FEATURES

■ **"Whole-Converter-Product"** no external components required, true field voltage inputs, assured accuracy and dynamics performance.

■ 100% Transformer Isolated or Solid State Signal & Reference Inputs.

■ True Ratiometric-Type II Tracking Converters.

■ 10 - 16 Bit Resolution.

■ Excitation Frequencies: 47 to 10,000Hz.

■ Insensitive to Freq. or Amplitude Variations.

■ Repeatable, Dynamic, Lag-Free Outputs.

■ Industry Standard Module Package.

■ True 3 wire Synchro & 4 Resolver Input Formats.

■ Commercial & Extended Temp. Grade Models.

■ Encapsulated for Safety/Shock/Vibration, Moisture/Flame Retardant Non-Feeding.
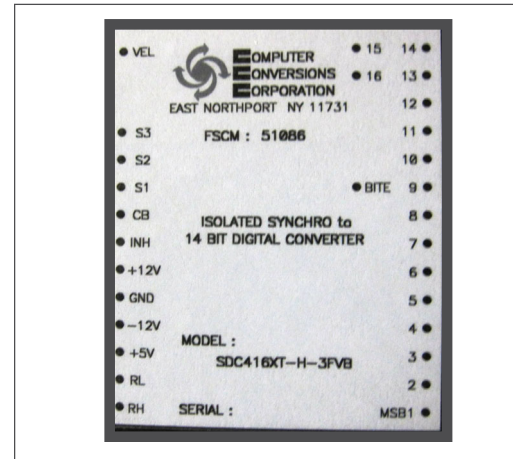
Description:

SDC/RDC-F Series are Industry Standard Tracking Synchro and Resolver to Digital Converter modules with programmable resolution, 8/16 Bit data bus controls, continuous Built-In Self-Test report, and forced angle test modes used for functional validations on command.

Models are available with either low cost differential inputs, or internally transformer isolated inputs for the most demanding industrial and military applications.
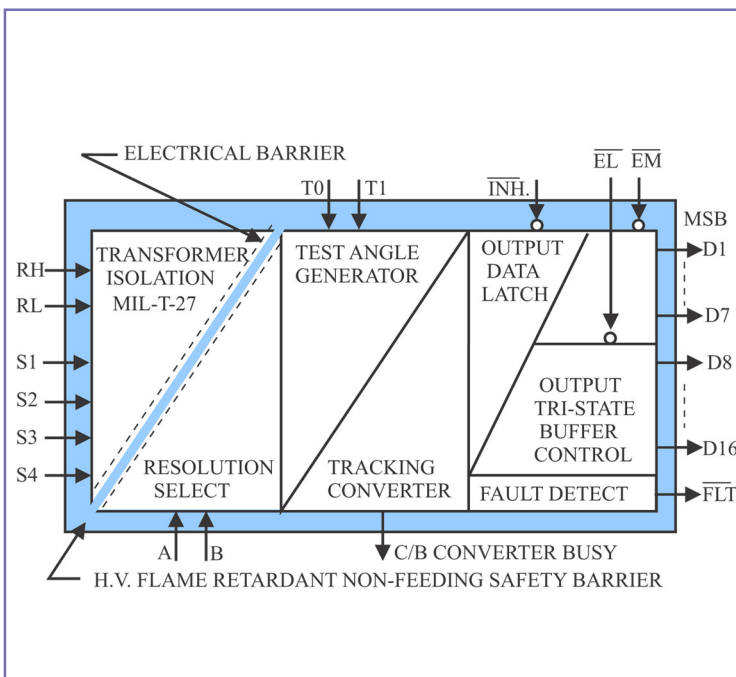
APPLICATIONS

● Military Servo Control Systems
● Fire Control Systems
● Antenna, Radar & Sonar Systems
● Avionic Systems & Instruments
● Robotics and Manipulators
● Naval Networks & Navigation
● Multi-axis Motor Controls
● GPS and Navigation Systems
● Fuel Rod Positioning Systems
● Vehicular Control Systems
● Semiconductor Water-Handling
● Engine Controls & Turbines

No external signal conditioning, critical dynamics, front-end components, or circuitry is required. The SDC/RDC-F series accepts direct field voltage synchro or resolver inputs, and converts them into real-time, accurate, natural binary digital data. Provided as a complete plug-in solution, accuracy and performance is assured from the field signals to the digital user. All units are shipped with printed test data.

The module package assures the user that all the high voltage components and transformers are conformally coated and safely contained in a flame retardant non-feeding encapsulated medium with a durable through hole solder mounting, for added containment and resistance to shock and vibration.

The resolution is available for 10-16 Bits, allowing the user to select the resolution best suited to the operating speed of any particular application.

The Inhibit input activates a buffered latch, and is internally synchronized to the busy, assuring that only the most recent valid data is stored and held on the outputs.

The SDC/RDC-F series are value-added whole converter solutions, designed for easy and guaranteed trouble free operation in the most demanding industrial and military applications.

Isolation:

SDC/RDC-F Series Transformer units feature internal Scott-T micro-transformers. These provide a true uncompromised galvanic isolation barrier between the field wired reference and signal lines, and the user power supplies, grounds and digital I/O. The use of high impedance transformer isolated inputs assure that signals are neither loaded or disturbed, and prevents interaction or impediment of grounding schemes respective of any other apparatus sharing those lines.

This completely isolates the users circuitry from the all field wiring, and any other systems that may be using these signals; eliminating concerns over troublesome ground loops, separate analog grounds, differing potentials, ground interjected spikes, or ghostly field noise, that frequently cause computer system instabilities.

Unlike external transformers that require significant real-estate, and reduce converter accuracy by their inherent non-linearities, and unlike hybrid-typical transformers that suffer poor reliability because of their insufficient coil conductor size; the SDC/RDC-F's internal micro-transformers provide a full 500VDC minimum breakdown voltage (high-pot), and the accuracy is guaranteed for the whole synchro/resolver converter system.
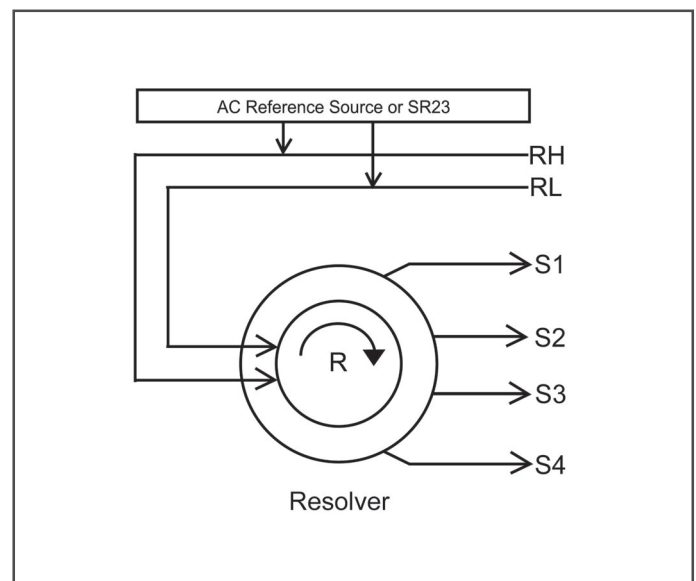
Package:

The complete converter including internal transformers, and requiring no external components, is provided in an industry standard package 3.1 x 2.6 x 0.42H.

The Converters

The SDC/RDC-F Series are high performance, transformer isolated, tracking, ratiometric; synchro/resolver to digital converters, with internal three-point-angle self test, and built-in-test; having internal solid state type two servo loops that track the absolute position displacement, real-time, providing a crisp, virtually dynamic response, very high accuracy, repeatability, and resolution that may even be programmed while in motion, from 10 to 16 bits wide.

Because the converter employs the use of a type II servo loop, the converter tracks the input angle real-time without velocity lag error, the output data is dynamic, always fresh, and continuously available. Only a minimum recoverable lag may occur with extremely large excessive accelerations.

Resolver

SALIENT SPECIFICATIONS

Resolution		10 Bits	12 Bits	14 Bits	16 Bits
Accuracy		+/-21'	+/-8.5'	+/-4'+1LSB	+/-4'
-HA Models				+/-2.6'+1LSB	+/-2.6'+1LSB
Tracking Rate		28.5/24	7.1/6	1.8/1.5	0.45/0.37
	400Hz.	192/160	48/40	12/10	3/2.5
	2.5Khz.+	100	80	30	5
-HS models	2.5KHz.+	200	200	50	10
Acceleration	60Hz.	370	93	23	5.8
	400Hz.	17000	4220	1050	260
for a 1 LSB lag	2,5KHz.	2500	9000	1620	
		1400	350	70	
	400Hz.	22000	5500	1100	
	2,5KHz.+	160K	40000	8100	
Step Response	60Hz.	500ms.	600ms.	900ms.	2200ms.
179 deg. step input	400Hz.	90ms.	100ms.	140ms.	320ms.

Frequency Range	60Hz.units 47-1000Hz.		400Hz.units: 360 - 1000Hz.(XT units)	
	2.5Khz. units 2000-4.8Khz.		Units to 10KHz. available	

Reference Inputs	26VRMS into 90K ohms
	115VRMS into 360K ohms
Signal Inputs	11.8VRMS L-L into 26K ohms Minimum L-L Balanced
	26VRMS L-L into 26K ohms Minimum L-L Balanced
	90VRMS L-L into 200K ohms Minimum L-L Balanced
Highpot	500 VDC Minimum to Ground on Transformer Units
Power Supplies	+5 VDC ±10% to 7 VDC without damage, @10 ma.
	+15 VDC (11 to 16.5 VDC), 18 without damage, @25 ma.
	-15 VDC (-11 to -16.5 VDC), -18 without damage,@20 ma.

Notes:

1) All units available with either low cost solid state, or Transformer Isolated signal and reference inputs.

   Transformer Isolation is highly recommended for all high voltage inputs, also when the signals are wired to more than one device or system, where ground loops or field noise may be significant for bus concerns, radar and antenna applications, and absolutely mandated for all Naval and most military concerns.

2) Accuracy applies over the operating temperature range, +/-10% amplitude and frequency variations, & +/- 5% power supply variations.

3) Different input voltages and frequencies available, higher tracking rates and accuracy.

4) For all units any one input line may be grounded.

This type II servo essentially closes its loop on the tangent expressed as the ratio of the sin/cos of the input angle, making this ratiometric conversion technique inherently insensitive to absolute amplitude and frequency variations, additionally; because the complex windings in the field mounted sensors themselves expand and contract together, though their absolute voltages may vary; the ratio of the sensor outputs preserve the ratiometric accuracy, thereby

Synchro

this ratio-conversion technique inherently provides the converter with automatic temperature compensation on the field mounted synchro/resolver sensor itself.

A small <1LSB hysteresis is injected into the loop to assure that the data outputs are crisp, stable and jitter-free, and to assure true 1 bit monotonicity (every single bit state must be successively discernible, no jumping of bits).

Data made available to the outputs is continuously updated (tracking) without interruption; output data is stable, accurate, and always fresh up to the maximum tracking rate of the converter.

No External Components:

The SDC/RDC-F converters are complete, isolated, "whole converter" products, No External Components are Required. No trial and error; accuracy and dynamic performance is fully tested and assured to the system level, treated more like

a simpler digital component; use reasonable care in routing the signal inputs, apply power and your done. SDC/ RDC-F converters are fully tested under static and dynamic conditions, and printed test data with traceability is shipped with every unit.

Optional BIT Output (Built-In-Test & Signal/Ref. Loss Detect, Continuous):

Built - In - Test, Continuosly running in th backround and provided as a discrete BIT output pin. The BIT/Fault output, detects loss of AC reference input, loss of signal (to within 100LSB's, +500Usec.), exceeding maximum tracking rate (Overspeed), major over-acceleration (as experienced and to monitor large step inputs typical of hard switching of synchro signals and using "large step Forced Angle for self test), and converter tracking failures.

Built-In Test (Bit) Output	
Bite Output	Status Indication
0	Error / Fault Detected
1	Status Okay

Notes:
1) Logic Level 0 = <0.4 VDC @ 1.6 ma.
   Logic Level 1 = > 2.8 VDC @ -.0.4 ma.
2) Fault condition is > 100 LSB error + 500 nsec. for loss of signal, loss of reference and overspeed condition.

Data Transfer:

When the /INH. (Inhibit) input is cleared to zero; within 300 nsec ll data bits are latched, and data is valid to be read. Release the Inhibit line for 100 nsec. min. to assure that new data is transferred towards the buffered latch type output.

The INH line may also be used to capture real-time position data synchronized to a time stamp, camera strobe, or to capture several axis of data simultaneously on coordinated axis' control schemes.

For simple Display type devices, the converters will be free running and use of the inhibit or C/B line may not be required.

COMPUTER CONVERSIONS CORPORATION
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SDC/RDC-F SERIES
ISOLATED SYNCHRO/RESOLVER TO DIGITAL CONVERTERS

Inhibit / Data Latch Control

Input INH.	Output Status
0	Latched and stable within 300 nsec.
1	Free Running

Notes:
1) Logic Level 0 = < 0.8VDC, Logic level 1 = > 2.0 VDC
2) Apply inhibit, wait 300 nsec. and read data.
3) Every LSB charge appears on output when free running.

Quality Level / Temperature Range:
Suffix, Nomenclature, Operating Temp. / Storage Temp.:

-1, Commercial, O^{o}C to +70°C/-55°C to +125°C
-3, Industrial/COTS, -40°C to +85°C/-55°C to +125°C
-2, Legacy Mil., -55°C to +105°C/-55°C to +125°C

Notes: Added Burn-Ins, or Legacy Military w/883B I.C.'s, etc. available on request.
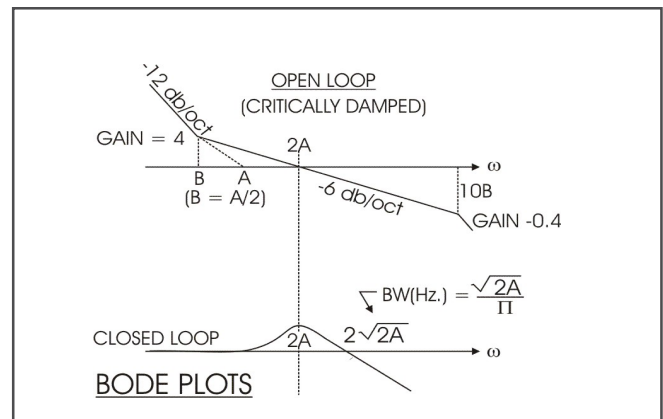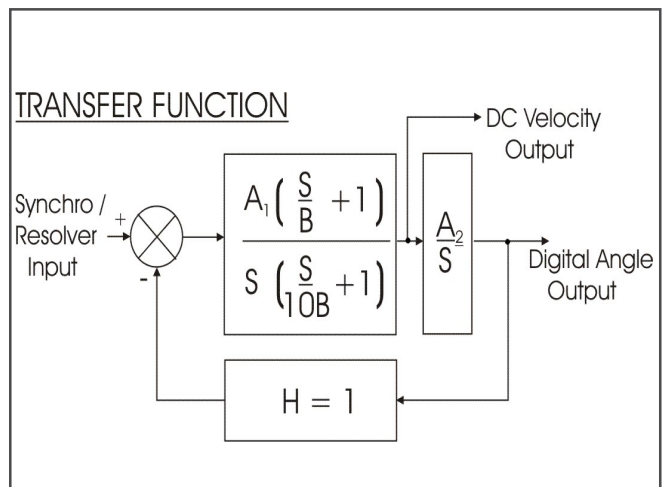
Timing and Interface:

The output data changes respective of realized displacement on the input angle and in proportion to speed. The output data is monotonic, whereby the every 1 least significant bit of change is realized on the output with no missing counts. A 1-2 microsecond "Converter Busy" (C/B) pulse is generated the instant the data output is being incremented/decremented, and stabilized within 0.2 microseconds respective of the C/B's leading edge. Interface considerations range from monitoring the C/B, to using the "Inhibit" (INH) signal input to stall the converter. A low level inhibit occurring during a C/B will be ignored until the new data is set on the outputs. To use the INH, simply: clear to zero, wait 2.0 Usec., read or transfer the data. Because applying the INH stalls the conversion process, always release the INH after reading or transferring data.
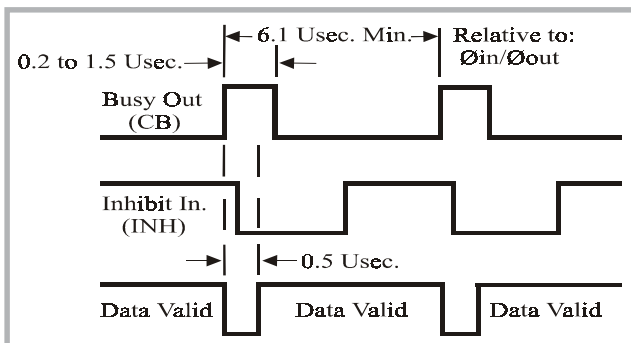
Safety and Construct:

All modules are encapsulated in an inert polymer that is self-extinguishing, flame retardant to U.L. 94VO, and will not feed or combust. Printed Circuit card material is flame retardant FR4, assemblies are conformal-coated for moisture resistance. Transformers are manufactured to MIL-T-27 and capable of withstanding high-pot to 500VDC. Case is flame resistant glass filled Diallyl Phthalate per MIL-M-14. Because all the high voltage circuitry is encapsulated within the self-extinguishing and flame retardant potting material; added protection is provided with respect to the potential for component failure, shock and vibration, and are suitable for the most severe industrial and military applications.

TRANSFER FUNCTION

$$A_1\left(\frac{S}{B}+1\right) \Big/ S\left(\frac{S}{10B}+1\right)$$

$$\frac{A_2}{S}$$

$$H = 1$$

OPEN LOOP (CRITICALLY DAMPED)
-12 db/oct
GAIN = 4
2A
-6 db/oct
10B
GAIN -0.4
B A (B = A/2)
$BW(Hz.) = \frac{\sqrt{2A}}{\Pi}$
CLOSED LOOP
2A
$2\sqrt{2A}$
BODE PLOTS

DYNAMIC CHARACTERISTICS

	60 Hz. Models		400 Hz. Models	
CARRIER FREQUENCY:	47Hz. to 1KHz.		360Hz. to 1KHz.	
BANDWIDTH:	15 Hz.		100Hz.	
LOOP DYNAMICS:	Ka = 1100/s.		Ka = 48000/s.	
	A = 33/s.	B= 16.3/s.	A = 220/s.	B = 110/s.
	A1 = 0.1/s	A2 = 7600/s.	A1 = 1/s.	A2 = 48K/s.

OUTLINE DIMENSIONS

PART IDENTIFICATION
THIS SURFACE

2.625
2.200
.212
.500
.262
3.125
2.600

●14 ●15	VEL ●
●13 ●16	
●12	S4 ●
●11	S3 ●
●10	S2 ●
●9 ●BITE	S1 ●
●8	CB ●
●7	INH ●
●6	+15V ●
●5	GND ●
●4	−15V ●
●3	+5V ●
●2	RL ●
●1 MSB	RH ●

.040 +/− .0015 DIA.

BOTTOM VIEW
(PIN SIDE)

.200
TYPICAL

.430

.250
MIN.

NOTES:

1. PIN S4 USED ON RESOLVER UNITS ONLY "RDC" PREFIX.

2. PIN VEL USED ON VELOCITY OUTPUT UNITS ONLY "V" SUFFIX.

3. OUTPUT RESOLUTION: LESS THAN 16 BITS, LSB'S NOT PRESENT.

4. BITE (FAULT) OUTPUT: B SUFFIX OPTION.

Model Selection Guide:

SDC = Synchro
RDC = Resolver

6 = 60Hz. Unit (47Hz. to 1000Hz.)
4 = 400Hz. Unit (350Hz. to 1000Hz.)
2K = 2KHz. Unit (2000Hz. to 4800Hz.)

SDC	4	0	XT	— H	— 3	F		

Resolution:
10 Bits = 10
12 Bits = 12
14 Bits = 0
16 Bits = 16
Programmable = P

Velocity option or blank

Bit output option or blank

Operating Temp.
-1 = 0°C to +70°C
-3 = -40°C to +85°C
-2 = -55°C to +105°C

Transformer Isolation = XT
Solid State Inputs = ST

Reference/Signal Inputs:
26/11.8V. L-L = -L
26/26V. L-L = -26
115/90V. L-L = -H