

product selection guide



CSI CONTROL SCIENCES INCORPORATED

- synchro/resolver instruments
- VMEbus synchro/resolver boards
- synchro/resolver to digital converters
- LVDT/RVDT to digital converters
- inductosyn™ to digital converters
- synchro/resolver to linear DC converters
- digital to synchro/resolver converters
- synchro amplifiers
- synchro/resolver excitation oscillators

The world's *only* handheld Digital Synchro meter. . . the DSM-4™

NSN: 6625-01-376-4375

- Auto-ranges to accept all standard military synchro signals
- 7-14V and 54-108V stators
- $\pm 0.2^\circ$ accuracy ($\pm 0.1^\circ$ near zero)
- 47 to 1200Hz frequency range
- Large 0.5" four digit LCD display
- Rugged, battery powered



DSM-4 and DRM-4 are Registered Trademarks of Control Sciences, Inc.

The world's *only* handheld Digital Resolver Meter. . . the DRM-4™

NSN: 6625-01-390-6513

- Dual range switch provides compatibility with all low level resolvers
- 3.5-7.0V and 7.0-14V stators
- 30 to 3000Hz frequency range
- Large 0.5" four digit LCD display
- $\pm 0.2^\circ$ accuracy ($\pm 0.1^\circ$ near zero)
- 70mv input option for low-level VOR testing
- Rugged, battery powered

The industry's *smallest* synchro/resolver digital panel meters. . . the four digit DPM-401

- Only 1.9" x 3.8" x 3.1" deep
- Bright 0.56" 4 digit LED display
- $\pm 0.2^\circ$ accuracy ($\pm 0.1^\circ$ near zero)
- 0° to 359.9° and 0° to $\pm 179.9^\circ$ ranges
- Requires +5Vdc power only
- 3-state BCD output



the five digit DPM-501

- Only 1.9" x 3.8" x 4.1" deep
- Bright 0.56" 5 digit LED display
- Single or two-speed inputs
- $\pm 0.03^\circ$ or $\pm 0.01^\circ$ accuracy
- 0° to 359.99° and 0° to $\pm 179.99^\circ$ ranges
- Requires +5Vdc power only
- 3-state binary and BCD outputs
- Optional analog output

High accuracy, *auto-ranging*, ultra broadband synchro and resolver angle position indicator. . . the AP-501

- Auto-ranging synchro and resolver inputs, 47-3000Hz
- Bright 0.56" 5 digit LED display
- $\pm 0.03^\circ$ accuracy
- 0° to 359.99° and 0° to $\pm 179.99^\circ$ ranges
- Insensitive to synchro/resolver phase shift
- 3-state binary and BCD outputs
- Loss of signal, reference and tracking alert
- Universal input power 85-265VAC, 47-440Hz
- Optional half rack mount configuration
- Optional analog output



Reference powered, *handheld*, decade synchro transmitter. . . the DST-400

- Angle entered via push-wheel switches
- 0.1° resolution
- $\pm 0.067^\circ$ accuracy
- 1.5VA drive capability @ 60Hz
- 4.5VA drive capability @ 400Hz



Low profile synchro/resolver angle position indicator with *offset*. . . the 800B301

- Synchro or resolver inputs, single or two-speed
- $\pm 0.03^\circ$ or $\pm 0.01^\circ$ accuracy
- Bright 0.56" 5 digit LED display
- 360° offset capability via 5 digit thumbwheel switch
- 19" rack mount, 1 3/4" panel height



Six single-speed synchro/resolver to digital channels. . . the VME1686

- One to six channels of single-speed synchro or resolver inputs (any combination)
- 14 or 16 bit resolution
- To ± 1.3 arc minute accuracy
- 50 to 3000Hz reference frequency
- Can be configured to accept virtually any reference and stator inputs
- Synthesized reference compensates for $\pm 45^\circ$ rotor/stator phase shifts
- Self-Test continuously monitors each converter conformance on-line
- Loss of reference and signal alert
- Front panel summary status LED's warn of board fault
- Optional on-board resolver excitation oscillator
- P1 bus slave
- 6U single slot, backplane powered



Three single-speed or two-speed synchro/resolver to digital channels. . . the VME1683/VME2683

- One to three channels of single or two-speed synchro or resolver inputs (any combination)
- 16 bit resolution
- ± 1.3 arc minute accuracy for single-speed channels
- ± 24 arc second accuracy for two-speed channels
- 50 to 5000Hz reference frequency
- Can be configured to accept virtually any reference and stator inputs
- Self-Test continuously monitors each converter conformance on-line
- Loss of reference and signal alert
- Front panel summary status LED's warn of board fault
- P1 bus slave
- 6U single slot, backplane powered

Three digital to synchro channels. . . the VME1923

- One to three channels per card
- Reference powered digital to synchro converters (no external power required)
- 14 bit resolution
- ± 4 arc minute accuracy
- 26V or 115V reference inputs
- 11.8V or 90V L-L synchro outputs
- 4.5VA output power at 400Hz
- 1.5VA output power at 60Hz
- P1 bus slave
- 6U double slot, backplane powered



Three digital to synchro/resolver channels. . . the VME2923

- One to three channels per card
- 14 bit resolution
- ± 4 arc minute accuracy
- Can be configured for virtually any reference input and stator output voltages
- 1.5VA output power at 400Hz
- P1 bus slave
- 6U single slot, backplane powered



General description

CSI synchro/resolver to digital converters are discrete encapsulated modules designed for printed circuit board mounting; each unit is fully trimmed, tested, requiring no external components. All units are Type II tracking converters that exhibit no velocity errors and only minor acceleration errors. Units incorporate solid state inputs featuring high reliability, frequency independence, and 1000% over-voltage protection. Input voltages from 2.5V to 130Vrms can be accommodated.

Single-speed tracking synchro/resolver to digital converters

Series	Resolution	Accuracy	Tracking	Input	Package	Description/Features
168F100	14 bits	±5.2'	10rps	2.5-130V	2.62 x 3.12 x 0.4"	Low profile, industry standard pin-out. Velocity output option. Synchro or resolver input.
168F200	10 bits	±30'	70rps	50-1200Hz		
168F300	12 bits	±8.5'	30rps			
168T300	12 bits	±8.5'	to 50rps	2.5-130V 50-2600Hz	2.0 x 2.0 x 0.4"	Synchro or resolver inputs. 3-state latched outputs with 8 bit byte or 12 bit addressing and velocity output.
168T350						Synchro or resolver inputs. 3-state latched outputs. Second source for Analog Devices SDC/RDC1725.
268A300			to 100rps	Synchro/resolver inputs. Direction, ripple clock, inter-LSB, demodulator and velocity outputs.		
268B300			100rps	2.5V 2.5-10KHz		Resolver input for inductosyn applications. Direction, ripple clock and velocity outputs.
268C300			to 50rps	2.5-130V 50-1200Hz		Low power version of 268A300.
268D300			to 100rps	2.5-130V 50-5000Hz		Synchro or resolver inputs. +5V only with 3-state latched outputs. Direction and ripple carry outputs.
268E300			1024 cycles 4096 counts	100rps		2.5V 1.0-5KHz
468A100	14 bits	±4.0'	to 20rps	2.5-130V 50-5000Hz	2.0 x 2.5 x 0.5"	Synchro or resolver inputs. 3-state latched outputs. BIT, velocity, loss of reference and signal outputs.
468H200		±2.6'				Synchro or resolver inputs. 3-state latched outputs. Bit, velocity, loss of reference and signal outputs.
468H100	16 bits	±1.3'	to 5rps	2.5-130V 50-3000Hz	2.62 x 3.12 x 0.4"	Synthesized reference for improved accuracy. 168H300 incorporates two programmable bandwidths.
168H300				2.5-130V 50-5000Hz		
168E700	3 decade BCD	±1°	10rps	2.5-130V 50-1200Hz	2.62 x 3.12 x 0.8"	Industry standard synchro or resolver to BCD converter. Either 0° to 359° or 0° to ±179° output ranges.
168E600	4 decade BCD	±0.2°				Industry standard synchro or resolver to BCD converter. Either 0° to 359.9° or 0° to ±179.9° output ranges.
268A600					2.0 x 2.0 x 0.44"	Synchro or resolver inputs with two programmable output ranges, either 0° to 359.9° or 0° to ±179.9°.

Two-speed tracking synchro/resolver to digital converters

Series	Resolution	Accuracy	Tracking	Input	Package	Description/Features
168H500	16 bits	±20"	to 3rps	2.5-130V 50-3000Hz	2.62 x 3.12 x 0.8"	Industry standard pin-out. 1:8, 1:16, 1:18, 1:32 and 1:36 speed ratios. Synchro or resolver inputs, BIT output.
168M500					2.62 x 3.12 x 0.4"	Low profile version of the 168H500. 1:8, 1:10, 1:16, 1:32, 1:36, and 1:64 speed ratios.
168T500						3-state latched output version of the 168M500.
168T600						3-state latched output. BIT, velocity, loss of reference and signal outputs. 1:8, 1:16, 1:32, 1:36, 1:64 speed ratios. Synchro or resolver inputs.
168K400					2.62 x 3.12 x 0.5"	3-state latched output. Synthesized Reference allowing for operation with multi-pole synchro and resolvers.
168K500	20 bits	±4"	1/3rps	1:16, 1:32 and 1:36 speed ratio.		

General description

CSI digital to synchro/resolver converters range from low to medium power encapsulated modules designed for printed circuit board mounting to high power bulkhead mounted devices. Natural parallel binary angle data is converted accurately to either 3-wire synchro or 4-wire resolver signals. Output power levels ranging from 1.5VA to 125VA are available.

Digital to synchro/resolver converters

Series	Resolution	Accuracy	Output	Drive	Package	Description/Features		
192B200	14 bits	± 3.0'	10(sin/cos)V DC-2600Hz	5mA	2.62 x 3.12 x 0.4" module	Industry standard high accuracy digital vector generator with 0.1% scale factor variation.		
292A700		± 4.0'	11.8V synchro 6.8V resolver		2.0 x 2.0 x 0.4" module	Micro-module D/S-R with current limiting and thermal protection. Requires external transformers for 90V output.		
292A800	12 bits	±6.0'	synchro/ resolver 11.8/90V 50-400Hz	1.5VA	50-400Hz	2.62 x 3.12 x 0.8" module	Industry standard pin-out.	
192B800	14 bits	±8.0'						
192B700		±4.0'						
192L700								
192L800	12 bits	±6.0'					2.62 x 3.12 x 0.5" module	Low profile industry standard pin-out. Current limiting and thermal protection. Low scale factor variation. ±12V version of 192L700/800.
192L810								
192L710								
192F500	14 bits	±4.0'		4.5VA	2.62 x 3.12 x 0.8" module	Industry standard reference powered with short circuit protection and thermal cut-off. 1.5VA output at 60Hz and no external transformers required.		
192E600		±6.0'				Industry standard pin-out with "kick circuit" allowing for use with torque receivers.		
192E500	12 bits	±8.0'		5.0VA				
392A100	16 bits	±2.0'	11.8V synchro 50-400Hz		2.0 x 2.0 x 0.54"	Micro-module D/S drives CT, CDX and TR loads. Solid-state output.		
192A300	16 bits	±4.0'	synchro 11.8/90V 50-400Hz	25VA	7.4 x 5.1 x 2.7"(60Hz) 7.4 x 5.1 x 1.9" (400Hz) bulkhead mount	Reference powered with fully protected outputs capable of driving multiple torque receiver loads. All inputs and outputs are isolated. Microprocessor compatible with double buffered binary angle inputs.		
192A600	12 bits	±10' (CT) ±21' (TR)					High power D/S with input data latches for driving TR loads. 8VA steady state power for CT loads.	
192A650					125VA	5.38 x 5.25 x 0.7" PC card	High peak power with "locked rotor" protection for driving torque receivers. 30VA steady state power for CT loads. External bulkhead mounted power stage. Overload and thermal shutdown.	

General description

Solid State Control Transformer (SSCT) modules accept either 3-wire synchro or 4-wire resolver signals and parallel binary angle data and output a phase-sensitive AC "rotor" signal representing the sine of the difference angle between the synchro/resolver input and binary angle input. Solid State Control Differential Transmitters (SSCDX) modules accept either 3-wire synchro or 4-wire resolver signals and parallel binary angle data and output either 3-wire synchro or 4-wire resolver signals accurately representing the difference angle between the synchro/resolver input and binary angle input.

SSCT and SSCDX converters

Series	Binary Input	Accuracy	Analog Input	Analog Output	Package	Description/Features
280A300	12 bits	±6.0'	synchro/ resolver 11.8/90V 50-400Hz	sin(Θ-Φ) 0.4V/°	2.0 x 2.0 x 0.4"	SSCT with demodulated output error signal.
180B100	14 bits	±4.0'		sin(Θ-Φ) 0.4V/° (11.8V) 1.0V/° (90V)	2.62 x 3.12 x 0.8"	SSCT with transformer isolated with 1VA "rotor" output signal. 60Hz module 1.0" high.
185A400	13 bits	±6.0'		synchro/resolver 11.8/90V		Transformer isolated SSCDX with 3VA output. 60Hz requires external transformers.

Synchro amplifiers

Series	Input	Accuracy	Output	Drive	Package	Description/Features
175A100	synchro/ resolver 6.8/11.8/90V 50-400Hz	±2.0'	synchro/ resolver 11.8/90V	3VA	2.62 x 3.12 x 0.8" module	Transformer isolated with short circuit and thermal cut-off protection. Integral metal cover provides required heat sinking. Operates from ±15V power.
175A400		±3.0'	synchro 11.8/90V	15VA	7.3 x 4.4 x 1.8" (60Hz) 7.3 x 4.4 x 1.5" (400Hz) bulkhead mount	Fully isolated referenced powered with short circuit and thermal cut-off protection. Designed for airborne and commercial applications.
175A300				25VA	7.4 x 5.1 x 2.6" (60Hz) 7.4 x 5.1 x 1.8" (400Hz) bulkhead mount	Reference powered with fully protected outputs. 75VA peak power with "locked rotor" protection for driving torque receiver loads. Fully isolated with Disable input and Fault output.

Power oscillators

Series	Power Input	Frequency	Output	Drive	Package	Description/Features
210A200	±12 to ±15Vdc	0.4-5KHz	0-15V	150mA	2.0 x 2.0 x 0.4"	Resolver excitation oscillator with eight discrete frequencies. Digital amplitude & frequency control.
210A100	±15Vdc	0.4-10KHz	2.5-7.0V	5VA		2.62 x 3.12 x 0.8"
110A100			6-115V		Fix voltage and frequency power oscillator.	
110A200		10KHz	5/10/15/20V		Inductosyn oscillator.	

Angle code converters

Series	Input	Output	Error	Convert Time	Package	Description/Features
269A100	12 bit binary	4 decade BCD	±0.125°	2.5 millisecc	2.0 x 2.0 x 0.4"	Low power binary angle to BCD converter.
269A101	15 bit binary	5 decade BCD	±0.009°	60 millisecc	2.62 x 3.12 x 0.8"	Either 0 to 360° or 0 to ±180° output.
169A107	16 bit binary		±0.01°	2.0 microsecc		High speed binary angle to BCD converter.
169A108	19 bit binary	6 decade BCD	±0.0009°	75 millisecc	2.62 x 3.12 x 0.8"	High resolution binary angle to BCD converter.
169A200	19 bit binary		±0.0003%	400 millisecc		Factory programmable scale factor.
196A102	6 decade BCD	19 bit binary	±0.0006°	600 millisecc		High resolution BCD to binary angle converter.

LVDT/RVDT to digital converters

Series	Resolution	Accuracy	Tracking	Input	Package	Description/Features
278A300	11 bit offset binary	±0.1%	to 400LSB/ millisecc	2.5V	2.0 x 2.0 x 0.4"	Ratiometric tracking LVDT/RVDT converter with over-range output.
178A100	14 bit offset binary	±0.024%		2.5V	2.62 x 3.12 x 0.4"	High accuracy ratiometric LVDT/RVDT converter with programmable gain and built-in excitation oscillator.

Inductosyn™ Pre-amplifier

Series	Input	Gain	Frequency	Output	Package	Description/Features
220A100	Inductosyn slider	1300	2.5-10KHz	3V max.	2.0 x 2.0 x 0.4"	Low noise inductosyn pre-amplifier. Use with 210A100 and 268B300 to form complete inductosyn to digital converter.

™Farrand Controls

Synchro/resolver to linear dc converter

Series	Resolution	Accuracy	Tracking	Input	Output	Package	Description/Features
430A100	±1.3'	±6.0'	to 20rps	2.5-130V 50-5000Hz	0 to +10Vdc or 0 to ±10Vdc	2.0 x 2.5 x 0.5"	Tracking converter insensitive harmonic distortion, amplitude and frequency variations.

Control Sciences manufactures a broad selection of synchro and resolver conversion products that are direct pin-for-pin replacements for products manufactured by Analog Devices, ILC Data Device Corporation, Muirhead, Natel Engineering and others. Listed below, by manufacturer, are converter models that we can supply direct pin-for-pin replacements. If you need an replacement for a unit not listed below, we can duplicate the electrical performance characteristics for most synchro/resolver converters currently in use. Please contact our applications department for our replacement part number or assistance in selecting an electrical equivalent.

Analog Devices

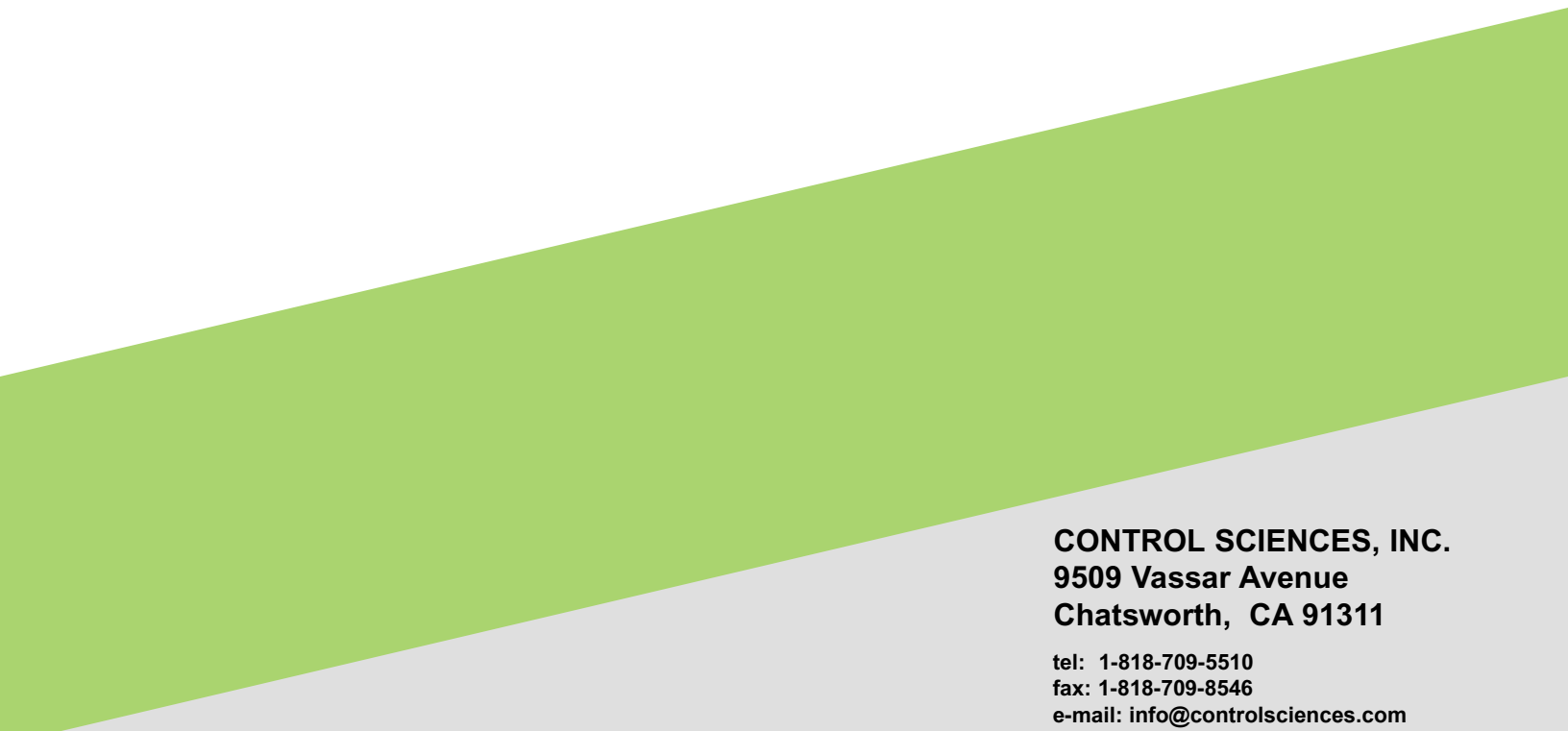
DRC1605	RBCD1757	SDC1603
DRC1705	RDC1602	SDC1604
DRC1706	RDC1603	SDC1700
DSC1605	RDC1604	SDC1702
DSC1705	RDC1700	SDC1704
DSC1706	RDC1702	SDC1725
DTM1716	RDC1704	SDC1786
DTM1717	RDC1725	SSCT1621
IPA1751	RDC1786	TSDC1608
IRDC1730	RSCT1621	TSDC1609
IRDC1731	SBCD1756	TSDC1610
OSC1754	SBCD1757	TSDC1611
RBCD1756	SDC1602	TSDC1612

ILC Data Device Corporation

DRC644	RDC520	SDC510
DSC544	RDC522	SDC511
DSC644	RDC524	SDC520
EDRC	RDC620	SDC522
EDSC	RDC630	SDC524
ESDC	RDC632	SDC620
ERDC	RDC634	SDC630
RDC36	RDC634a	SDC632
RDC361	SBA25000	SDC634
RDC362	SDC36	SDC634a
RDC510	SDC361	TS100CM
RDC511	SDC362	TD101CM

Natel Engineering/Muirhead

DRC5012	RD331	SD331
DRC5112	RD340	SD340
DRC5114	RD341	SD341
DSC5012	RD432	SD432
DSC5112	RD434	SD434
DSC5114	RD532	SD532
DSC6206	RD552	SD552
DTG5126	SCT450	TLS1036
RD330	SD330	



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