0 G = 0.0196	CRM2-DPX-5 SM2-RMD P3 (14)

CRM2 VOLTAGE AND 4-20mA RANGE CHART

Range Code	VDC Range	SM2 ** Base/Gain	CRM2 Part Number	Range Code	mA range	SM2 ** Base/Gain	CRM2 Part Number
VLT-01	0 to 1V DC	B = 0.0 G= 0.0039	CRM2-VLT-01	mA-01	0 to 1mA	B = 0.0 G = 0.0039	CRM2-mA-01 1K Ω load resistor
VLT-02	0 to 2V DC	B = 0.0 G = 0.0078	CRM2-VLT-02				
VLT-2.5	0 to 2.5V DC	B = 0.0 G = 0.0098	CRM2-VLT-2.5				
VLT-03	0 to 3V DC	B = 0.0 G = 0.0118	CRM2-VLT-03				
VLT-04	0 to 4V DC	B = 0.0 G = 0.0157	CRM2-VLT-04				
VLT-10	0 to 10V DC	B = 0.0 G = 0.0392	CRM2-VLT-10				
VLT-40	1 to 5V DC	B = 1.0 G = 0.0157	CRM2-VLT-40	mA-40	4 to 20mA	B = 4.0 G = 0.0627	CRM2-MA-40 250 Ω load resistor
VLT-41	1 to 1.4V DC	B = 1.0 G = 0.0015	CRM2-VLT-41	mA-41	4 to 5.6mA	B = ? G = ?	CRM2-MA-41 SM2-MUX Sq. rt.
VLT-42	1 to 1.8V DC	B = 1.0 G = 0.0314	CRM2-VLT-42	mA-42	4 to 7.2mA	B = ? G = ?	CRM2-MA-42 SM2-MUX Sq. rt.
VLT-44	.2 to 1V DC	B = 0.2 G = 0.0314	CRM2-VLT-44	mA-44	4 to 20mA	B = ? G = ?	CRM2-MA-44 50 Ω load resistor
VLT-210	2 to 10V DC	B = 2.0 G = 0.0314	CRM2-VLT-210	mA-45	5.82 to 10.91mA	B = ? G = ?	CRM2-MA-45 250 Ω load resistor
				mA-48	8.44 to 17.33mA	B = ? G = ?	CRM2-MA-48 250 Ω load resistor

NOTE: The SM2 Base and Gain values in the chart are calculated to display the voltage on the SM2 input. Your Base and Gain values should be calculated on what your input signal represents (%RH, 0 to 100% Temperature etc.).

Call for other calibration ranges and versions.

If you have a different application or need, please call 1-800-261-3602 and discuss your needs with our Sales Engineers.

TEMPERATURE RANGE CHART - CUSTOM RANGES (others available upon request)

CRM2

Temp	Temperature	SMART II		AD	590	RTD1k		RTD	STAEFA JC		JC	Temp	Temperature	SMART II		AD590		RTD1k		RTD	STAEFA		JC
Code	Range	Base	Gain	+5V	+15V	385	375	2k	T-1	T-XX	1k/70°	Code	Range	Base	Gain	+5V	+15V	385	375	2k	T-1	T-XX	1k/70°
00	-31 to 95°F -35 to 35°C	-31.0 -35.0	0.4941 0.2745				■ A			T-35		20	80 to 180°F 26.7 to 82.2°C	80.0 26.7	0.3922 0.2176				■ A			T-20	
01	-10 to 118°F -23.3 to 47.8°C	-10.0 -23.3	0.5020 0.2788				■ A					21	53 to 180°F 11.7 to 82.2°C	53.0 11.7	0.4980 0.2765				■ A			T-120	
02	-36 to 120°F -37.8 to 48.9°C	-36.0 -37.8	0.6118 0.3400				■ A					22	140 to 210°F 60.0 to 98.9°C	140 60.0	0.2745 0.1525				■ A			T-105	
03	0 to 100°F -17.8 to 37.8°C	0.00 -17.8	0.3922 0.2180				■ A					23	-36 to 50°F -37.8 to 10°C	-36.0 -37.8	0.3373 0.1875				■ A	NA			
04	32 to 86°F 0 to 30°C	32.0 0.00	0.2118 0.1176	NA		NA	NA			T-30	TE-1900	24	-50 to 100°F -45.6 to 37.8°C	-50.0 -45.6	0.5882 0.3271			-	■ A	NA	NA		
04G	35 to 86°F 1.7 to 30°C	35.0 1.70	0.2000 0.1110	NA		NA	NA	NA				25	40 to 70°F 4.4 to 21.1°C	40.0 4.40	0.1176 0.0655	NA		NA	NA	NA	NA	T-30	
05	32 to 100°F 0 to 37.8°C	32.0 0.00	0.2667 0.1482				■ A			T-30		26	55 to 85°F 12.8 to 29.4°C	55.0 12.8	0.1176 0.0655	NA		NA	NA	NA	NA	T-30	
06	20 to 148°F -6.7 to 64.4°C	20.0 -6.70	0.5020 0.2788	•			■ A				TE-1900	27	35 to 75°F 1.7 to 23.9°C	35.0 1.70	0.1569 0.0871	NA		NA	NA	NA	NA	T-30	
07	80 to 208 F 26.7 to 97.8°C	80.0 26.7	0.5020	•			■ A			T-105	TE-1900	28	80 to 110°F 26.7 to 43.3°C	80.0 26.7	0.1176 0.0655	NA		NA	NA	NA	NA	T-120	
08	23.9 to 60.0°C	75.0 23.9	0.2549				■ A			T-120		29	50 to 80°F 10 to 26.7°C	50.0 10.0	0.1176 0.0655	NA		NA	NA	NA	NA	T-30	
08G	55 to 140 F 12.8 to 60.0°C	55.0 12.8	0.3333	•			■ A					30	4.64k Pull-up SM2-RMP (01)			NA	NA	NA	NA	NA	NA	T-35 T-120	
09	-17.8 to124.4°C	-17.8	0.5576				■ A															T-20 T-30	
10	-35.6 to 104.4°C	-32.0	0.9882				■ A					31	Klimo (5V ref.) SM2-RMT (02)			NA	NA	NA	NA	NA	NA	T-38 T-40 T-75	
11	-6.7 to 48.9°C	20.0 -6.70	0.3922				■ A															T-105	
12	40 to 140°F 4.4 to 60.0°C	40.0 4.40	0.3922 0.2180				■ A					32	Klimo (6V ref.) SM2-RMK (03)	30.0	0.2353	NA	NA	NA	NA	NA	NA	H-90 (6V)	
13	30 to 130°F -1.1 to 54.4°C	30.0 -1.10	0.3922 0.2180	•			■ A					33		30.0	0.2353	NA	NA	NA	NA	NA	NA	H-90 (5V)	
14	25 to 75°F -3.9 to 23.9°C	25.0 -3.90	0.1961 0.1090	NA		NA	NA	NA		T-35		34	SM2-RMt-30X	39.0 3.90	0.2431 0.1349	NA	NA	NA	NA	NA	NA	T-30	
15	50 to 100°F 10 to 37.8°C	50.0 10.0	0.1961 0.1090	NA		NA	NA			T-30 T-120		35	**See Appl #12	40.0	0.0704	NA	NA	**	■ A **	**	NA	T-30	
16	0 to 64°F -17.8 to 17.8°C	0.00 -17.8	0.2510 0.1396				■ A			T-38		36	40 to 60 F 4.4 to 15.6°C	40.0 4.40	0.0784	NA		NA	NA	NA	NA	T-30	
17	32 to 118°F 0 to 47.8°C	32.0 0.0	0.3373 0.1875				■ A					37	15.6 to 26.7°C	60.0 15.6	0.0784 0.0439	NA		NA	NA	NA	NA	T-30	
18	14 to 142°F -10 to 61.1°C	14.0 -10.0	0.5020 0.2788				■ A					38	58 to 83°F 14.4 to 28.3°C	58.0 14.4	0.0980 0.0545	NA		NA	NA	NA	NA	T-30	
19	60 to 115°F 15.6 to 46.1°C	60.0 15.6	0.2571 0.1196			NA	NA			T-120		39	60 to 100°F 15.6 to 37.8°C	60.0 15.6	0.1569 0.0871	NA		NA	NA	NA	NA	T-30	

TEMPERATURE RANGE CHART - CUSTOM RANGES (others available upon request)

Code Range Base Gain +5V 15V 355 375 2K T.1 T.XX 1K/70* Code Range Base Gain +5V +15V 385 375 2K T 50 39 to 101°F 30.0 0.1343 -	
50 39 to 101°F 30 to 2041 1 1 1 0 to 40°F 0.0 0.1349 1 1 0 0.0317 1.730 0.0 0.1317 1 1 0 0.0160°F 0.0 0.2275 0.1745 1 0 0.2275 0.1745 1 0 0.2275 0.1745 1 0 0.2275 0.1745 1 0 0.2275 1.10 0.1525 1 0 0.2275 0.1635 1 0.0 0.2275 0.1635 1 0.0 0.2275 0.1635 1 0.0 0.2275 0.1635 1 0.0 0.2275 0.1635 1 0.0 0.0 0.0 0.2275 0.1635 1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 <td< td=""><td>T-XX 1k/70°</td></td<>	T-XX 1k/70°
51 80 to 160°F 80.0 0.3137 9 9 9 7-105 90 90 15.6 0.10267 16.6 0.10267 16.6 0.10267 16.6 0.1263 16.7	T-35
59 23 to 87° 23 o. 0.2510 0.4 0.0 0.2510 0.2745 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510 0.2941 0.2510<	T-105
60	T-30 T-38 TE-1900
61 $40 \ 080^{\circ}\text{F}$ 4.0 0.0875 NA T-30 86 96 to 160°F 96.0 0.2510 0.96.0 0.2510 0.96.0 0.2510 0.96.0 0.2510 0.96.0 0.2510 0.96.0 0.2510 0.0500 NA NA NA T-120 87 150 to 400°F 150.0 0.000.0 0.78.3 NA 10 to 1012.1.0°C 10.	T-120
62 55 to 80°F 55.0 0.0980 NA NA NA NA NA T-30 86 96 to 160°F 96.0 0.2210 Image: constraints of the constraints of	T-105
66 50 to 220°F 50.0 0.6667 • <td>T-105</td>	T-105
67 $-50 ext{ to 50^{\circ}}{ ext{ to 10^{\circ}}{ ext{ to 45.6}}}$ $0.3922 \\ 0.2180$ \bullet	
68 $-25 \text{ to } 50^{\circ}\text{F} \\ -31.7 \text{ to } 10^{\circ}\text{C} \\ -17.8 \text{ to } 21.1^{\circ}\text{ c} \\ -17.8 \text{ to } 21.2^{\circ}\text{ c} \\ -17.8 $	
69 $0 \text{ to } 70^\circ \text{F}$ 0.00 0.2745 \bullet \bullet \bullet $T-35$ 90 $15 \text{ to } 90^\circ \text{F}$ 15.0 0.2941 \bullet \bullet \bullet \bullet 70 $20 \text{ to } 84^\circ \text{F}$ 20.0 0.2510 0.2510 0.2941 0.1631 \bullet \bullet \bullet 0.1631 \bullet \bullet \bullet \bullet \bullet \bullet 0.1631 \bullet \bullet \bullet \bullet 0.1631 \bullet \bullet \bullet \bullet 0.1631 \bullet \bullet \bullet \bullet 0.2941 0.1631 \bullet \bullet \bullet \bullet 0.1631 \bullet \bullet \bullet 0.1631 \bullet \bullet \bullet 0.1631 \bullet \bullet 0.1631 0.1631 0.2941 0.1631	
70 $20 \text{ to } 84^{\circ}\text{F}$ 20.0 0.2510 1.396 1.4 1.396 1	T-35 T-38
$40 \text{ to } 100^{\circ}\text{F}$ 40.0 0.2353 \bullet	
72 $40 \text{ to } 200^{\circ}\text{F}$ 40.0 0.6275 \bullet \bullet \bullet NA NA 101 $32 \text{ to } 122^{\circ}\text{F}$ 32.0 0.3529 \bullet <td></td>	
73 80 to 250°F 26.7 to 121.1°C 80.0 26.7 0.6667 0.3702 \blacksquare \blacksquare \blacksquare \top -120 -50 to 400°E -50 to 4	
-50 to 400°E -50 0 1 7650	
74 -45.6 to 204.4°C -45.6 0.9804	
75 -100 to 0.0°F -73.3 to -17.8°C -100 0.3922 0.2176 Image: Constraint of the second s	
76 -140 to -40°F -95.6 to -40.0°C -140 0.3922 0.2180 Image: Constraint of the second s	T-105
77 -140 to -100°F -95.6 to -73.3°C -95.6 0.0875 ■ ■ NA NA NA NA 106 71.6 to 302°F 22 to 150°C 22.0 0.5020 ■ ■ ■ A NA	\square
-40 to 20°F -40.0 0.2353 Image: Constraint of the constraint of	-
79 -130 to -50°F -130 0.3137 ■ <	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	

NOTE: When ordering CRM2 range modules for RTD-1k with a T.C. of 0.00375 add an "A" to the temperature range code. Example CRM2/RTD-1k/50A. "• A" is a reminder to ADD "A" to the ordering code. The • indicates that a CRM2 Module has been built for that sensor type & temperature range.

APPLICATIONS AND INSTALLATION INSTRUCTIONS

APPLICATION 1 - VOLTAGE SCALING (UP)



The 0-1V DC signal or 0-1mA through a 1K Ω resistor is fed into the *Smart II* analog input. The output from the amplifier is 0-5V DC with the CRM2-VLT-1 module. Other voltage ranges are available upon request.

APPLICATION 3 - CUSTOM VOLTAGE SCALING



The custom voltage signal is fed into the *Smart II* analog input, through a 10K Ω resistor, and into an amplifier stage. The CRM2-VLT-Custom range module then provides the second half of a voltage divider network (R7), which scales the input signal to 0-5V DC. The CRM2 <u>MUST</u> be ordered for the specific input voltage signal.

APPLICATION 5 - AD590 TEMPERATURE SENSOR



Analog Devices: AD590 is a linear current temperature sensor $(273\mu A = 0^{\circ}C, 373\mu A = 100^{\circ}C)$. It wires between the *Smart II* +5V DC supply and input, and produces a voltage across R2 of the CRM2 module. The desired range is then amplified to 0-5V DC on board the *Smart II*.

Call for other calibration ranges and versions.

APPLICATION 2 - VOLTAGE SCALING (DOWN)



The 0-10V DC signal is fed into the *Smart II* analog input, through a 10K Ω ohm resistor, and into an amplifier stage. The CRM2-VLT-10 range module then provides the second half of a voltage divider network (R7), which scales the input signal down to 0-5V DC.

APPLICATION 4 - MA SCALING



The4-20mA signal is fed into the *Smart II* analog input and dropped across the 249 ohm load resistor located on the CRM2-MA-40 range module, producing a 1-5V DC signal. This signal is then amplified to 0-5V DC. Other CRM2-MA modules are available, See Voltage /mA range chart.

APPLICATION 6 - 1000 Ω RTD SENSOR



The 1000 Ω platinum RTD forms a voltage divider with R2 (2.74K Ω) a pull-up resistor on the CRM2 module, the desired range is then amplified to 0-5V DC on board the Smart II. See Temperature range chart for available temperature ranges.

If you have a different application or need, please call 1-800-261-3602 and discuss your needs with our Sales Engineers.

APPLICATIONS AND INSTALLATION INSTRUCTIONS

APPLICATION 7 - T-30 NARROW RANGE APP.



By using the *Smart II* universal inputs, a narrower temperature range can be selected from the T-30 sensor for tight temperature control. The standard T-30 sensor differential is 32 to 86°f or Δ of 54°f, with the CRM2 range module, a Δ as narrow as 15°f ca be achieved without exceeding the gain requirements of the *Smart II* input amplifier.

APPLICATION 8 - T1 TEMPERATURE SENSOR



Staefaonly offers a couple ranges for the T1 sensor. Many applications require different temperature ranges for control. Atkinson Electronics offer several standard ranges for the T1 sensor, See Temperature Range Chart for available temperature ranges.

APPLICATION 9 - AD590 NARROW TEMPERATURE RANGE WITH EXTERNAL SUPPLY



The AD590 temperature sensor puts out 1 microamp per degree C (273μ A = 0°C, 373μ A = 100°C). The DCPS powered by the *Smart Il aux*iliary output terminals 3 & 4, puts out +15V DC to power the AD590 temperature sensor for short distances of less than 25 feet. The +15V DC enables the AD590 to drive a high enough valve resistor on the CRM2-AD15-62 range module to allow narrow ranges such as 55-80°F. These ranges provide 10 counts or more per degree for much higher resolution in close temperature control applications. To minimize noise effecting the microamp signal, shielded cable should be used. If noise does occur add a 1000µf 16V electrolytic cap across input to ground.

APPLICATION 10 - T1 NARROW TEMPERATURE RANGE WITH EXTERNAL SUPPLY



Staefa only offers 3 temperature sensor ranges for the T1 sensor. By using a +15V DC power supply and a 10K Ω .1% pull-up resistor the T1 sensor can achieve a range as narrow as 25°F. The 10K Ω pull-up resistor is connected between the DCPS power supply output (Term #5) and the *Smart II* signal input. Please specify temperature range and that it's powered for a +15V DC source when ordering the custom T1 range modules. To minimize noise effecting the microamp signal, shielded cable should be used. If noise does occur add a 1000 μ f 16V electrolytic cap across input to ground.

If you have a different application or need, please call 1-800-261-3602 and discuss your needs with our Sales Engineers.

APPLICATION 11 - AD590 NARROW TEMPERATURE RANGE WITH 4-20 MA TRANSMITTER



For AD590 sensor runs of greater than 25 feet, a 4-20mA Transmitter is recommended. The DCPS powered by the *Smart II* auxiliary 24V AC output, puts out +24V DC to power the UMATR 4-20mA transmitter. The UMATR can be calibrated for temperature range with a differential of 50°F. For narrower ranges a custom CRM2-MA range module would be used.

APPLICATION 12 - STAEFA'S 1KΩ RTD AVERAGING SENSOR REPLACEMENT FOR FDN-30





The 1000 Ω RTD duct averaging sensor P/N 544-342 replaces the old FDN-30 averaging sensor. The 1K RTD sensor is direct acting and the FDN-30 was reverse acting. To make the 1K RTD work it requires it to be wired between +5VDC (39) and input (38) terminals and use CRM2/RTD-1KA-35 range module which provides the load resistor between the input and common. The voltage generated across the load resistor (R2-2.74K Ω) is reverse acting and is scaled by the CRM2 to the 27 to 154°F input range.

The QAM22.6 duct averaging sensor from Staefa can also be used to replace the old FDN-30 averaging sensor. The QAM22.6 sensor is a Ni 1K Ω RTD that is direct acting and thus requires it to be wired the same as the 1K RTD sensor, between +5VDC (39)and input (38) terminals. Use CRM2/QAM22-35 range module which provides the load resistor between the input and common. The voltage generated across the load resistor (R2-2.74K Ω) is reverse acting and is scaled by the CRM2 to the 27 to 154°F input range.



The $2K\Omega$ RTD duct averaging sensor from Minco P/N S446FC can replace the old FDN-30 averaging sensor also. The Minco 2K RTD sensor is also direct acting and requires it to be wired the same as the 1K RTD sensor, between +5VDC (39)and input (38) terminals. Us e CRM2/RTD-2K-35 range module which provides the load resistor between the input and common. The voltage generated across the load resistor (R2-2.74) is reverse acting and is scaled by the CRM2 to the 27 to 154°F input range.

Call for other calibration ranges and versions.

If you have a different application or need, please call 1-800-261-3602 and discuss your needs with our Sales Engineers.

ATKINSON ELECTRONICS, INC. 14 West Vine Street E Murray, UT 84107 Phone (801) 262-6400, 1-800-261-3602 Fax (801) 261-3796, EMAIL: cbdaei@atkinsonel.com