North Atlantic Industries

Accelerate Your Time-to-Mission

Model 65CS4

MULTI-CHANNEL SYNCHRO/RESOLVER STIMULUS AND MEASUREMENT

VXI bus

Four (4) Instrument Grade Synchro/Resolver Measurement Channels
Four (4) Instrument Grade Synchro/Resolver Stimulus Channels
or
Eight (8) Embedded Grade Synchro/Resolver Stimulus Channels

FEATURES

INSTRUMENT Grade (High Accuracy) and/or EMBEDDED Grade (Moderate Accuracy w/ High Channel Count)

- Multiple functions on a single slot VXI card
- ±0.005° Instrument Grade Measurement and Stimulus Accuracy
- ±0.015° Embedded Grade Stimulus Accuracy (higher channel density / lower accuracy)
- 47 Hz to 4,000 Hz (see part number).
  (for 47 Hz to 10 KHz or 20 KHz, contact factory)
- User programmable output voltages
- 2.2 VA Stimulus Outputs
- 2.2 VA Programmable Reference Generators
- Simultaneous and independent Measurement and Simulation
- Single-Speed or Multi-Speed Programmable for Measurement and Simulation
- Programmable Multi-Speed Ratios (2 to 255)
- Dynamic address configuration
- VXIbus data rate of 2 megabytes/sec
- Data is processed within 100μs
- Self-Test capability
- As direct replacement for 5410C-89, use P/N 65CS4-A2200G0-A2100G0-M and cable harness 07-0018.
- As direct replacement for B5410C-89-1, use P/N 65CS4-A2200G0-A2101G0-M and cable harness 07-0021.

DESCRIPTION

This single slot VXI ("C"-size card) is an Instrument/Embedded Grade, intelligent DSP design, that incorporates up to four Synchro/Resolver Measurement channels, and up to four Instrument Grade Synchro/Resolver Simulation channels or up to eight Embedded Grade Synchro/Resolver (Simulation) channels that can be used independently and/or simultaneously. The internal modular design of the card utilizes a motherboard that may be populated with up to two daughter cards. Each daughter card, instrument grade or embedded grade, may each be populated with S/D, D/S or REF modules, depending on the grade type (see configurations following).

- Instrument Grade is defined as 0.005° Accuracy
- Embedded Grade is defined as 0.015° Accuracy (less accurate than Instrument Grade but offers a higher channel density.

Two Reference Supplies are available (one on each daughter card). If > 2 Reference supplies are required, the additional Reference(s) will replace Stimulus channels (contact factory for special configurations).

All measurement and simulation channels are user programmable for either Synchro or Resolver format and may be formatted for either single-speed or multi-speed applications. Programmable speed ratios (2:1 to 255:1) offer additional flexibility for those applications requiring two-speed capability.
Each Simulation channel can be programmed for either continuous rotation or programmable Start and Stop angles.

This instrument contains all the necessary functions to fully evaluate, calibrate and simulate the Synchro/Resolver components and systems. With its built-in reference generators, superb accuracy, resolution and high power output capability, this module can form the basis of a fully integrated system for testing any Synchro/Resolver signal. This design also incorporates our new internal wrap-around Self Test capability that does not require any external hardware.

21st Century technology combined with nearly 50 years of synchro/resolver product experience yield state-of-the-art performance and accuracy.

TABLE OF CONTENTS

GENERAL ARCHITECTURE

This universal card eliminates the need for specialized simulation and measurement for Synchro/Resolver components and systems. The card architecture consists of a motherboard with two daughter-boards that enable the user to specify a variety of functions within this single slot card design. (See part number for details).

The daughter-boards consist of independent measurement / stimulus / reference modules that may be populated to provide up to four Synchro/Resolver Measurement channels and up to four Instrument Grade Synchro/Resolver Simulation channels or up to eight Embedded Grade Synchro/Resolver (Simulation) channels that can be used independently and/or simultaneously.

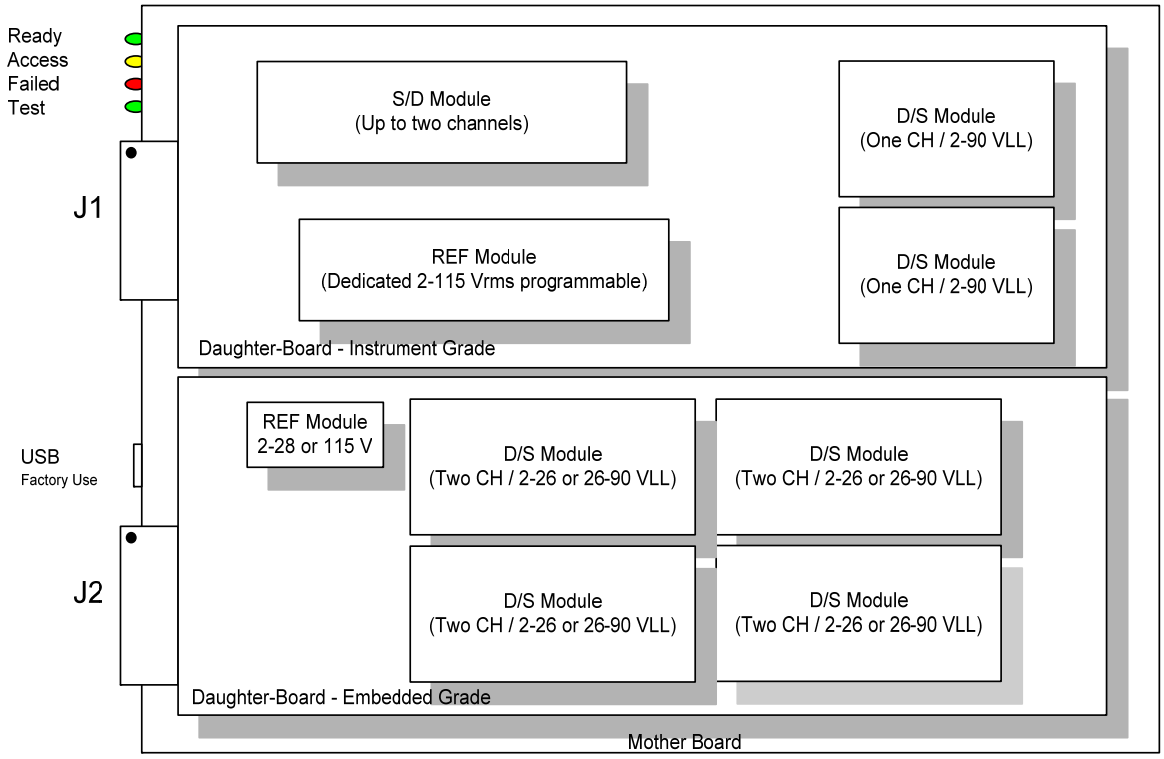


Fig 1. Instrument / Embedded Board Daughter Card Combination

- Typical configuration example: (Note) – One or two Daughter Boards can be mixed / matched (at factory / time of order) to suit configuration preference.
- If a second and/or third reference supply is specified on an Instrument Grade daughter card, it replaces D/S channel 2 then 1 respectively and only RHi and RLo (S1, S3) pins are active. (Please contact factory for special configuration requests).

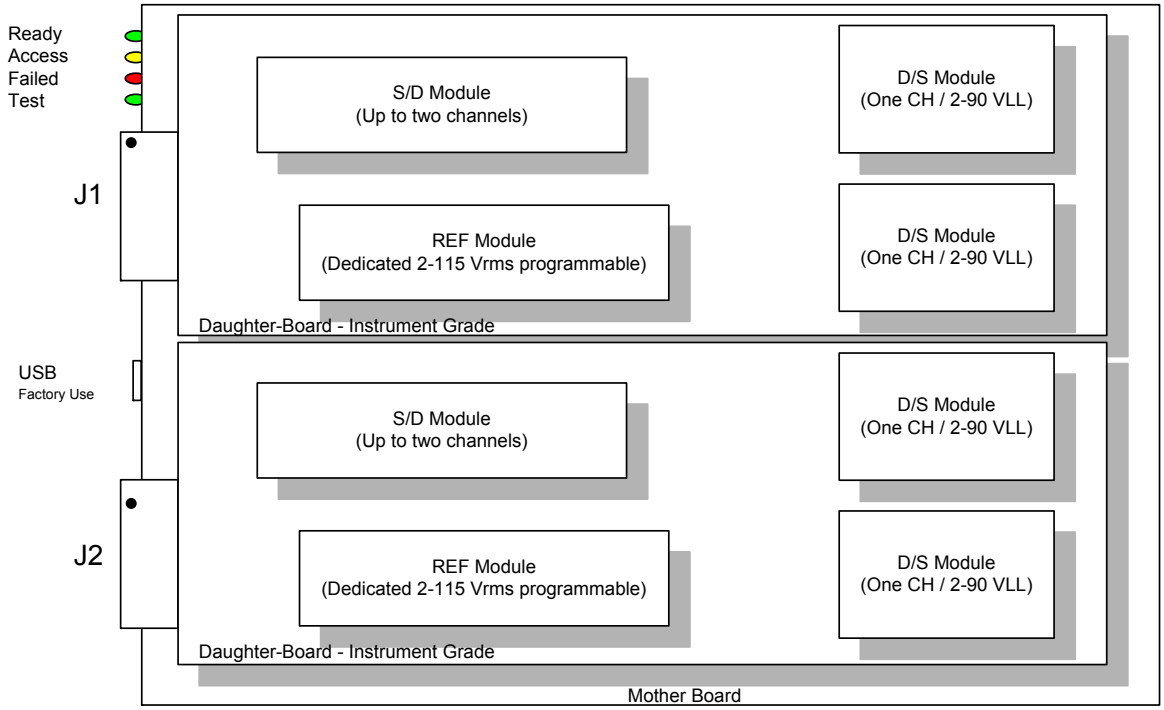


Fig 2. Dual Instrument Grade Daughter Board Combination

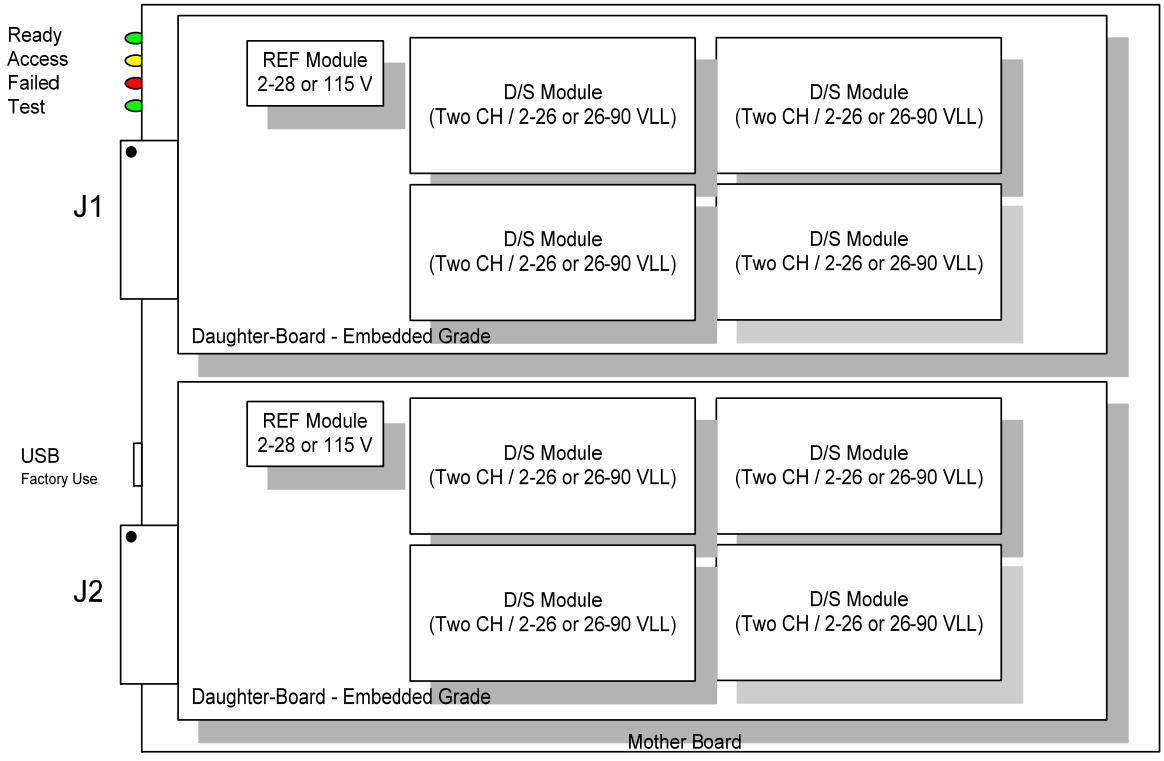


Fig 3. Dual Embedded Grade Daughter Board Combination

SPECIFICATIONS

Motherboard -- General

DSP Design	Dedicated DSP for VXI Bus Data Transfer
VXI Bus Data transfer	2 MB/sec
Daughter Card Configuration	Up to (2) daughter-cards
ESD protection	Designed to meet the testing requirements of IEC 801-2 level 2 (4KV transient with a peak current of 7.5A with a time constant of approximately 60 ns.

Applicable to the Overall Card:

VXIBus Data Rate:	2 megabytes/second
Trigger:	Rotation may be initiated by either an external (Front Panel) or via the trigger bus. External trigger is terminated with a 499 Ω resistor and is connected to a differential Line Receiver (SN75115N). Trigger input to be 8 microseconds min width.
Data states:	Track or freeze for Measurement channels only
Temperature, Operating:	0°C to +52°C
Temp. Non-Operating:	-40°C to +71°C
Relative Humidity:	to 95% RH, non-condensing
Shock:	Designed to meet 15G, 11 ms
Vibration:	Designed to meet MIL-PRF-28800F for class 3 equipment.
Altitude, Operating:	15,000 feet
Altitude, Non-Operating:	40,000 feet
Size:	"C" size (13.386" x 9.187"), 1.2" pitch. (349mm x 234 mm), 30 mm pitch
Weight:	4.3 lb.
Calibration Intervals:	Annual verification is suggested
Cooling:	25 cfm @ 0.12”

Daughter-Board – Instrument Grade

General Configuration

Up to (2) Instrument Grade Measurement channels
Up to (2) Instrument Grade Stimulus channels
(1) Reference channel (may be increased in lieu of stimulus channels)

Instrument Grade Measurement, Input Module(s)

Number of Channels:		Up to four (see part number)
Input Mode: Angular		Synchro/Resolver, programmable
Range:		0 – 359.9999
Resolution:		0.0002°
Accuracy:	(Resolver):	±0.005º at 47 to 4,000 Hz ±0.0083º at 5.0 KHz ±0.0167º at 10.0 KHz (2 - 28 V_{L-L})
	(Synchro):	±0.005º at 47Hz to 1.0 KHz
Input Voltage	(Resolver):	1.0 - 90 V_{L-L} Auto-ranging (100 V_{L-L} max. for 64CS4-A2200G0-A2100G0-M)
Input Voltage	(Synchro):	11.8 – 90 V_{L-L} Auto-ranging (100 V_{L-L} max. for 64CS4-A2200G0-A2100G0-M)
Input Impedance:		>11.8 V_{L-L} 60kΩ; <11.8 V_{L-L} 13.3 KΩ
Tracking Rate:		±10,000°/sec. (±27.7 rps) For two-speed applications, speed is referenced to the fine channel.
Angle Rate, Digital:		16-bit resolution; Linearity: 0.1%. Scalable to 0.1°/sec resolution.
Angle Rate, DC		Programmable from ±100 to ±1000°/sec = ±10 VDC (referred to Coarse input) 4 mA Short Circuit Protected
Speed Ratio:		Requires two channels, then the pair is programmable from 2:1 to 255:1 in increments of 1.
Input Reference, Frequency:		See part number
Reference, Voltage:		2 Vrms to 130 Vrms, Auto-ranging
Reference, Input Z:		100 KΩ
Auto phase Correction:		Up to 80° between Reference and Signal
Common Mode:		0.6 V max.
Isolation:		Each Signal & Reference Input is isolated with ±500 V peak breakdown

Instrument Grade Stimulus, Output Module(s)

Number of Channels:		Four (see part number)
Output Mode:		Synchro/Resolver, programmable/channel
Resolution:		0.001°
Accuracy:	(Resolver):	±0.005° 360Hz to 800Hz
		±0.010° > 800Hz to 2,000Hz
		±0.010º at 5,000Hz & 20 KΩ min. load (3 V_{L-L} to 26 V_{L-L})
		±0.020º at 5,000Hz & 20 KΩ min. load (1 V_{L-L} to < 3 V_{L-L})
		±0.010º at 10,000Hz & 20 KΩ min. load (3 V_{L-L} to 26 V_{L-L})
		±0.025º at 10,000Hz & 20 KΩ min. load (1 V_{L-L} to < 3 V_{L-L})
	(Synchro):	±0.005° > 100Hz to 800Hz
		±0.012° 47Hz to 100Hz
Output Drive:		2.2 VA, ≥11.8 V_{L-L}; 200 mA rms, <11.8 V_{L-L}
Output voltage:		1.0 to 90 V_{L-L}, programmable
Output Protection:		Over-current and over-temperature
Output VL-L Resolution:		0.01V. Output voltage varies directly with Reference voltage.
Output VL-L, Accuracy:		2% (relative to the reference voltage)
Input Reference, Frequency:		See part number
Reference, Voltage:		2 Vrms to 115 Vrms, programmable
Phase Shift:		2° max. Reference input to Signal output.
Speed Ratio:		Requires two channels, then the pair is programmable from 2:1 to 255:1 in increments of 1.
Rotation:		±10000°/sec. (±27.7 rps) with a resolution of 0.01°/sec. Continuous rotation or programmable Start and Stop angles.
Velocity Output, DC		±10,000 °/sec = ±10 VDC (referred to Coarse output)
		±100 °/sec = ±10 VDC
		4 mA Short Circuit Protected
Accuracy Velocity Output		±0.25% FS (Full Scale) Gain ±10mV offset
Isolation:		Each Signal & Reference Input is galvanically isolated with 500 V peak breakdown over the specified frequency range.

Reference Generator

(Available on Instrument Grade Daughter Board)

Number of Channels:	One (Up to six available – substitute for D/S modules - see part number)
Voltage Output:	2 Vrms to 115 Vrms, Programmable
Resolution:	0.1 V
Accuracy, voltage:	±3% (± 6% @ > 7.5 KHz)
Harmonic Content:	1.0% maximum
Output Drive Capability:	2.2 VA
Output Protection:	Over-current and over-temperature
Frequency:	47 Hz to 10 kHz Programmable with 0.1 Hz steps
Accuracy, frequency:	0.1%

Daughter-Board – Embedded Grade

General Configuration

Up to (8) Embedded Grade Stimulus channels
(1) Reference module; 2-28 Vrms or 115 Vrms (see part number)

Embedded Grade Stimulus, Output

Number of Channels:	Eight (see part number)
Output Mode:	Synchro/Resolver, programmable/channel
Resolution:	0.1°
Accuracy (Synchro/Resolver):	±0.02° over frequency of 340 Hz to 1,000Hz;
Output Drive:	1.25 VA at 70°
Output Protection:	Over-current and over-temperature
Output VL-L	2.0 to 28 V_{L-L}, programmable; resolution 0.01V Or 29 to 90 V_{L-L}, programmable; resolution 0.01V Output voltage varies directly with Reference voltage.
Output VL-L, Accuracy:	2% (relative to the reference voltage)
Reference, Frequency:	360 Hz to 1,000 Hz
Reference, Voltage:	26 Vrms, 90 Vrms, or 115 Vrms, programmable
Phase Shift range:	±179.9° Reference input to Signal output.
Phase shift resolution:	0.1°
Phase shift accuracy:	Offset 0.5°max. then linearity is 0.1° over range.
Rotation:	Continuous rotation or programmable Start and Stop angles. 0 to ±13.6 rps with a resolution of 0.15°/sec. Step size is 16 bits (0.0055)° up to 1.5 rps, then linearly increases to 12 bits (0.088°) at 13.6 rps.
Isolation:	Each Signal & Reference Input is galvanically isolated with 500 V peak breakdown over the specified frequency range.

Overall Unit Power Requirements / Matrix

Subcomponent	+5V (A) (average)	+/-12V (A) (average)
Motherboard	0.75	-N/A-
Daughter-Board, Instrument or Embedded Grade	0.7	0.01
Stimulus module, Instrument Grade	0.8 (no load) Add 0.41 per 1VA load	-N/A-
Stimulus module, Embedded Grade	0.8 (no load) Add 0.72 per 1VA load (per channel)	-N/A-
Measurement module, Instrument Grade	0.5	-N/A-
Reference Module	0.2 Add 0.41 per 1VA load	-N/A-

CARD ADDRESS

Address Dip Switch 1 can be configured for logical addresses 1 to 255, where OFF=1 and ON=0. LSB is position 1. Card SW1 is default configured for logical address 128, to address the first set of 8 channels. (Address Dip Switch 2 is not used).

Decimal	Logical Address 128 (Default)	Logical Address 33 (Example)
1 (LSB)	SW1, position 1=0 (ON)	SW1, position 1=1 (OFF)
2	SW1, position 2=0 (ON)	SW1, position 2=0 (ON)
4	SW1, position 3=0 (ON)	SW1, position 3=0 (ON)
8	SW1, position 4=0 (ON)	SW1, position 4=0 (ON)
16	SW1, position 5=0 (ON)	SW1, position 5=0 (ON)
32	SW1, position 6=0 (ON)	SW1, position 6=1 (OFF)
64	SW1, position 7=0 (ON)	SW1, position 7=0 (ON)
128 (MSB)	SW1, position 8=1 (OFF)	SW1, position 8=0 (ON)

65CS1 Bottom View

FRONT PANEL STATUS INDICATORS

Status Indicators	Function
READY	Indicates that unit is ready to accept commands
ACCESS	Illuminates when VXI bus controller sends or reads a message or status.
FAILED	Lights on power-up and goes out after unit has passes system self-test (approx one minute). Stays lit if device has failed Self-Test or Calibration. Indicator will also light in response to Controller SYSFAIL output
TEST	Illuminates while Internal Self-Test is running. Flashes during Calibration cycle.

PROGRAMMING

The 65CS4 can be supplied with either **Native (See below)** or **Mate/CIIL Syntax (See page 18)**. See P/N for specifying the required format.

Native Syntax

One VXI 65CS4 supports up to 4 channels of measurement and stimulus (see configuration in part number). Use SW1 to configure the address for those channels. (SW2 is not used). Use Native Syntax to address any channel of that associated logical address.

Self-test can be performed at any time without effecting any set parameters. Self-test requires approximately 45 seconds to complete.

TO POWER ON CARD AND ENABLE OPERATION, user must initially send the command: *IDN?
Perform self-test (*TST?<CR><LF>) before programming. Testing is complete in approximately 45 seconds.

The following sections define Native programming format with supporting examples

Software / Driver Support

The VXI Software Support Kit (SSK) is supplied with all VXI platform based board level products. This platform's SSK contents include "help" documentation which defines the command set. An IVI driver is provided for each card function implementation. A sample LabWindows application is provided for simple instrumentation, card test and debug.

SSK Details:

Type	GPIB, VXIBus Instrument Control, Software Support Kit (SSK)
Help Documentation:	MS Word Document Format
Library:	Functional Command Set
Driver	IVI Driver
LabWindows CVI	GUI application (or Soft Panel) for simple instrumentation, card test and debug.

Formal Syntax Notation

< >	field boundaries of inseparable and mandatory items
[ ]	field boundaries of optional items
( )	grouping braces
::=	"is defined to be"
|	alteration, exclusive OR
…	optional repetition of immediately preceding item or group

General Command Definition

<value>	(ASCII encoded scientific number | ASCII encoded decimal number | ASCII encoded integer)
	All <*values*> The resolution (number of decimal places is dependent on the specific command sent. Higher resolutions will be accepted but will be truncated to the acceptable number of digits to the right of the decimal point.
<scientific number>	[+ | -] [<*digit*>…] <*dp*><*digit*>…E<+ | -><*digit*>[<*digit*>]
<decimal number>	([+ | -]<*digit*>…<*dp*> [<*digit*>…] | [+ | -]<*dp*><*digit*>…)
<integer>	[+ | -]<*digit*>…
<channel>	<*digit*>
<*dp*>	ASCII decimal point (period) "."
<*digit*>	(0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9)
<*b*>	one or more ASCII blank characters
<*cr*>	ASCII carriage return
<*lf*>	ASCII line feed
<grade>	[<H> | <L>] (H = Instrument Grade, L = Embedded Grade)
	The grade option is utilized to differentiate between instrument grade and embedded grade functions for S/D and D/S modules

Detailed Command Syntax

SIMULATOR COMMANDS

Angle DS<grade><channel><*b*>ANGLE<*b*><value><*cr*><*lf*> DS<grade><channel><*b*>ANGLE?<cr><*lf*>	Sets output angle (in degrees): Range: -359.9999 < value < 359.9999 Queries Angle returns value in uni-polar mode: Range: 0.0000 < value < 359.9999
DC Scale DS<grade><channel><*b*> DC_SCALE<*b*><value><*cr*><*lf*> DS<grade><channel><*b*>DC_SCALE?<cr><*lf*>	Sets Channel DC output Scale; Full scale = 10Volts Range: 100 <= value <= 1000. (e.g. 100 = 10 degrees / sec / V) Query returns Channel DC Scale value
Signal Mode DS<grade><channel><*b*>MODE<*b*>RSL<*cr*><*lf*> DS<grade><channel><*b*>MODE<*b*>SYN<*cr*><*lf*> DS<grade><channel><*b*>MODE?<cr><*lf*>	Sets channel signal format (mode) to RESOLVER Sets channel signal format (mode) to SYNCHRO Query returns current Signal Mode ('RSL' or 'SYN')
Ratio DS<grade><channel><*b*>RATIO<*b*><value><*cr*><*lf*> DS<grade><channel><*b*>RATIO?<cr><*lf*>	Sets 2-speed ratio; Range = 2 to 255. Ratio is 1 for independent outputs. Query returns Ratio setting.
Relay Function DS<grade><channel><*b*> STATE<*b*>< OPEN | CLOSE ><*cr*><*lf*> DS<grade><channel><*b*>STATE?<cr><*lf*>	Sets I/O isolation relay state; "OPEN" or "CLOSE". Query returns I/O relay status "OPENED" or "CLOSED".
Reference Mode DS<grade><channel><*b*> REF_SOURCE<*b*>< INT | EXT ><*cr*><*lf*> DS<grade><channel><*b*>REF_SOURCE?<cr><*lf*>	Sets Channel Reference Source; INT=Internal or EXT=External Internal Source Channels 1 & 2 is Reference 1. Internal Source Channels 3 & 4 is Reference 2. Query returns Channel Reference Mode ('INT' or 'EXT')
Line-to-Line Voltage DS<grade><channel><*b*> VLL_VOLT<*b*><value><*cr*><*lf*> DS<grade><channel><*b*>VLL_VOLT?<cr><*lf*>	Sets Line-to-Line voltage in Volts. Range:1 to 90. Query returns current Line-to-Line Voltage value
Input Reference Voltage DS<grade><channel><*b*> REF_VOLT_IN<*b*><value><*cr*><*lf*> DS<grade><channel><*b*>REF_VOLT_IN?<cr><*lf*>	Configure Channel for Input Reference Voltage Level. Range: 2.0 to 115.0 Query returns Channel Input Reference Voltage Level Setting

Rotation Complete DS<grade><channel><*b*>ROT_DONE?<cr><*lf*>	Query returns Step Rotation Status (“DONE” = Done or “NOT_DONE” = Step not complete). Only applies when in Step Rotation Mode.
Rotation Initialization DS<grade><channel><*b*>ROT_INIT<*b*><*cr*><*lf*>	Command initiates rotation of channel output.
Rotation Rate DS<grade><channel><*b*> ROT_RATE<*b*><value><*cr*><*lf*> DS<grade><channel><*b*>ROT_RATE?<cr><*lf*>	Set channel Rotation Rate in revolutions per second. ±10000°/sec. (±27.7 rps) Query returns programmed channel Rotation Rate.
Rotation Stop Angle DS<grade><channel><*b*> ROT_STOP_ANGLE<*b*><value><*cr*><*lf*> DS<grade><channel><*b*> ROT_STOP_ANGLE?<cr><*lf*>	Sets channel output angle (in degrees): Range: -359.9999 < value < 359.9999 Queries returns Channel Stop Angle in uni-polar mode: Range: 0.0000 < value < 359.9999
Rotation Mode DS<grade><channel><*b*> ROT_MODE<*b*>< CONT | STEP ><*cr*><*lf*> DS<grade><channel><*b*>ROT_MODE?<cr><*lf*>	Sets Channel Reference Source; CONT=Continuous or STEP=Step Query returns Channel Rotation Mode (‘CONT’ or ‘STEP’)
Trigger Source (note *1) DS<grade><channel><*b*>TRIG_SOURCE<*b*> < BUS | INT | EXT | TTL ><*cr*><*lf*> DS<grade><channel><*b*> TRIG_SOURCE?<cr><*lf*>	Sets Channel Trigger Source; BUS=Bus, INT=Internal, EXT=External, or TTL=TTL Level Query returns Channel Trigger Source (‘BUS’,’INT’,‘EXT’,or TTL’)
Trigger Slope DS<grade><channel><*b*>TRIG_SLOPE<*b*> < NEG | POS ><*cr*><*lf*> DS<grade><channel><*b*> TRIG_SLOPE?<cr><*lf*>	Sets Channel Trigger Sense for Positive or Negative going level; NEG=Negative, POS=Position Query returns Channel Trigger Sense (‘NEG’, or ’POS’)
Phase Shift DS<grade><channel><*b*>PHASE<*b*><value><*cr*><*lf*> DS<grade><channel><*b*>PHASE?<cr><*lf*>	Sets Channel Phase (degrees); Range ±180.0 Query returns Channel Phase (degrees); Range: ±180

API COMMANDS

Angle SD<grade><channel><*b*> ANGLE?<*b*><value><*cr*><*lf*>	Query returns API angle (in degrees): Range: 0.0000 < value < 359.9999
DC Scale SD<grade><channel><*b*> DC_SCALE<*b*><value><*cr*><*lf*> SD<grade><channel><*b*>DC_SCALE?<cr><*lf*>	Sets Channel DC output Scale; Full scale = 10Volts Range: 100 <= value <= 1000. (e.g. 100 = 10 degrees / sec / V) Query returns Channel DC Scale value
Bandwidth SD<grade><channel><*b*> BANDWIDTH<*b*>< HIGH | LOW ><*cr*><*lf*> SD<grade><channel><*b*>BANDWIDTH?<cr><*lf*>	Sets Channel for either High or Low Bandwidth (BW); HIGH=100 Hz BW or LOW= 10 Hz BW Use LOW for carrier (reference) freq <300Hz. Query returns Channel Bandwidth ('HIGH' or 'LOW')
Maximum Angle Settle Time SD<grade><channel><*b*>MAXT<*b*><value><*cr*><*lf*> SD<grade><channel><*b*>MAXT?<cr><*lf*>	Maximum wait time for settled API reading. Sets channel Max ? (in ?): Range: 0 < value < 20 Queries returns Channel Max ?.
Signal Mode SD<grade><channel><*b*>MODE<*b*>RSL<*cr*><*lf*> SD<grade><channel><*b*>MODE<*b*>SYN<*cr*><*lf*> SD<grade><channel><*b*>MODE?<cr><*lf*>	Sets channel signal format (mode) to RESOLVER Sets channel signal format (mode) to SYNCHRO Query returns current Signal Mode ('RSL' or 'SYN')
Ratio SD<grade><channel><*b*>RATIO<*b*><value><*cr*><*lf*> SD<grade><channel><*b*>RATIO?<cr><*lf*>	Sets channel 2-Speed/Multi-speed ratio; Range = 1 to 255. Query returns channel 2-Speed/Multi-speed ratio setting.
Reference Mode SD<grade><channel><*b*> REF_SOURCE<*b*>< INT | EXT ><*cr*><*lf*> SD<grade><channel><*b*>REF_SOURCE?<cr><*lf*>	Sets Channel Reference Source; INT=Internal or EXT=External Internal Source Channels 1 & 2 is Reference 1. Internal Source Channels 3 & 4 is Reference 2. Query returns Channel Reference Mode ('INT' or 'EXT')

Relay Function SD<grade><channel><*b*> STATE<*b*>< OPEN | CLOSE ><*cr*><*lf*> SD<grade><channel><*b*>STATE?<cr><*lf*>	Sets I/O isolation relay state; "OPEN" or "CLOSE". Query returns I/O relay status "OPENED" or "CLOSED".
Measurement Mode SD<grade><channel><*b*> UPDATE<*b*>< LATCH | TRACK ><*cr*><*lf*> SD<grade><channel><*b*>UPDATE?<cr><*lf*>	Sets API channel Update Mode to "LATCH" or "TRACK". Query returns channel Update mode "LATCHED" or "TRACKING".
Velocity SD<grade><channel><*b*>VEL?<*b*><value><*cr*><*lf*>	Query returns channel velocity Range: -32767 < value < 32767. Typically ±10,000º/sec.

REFERENCE COMMANDS

Reference Generator Frequency REF_GEN<channel><*b*> FREQ<*b*><value><*cr*><*lf*> REF_GEN <channel><*b*>FREQ?<cr><*lf*>	Sets internal Reference Generator frequency in Hz. Range = 47.00 to 10000.00 Query returns Reference Generator frequency setting.
Relay Function REF_GEN<channel><*b*> STATE<*b*>< OPEN | CLOSE ><*cr*><*lf*> REF_GEN <channel><*b*>STATE?<cr><*lf*>	Sets I/O isolation relay state; "OPEN" or "CLOSE". Query returns I/O relay status "OPENED" or "CLOSED".
Reference Generator Voltage REF_GEN<channel><*b*> VOLT<b><value><cr><lf> REF_GEN <channel><*b*>VOLT?<cr><lf>	Sets internal Reference Generator voltage; Range = 2 to 115 volts. Returns internal Reference Generator voltage setting.

UTILITY FUNCTIONS

Self-Test *TST?<*cr*><*lf*>	Initiates self-test. Query returns 0<*cr*><*lf*> if test passed or SELF TEST FAILED...<*cr*><*lf*> if test failed. Self-test requires approximately 45 seconds to complete.
Identification *IDN?<*cr*><*lf*>	Returns: "north atlantic, <part number>,<serial #>, <firmware revision>" **THIS COMMAND IS INITIALLY REQUIRED TO POWER ON CARD AND ENABLES OPERATION.**
Error Reporting *ERR?<*cr*><*lf*>	Query returns up to 10 most recent error messages or "No error." To clear error queue, read until "No error" is received.

Reset *RST<*cr*><*lf*>	Sets unit to power-up default state: SD MAXT = 0 SD BANDWIDTH = HIGH SD DC SCALE = 1000 SD RATIO = 1 SD REF SOURCE = EXT SD STATE = OPEN SD UPDATE = TRACK REF FREQ = 400 REF VOLT = 115 REF STATE = OPEN DS ANGLE = 0.0000 DS DC SCALE = 1000 DS MODE = SYN DS RATIO = 1 DS REF SOURCE = EXT DS REF VOLT = 115 DS ROT RATE = 0 DS STOP ANGLE = 0.0000 DS ROT MODE = CONT DS STATE = OPEN DS TRIG SLOPE = POS DS TRIG SOURCE = INT DS VLL VOLT = 90

Note *1 – SIMULATOR TRIGGER CONTROL DEFINIITIONS

The BUS, INT, EXT and TTL triggers relate to the Rotation Command **only**;
Each DS (stimulus) channel has an independent Trigger Source (and associated Trigger Slope) – there are four sources available;
If the **TRIG_SOURCE** is set to **<INT>;** (which is default); the DS will rotate upon execution of the ROT_INIT command.
If the **TRIG_SOURCE** is set to **<BUS>;** the DS will rotate upon execution of a low level command EDFF(h)
If the **TRIG_SOURCE** is set to **<TTL>;** the DS will initiate rotate upon TTL signal application on the VXI chassis backplane I/O P2 connector. You can set the individual channel to trigger on one of 8 possible signal inputs. This is identified as:

P2-23A	TrigTTL0
P2-24A	TrigTTL2
P2-26A	TrigTTL4
P2-27A	TrigTTL6
P2-23C	TrigTTL1
P2-24C	TrigTTL3
P2-26C	TrigTTL5
P2-27C	TrigTTL7

If the **TRIG_SOURCE** is set to **<EXT>;** the DS will initiate rotation upon application of the trigger signal from the front panel connector.

19	Trigger -
37	Trigger +

Instrument Setup Queries

Any Model 65CS4 setup state or value may be queried by sending the command mnemonic with a question mark (?) appended and reading the response. See *Command Definition Section* for detailed command syntax. Valid instrument queries are summarized as follows:

Query	Purpose/Response
ANGLE?	Generator output angle or API reading
DC_SCALE?	Return DC Scale
MODE?	Synchro (SYN) or Resolver (RSL) mode
VLL_VOLT?	Line-to-Line input/output voltage value
RATIO?	Speed Ratio value
REF_VOLT_IN?	Input Reference Voltage Setting
ROT_DONE?	Step Rotation Status
ROT_RATE?	Rotation Rate
ROT_STOP_ANGLE?	Stop Angle
REF_SOURCE?	Reference Internal (INT) or External (EXT)
TRIG_SOURCE?	Trigger Source
TRIG_SLOPE?	Trigger Slope
BANDWIDTH?	Returns Bandwidth
MAXT?	API stable measurement timeout value
STATE?	Relay State OPENED or CLOSED
UPDATE?	Generator velocity value
VEL?	Velocity
*TST?	Self test status. Self-test requires approximately 45 seconds to complete.
*IDN?	Instrument Identification string. **Initially required to power on card and enables operation.**
*ERR?	Returns 10 recent error messages

Mate/CIIL Syntax

COMMANDS

1)	FNC	(SET) set up instrument
2)	CLS	close input path
3)	OPN	open input path
4)	RST	reset channel
5)	STA	report status
6)	CNF	perform confidence test
7)	IST	perform built in test
8)	INX	initiate conversion
9)	FTH	retrieve data

NOTATION

< >	field boundaries
< b >	ASCII blank
•••	optional field or structure field or structure repeated as often as required
< CR > < LF >	ASCII carriage return followed by ASCII line feed
< NOUN >	RSL
< SET CODE >	SET
< CHAN NUM >	0 to 5 or 00 to 05

< VALUE > DATA FIELD

SENSOR FORMAT

FNC function

FNC < b > < NOUN > < b > <MCHAR> < b >: CH < CHAN NUM > [< b > < SETCODE > < MODIFIER > < b > < VALUE >]• • •
< CR > < LF >

< NOUN >		SYN RSL	 (error msg) #18
< CHAN NUM >	0 to 2	 00 to 02	 (error msg) #15
< SET CODE >		SET	(error msg) #16
< MODIFIER >	FREQ	Sets Frequency	
		REFV	Sets Ref. Voltage
		VOLT	Sets L-L Voltage
		GAWD	Sets Gate width (measurement interval)
< MCHAR >	ANGL	Angle -360 TO +360	(error msg) #17
< VALUE >			
	FREQ	 360 to 5,000 Hz	(error msg) #5
< VALUE >			
	REFV	 5 to 115 V	(error msg) #5
< VALUE >			
	VOLT	 3.5 to 100 V	(error msg) #5
< VALUE >			
	GAWD	0 to 1.8 secs	(error msg) #5

STIMULUS FORMAT

FNC function

FNC < b > < NOUN > < b > : CH < CHAN NUM > [< b > < SETCODE > < MODIFIER > < b > < VALUE >]
• • • < CR > < LF >

< NOUN >		SYN		
		RSL		(error msg) #18
< CHAN NUM >	3 to 5			
		03 to 05		(error msg) #15
< SET CODE >		SET		(error msg) #16
		SRX		
		SRN		
< MODIFIER >	ANGL	Sets Angle		
		ANRT	Sets Angle Rate	
		EANG	Sets End Angle	
		FREQ	Sets Frequency	
		REFV	Sets Ref. Voltage	
		VOLT	Sets L-L Voltage	(error msg) #17
		TRSC	Select Trigger Source	
		TRSL	Select Trigger Slope	

< VALUE >

ANGL	0 to 359.99 (Resolution .01°)	(error msg) #5

< VALUE >

ANRT	.1°/sec to 1000°/sec Resolution .1°/sec + = CW, - = CCW	

< VALUE >

EANG	0 to 359.99 (Resolution .1°) or CONT = continuous	

< VALUE >

REFV	26	(error msg) #5

< VALUE >

VOLT	See Specifications for proper voltage	(error msg) #5

< VALUE >

FREQ	360 to 5000 Hz	

< VALUE >

TRSC	INT	Internal	
	EXT	External	
	TTL <N>	TTL TRIG BUS	N = 0 TO 7

< VALUE >

TRSL	POS	
	NEG	(EXTERNAL ONLY)

FORMAT **(STIMULUS)**

RST RST < b > <NOUN> < b > : CH < CHAN NUM > < CR > < LF >
results Relay open

ANY PENDING ERROR MESSAGES ON <CHAN NUM> CLEARED

Angle = 0
Angle Rate = 0
End Angle = 0
Resolver

FORMAT **(SENSOR)**

RST RST < b > <NOUN> < b > <MCHAR> < b > : CH < CHAN NUM > < CR > < LF >
results Relay open
ANY PENDING ERROR MESSAGES ON <CHAN NUM> CLEARED
NOTE: MCHAR must match MCHAR on most recent FNC statement for CHANNUM

FORMAT

STA report status
STA < CR > < LF >
response
normal = < b > < CR > < LF >
errors = < b > < error msg > < CR > < LF >

FORMAT

IST internal self test
CNF confidence

IST < CR > < LF >
CNF < CR > < LF >

FORMAT

CLS close isolation relay

CLS < b > : CH < CHAN NUM > < CR > < LF >

OPN open isolation relay

OPN < b > : CH < CHAN NUM > < CR > < LF >

ERROR MESSAGES:

F07SRS00 (MOD):	INVALID DATA FIELD	1
F07SRS00 (MOD):	MESSAGE OVERFLOW	2
F07SRS00 (MOD):	SYNTAX ERROR	3
F07SRS00 (MOD):	INVALID SEQUENCE	4
F07SRS00 (MOD):	DATA RANGE ERROR	5
F07SRS00 (MOD):	INVALID INX-FTH SEQUENCE	6
F07SRS00 (MOD):	MODIFIER MISMATCH	7
F07SRS00 (MOD):	NO SPACE	8
F07SRS00 (MOD):	R/D BIT NOT READY	9
F07SRS00 (MOD):	BIT FAIL DEG.	10
F07SRS00 (MOD):	ERROR IN EXPONENT RANGE	11
F01SRS00 (MOD):	INDICATES LOSS OF INPUT SIGNAL	12
F07SRS00 (MOD):	NO CARRIAGE RETURN	13
F07SRS00 (MOD):	INVALID MESSAGE COMMAND	14
F07SRS00 (MOD):	CHANNEL NUMBER ERROR	15
F07SRS00 (MOD):	SET CODE ERROR	16
F07SRS00 (MOD):	MODIFIER ERROR	17
F07SRS00 (MOD):	NOUN ERROR	18

Channel Number

EXAMPLE
To set CH 3 for 11.8 synchro output with a 26 Vrm reference and a 46.78° angle:

FNC _ SYN _ : CH3 _ SET _ ANGL _ 46.78 _
SET _ REFV _ 26 _ SET _ VOLT _ 11.8 < CR > < LF >
CLS _ : CH3 < CR > < LF >

To read a synchro angle with Ch 1

FNC _ SYN _ ANGL _ : CH1 < CR > < LF >
CLS _ : CH1 < CR > < LF >
INX _ ANGL _ < CR > < LF >
Response to INX should be 2 < CR > < LF >
After 2 seconds FTH _ ANGL < CR > < LF >

To set CH4 to rotate from 7° to 250° at 10°/sec with external trigger:
FNC _ SYN _ : CH4 _ SET _ ANGL _ 7 _ SET _ ANRT _ 10 _ SET _ EANG _ 250 _ SET _ TRSC _ EXT < CR > < LF >

CALIBRATION

Annual verification is suggested.

CALIBRATION VERIFICATION TEST SET-UP

This unit does not require field calibration. Use the following setup to verify performance that may be performed approximately every two years.

The below tests (using Native Syntax) will not necessarily assure conformance to all specification limits but will verify that all features are functional. Each test is presented in a step-by-step format and references a test equipment setup diagram. The test equipment setup figure illustrates the complement of test equipment necessary to perform the test for a single or pair of channels and shows all required interconnections between the test equipment and the device under test (DUT) using the standard J1 configuration #1. As applicable, all tests can be repeated as required to test the remaining channels (see part number).

NOTE(s):

1. After applying power to the DUT, *idn? Command must be sent to "internally" power up the DUT.
2. The following is general instructions – use the following as a guideline insuring the use of the <grade> variable for DS and SD commands (i.e. substitute DSH, SDH for Instrument Grade type and DSL, SDL for Embedded Grade type).
3. The following general test methods/verification is for general test of each module type with external test equipment available and provided by North Atlantic Industries. Other testing methods/equivalent test equipment may be used.

Internal Reference Checkout Procedure

a. Set up equipment as shown in Figure 1.

b. Program DUT using the following commands strings:

REF_GEN1 FREQ 400.00
REF_GEN1 VOLT 26.0
REF_GEN1 STATE CLOSE

d. Verify that the Frequency reading on the DMM is programmed value ±2%..

d. Verify that the Fundamental Voltage reading on the DAV (read REF channel) is programmed value ±0.1%.

e. Verify that the Distortion Measurement on the DAV (read REF channel) is less than 1.0%.

f. Program DUT to 115V with the following string and repeat steps (c) through (e) above.

REF_GEN1 VOLT 115.0

g. Program DUT to 6V with the following string and repeat steps (c) through (e) above.

REF_GEN1 VOLT 6.0

h. Program DUT to 47Hz with the following string and repeat steps (c) through (g) above (for 5395-F2 only).

REF_GEN1 FREQ 47.00

i. Program DUT to 2000Hz with the following string and repeat steps (c) through (g) above.

REF_GEN1 FREQ 2000.00

Single-Speed Generation (Simulator) Internal Reference Checkout Procedure

a. Set up equipment as shown in Figure 2.

b. Program DUT using the following command strings:

DS1 REF_SOURCE INT

REF_VOLT_IN 115.0
REF_GEN1 FREQ 47.00
REF_GEN1 VOLT 115.0
DS1 VLL_VOLT 90.0

DS1 MODE SYN
DS2 RATIO 1
DS1 CLOSED
REF_GEN1 STATE CLOSE

c. For each angle listed below, make connections to DAV SIG HI and SIG LO as shown. Program each specified angle using the ANGLE 3 <value> command.

Angle	Connections
0.000	S3 to HI, S1 to LO
60.00	S3 to HI, S2 to LO
120.0	S1 to HI, S2 to LO
180.0	S1 to HI, S3 to LO
240.0	S3 to HI, S2 to LO
300.0	S1 to HI, S2 to LO

d. Verify that each in-phase voltage reading is within the limits specified:

limit: 0±23.56mV in-phase

e. Program DUT to 400Hz using the following command string:

REF_GEN1 FREQ 400.00

f. Repeat step (c) above.

g. Verify that each in-phase voltage reading is within the limits specified:

limit: 0±7.853mV in-phase

h. Program DUT to Resolver Mode, 26V L-L, 26V reference using the following command string:

DS1 MODE RSL
REF_GEN1 VOLT 26.0
DS1 VLL_VOLT 26.0

i. For each angle listed below, make connections to DAV SIG HI and SIG LO as shown. Program each specified angle using the ANGLE<value> command.

Angle	Connections
0.000	S1 to S4, S3 to HI, S1 to LO
45.00	S1 to S4, S3 to HI, S2 to LO
90.00	S1 to S2, S2 to HI, S4 to LO
135.0	S1 to S2, S3 to HI, S4 to LO
180.0	S1 to S4, S3 to HI, S1 to LO
225.0	S1 to S4, S3 to HI, S2 to LO
270.0	S1 to S2, S2 to HI, S4 to LO
315.0	S1 to S2, S3 to HI, S4 to LO

j. Verify that each in-phase voltage reading is within the limits specified:

Angles 0, 90, 180, 270
limit: 0±2.268mV in-phase

Angles 45, 135, 225, 315
limit: 0±3.207mV in-phase

k. Program DUT to 11.8V L-L using the following command string:

DS1 VLL_VOLT 11.8

l. Repeat step (i) above.

m. Verify that each in-phase voltage reading is within the limits specified:

Angles 0, 90, 180, 270
limit: 0±1.029mV in-phase

Angles 45, 135, 225, 315
limit: 0±1.455mV in-phase

n. Program DUT to 2000Hz using the following command string:

REF_GEN1 FREQ 2000.00

o. Repeat step (i) above.

p. Verify that each in-phase voltage reading is within the limits specified:

Angles 0, 90, 180, 270
limit: 0±2.058mV in-phase

Angles 45, 135, 225, 315
limit: 0±2.910mV in-phase

q. Program DUT to 1.0V L-L and 6V Reference using the following command string:

DS1 VLL_VOLT 1.0
REF_GEN1 VOLT 6.0

r. Repeat step (i) above.

s. Verify that each in-phase voltage reading is within the limits specified:

Angles 0, 90, 180, 270
limit: 0±0.1745mV in-phase

Angles 45, 135, 225, 315
limit: 0±0.2468mV in-phase

Single-Speed Generation (Simulator) External Reference Checkout Procedure

a. Set up equipment as shown in Figure 3.

b. Program DUT using the following command strings:

DS1 REF_SOURCE EXT
DS1 REF_VOLT_IN 115.0
DS1 VLL_VOLT 90.0
DS1 MODE SYN
DS2 RATIO 1
DS1 STATE CLOSED

c. Turn on Model 5300 Reference Source and set reference output to Internal Reference, 47 Hz, 115V.

d. For each angle listed below, make connections to DAV SIG HI and SIG LO as shown. Program each specified angle using the **DS1 ANGLE<value>** command.

Angle	Connections
0.000	S3 to HI, S1 to LO
60.00	S3 to HI, S2 to LO
120.0	S1 to HI, S2 to LO
180.0	S1 to HI, S3 to LO
240.0	S3 to HI, S2 to LO
300.0	S1 to HI, S2 to LO

d. Verify that each in-phase voltage reading is within the limits specified:

limit: 0±23.56mV in-phase

e. Program DUT to Resolver mode, 400Hz, 26V L-L, 26V Reference using the following command string:

DS1 MODE RSL
DS1 VLL_VOLT 26.0

f. Set Model 5300 Reference Source to 400Hz.

g. For each angle listed below, make connections to DAV SIG HI and SIG LO as shown. Program each specified angle using the **DS1 ANGLE <value>** command.

Angle	Connections
0.000	S1 to S4, S3 to HI, S1 to LO
45.00	S1 to S4, S3 to HI, S2 to LO
90.00	S1 to S2, S2 to HI, S4 to LO
135.0	S1 to S2, S3 to HI, S4 to LO
180.0	S1 to S4, S3 to HI, S1 to LO
225.0	S1 to S4, S3 to HI, S2 to LO
270.0	S1 to S2, S2 to HI, S4 to LO
315.0	S1 to S2, S3 to HI, S4 to LO

h. Verify that each in-phase voltage reading is within the limits specified:

Angles 0, 90, 180, 270
limit: 0±2.268mV in-phase

Angles 45, 135, 225, 315
limit: 0±3.207mV in-phase

i. Program DUT to 11.8V L-L, 2000Hz using the following command string:

DS1 VLL_VOLT 11.8

j. Set Model 5300 Reference Source to 2000Hz.

k. Repeat step (g) above.

l. Verify that each in-phase voltage reading is within the limits specified:

Angles 0, 90, 180, 270
limit: 0±2.058mV in-phase

Angles 45, 135, 225, 315
limit: 0±2.910mV in-phase

Two-Speed Generation (Simulator) Checkout Procedure

a. Set up equipment as shown in Figure 4.

b. Program DUT using the following command strings:

DS1 REF_SOURCE INT
REF_GEN1 FREQ 400.00
REF_GEN1 VOLT 26.0
DS1 VLL_VOLT 11.8
DS2 VLL_VOLT 11.8
DS1 MODE RSL
DS2 MODE RSL
DS1 STATE CLOSED
DS2 STATE CLOSED
REF_GEN1 STATE CLOSE

c. Set DUT speed ratio to 2 with the following program string:

DS2 RATIO 2

d. For each angle listed below, read the 1X API and the NX API. Program each specified angle using the **DS1 ANGLE <value>** command.

Nominal Angle
0.000
45.00
90.00
135.0
180.0
225.0
270.0
315.0

e. Verify that each API reading is within the limits specified:

1X API
limit: ±45.0° from nominal

NX API
limit: 0±0.01° from nominal

f. Set DUT speed ratio to 15 with the following program string:

DS2 RATIO 15

g. Repeat step (d) above.

i. Verify that each API reading is within the limits specified:

1X API
limit: ±6.0° from nominal

NX API
limit: 0±0.075° from nominal

j. Set DUT speed ratio to 50 with the following program string:

DS2 RATIO 50

k. Repeat step (d) above.

l. Verify that each API reading is within the limits specified:

1X API
limit: ±1.8° from nominal

NX API
limit: 0±0.250° from nominal

Generation (Simulator) Angle Rate Checkout

a. Set up equipment as shown in Figure 5.

b. Program DUT using the following command strings:

DS1 REF_SOURCE INT
REF_GEN1 FREQ 400.00
REF_GEN1 VOLT 26.0
DS1 VLL_VOLT 11.8
DS1 MODE RSL
DS2 RATIO 1
DS1 ROT_RATE 360
DS1 ROT_MODE CONT
DS1 STATE CLOSED
REF_GEN1 STATE CLOSE
DS1 ROT_INIT

c. Set oscilloscope to 100mS per division.

d. Synchronize oscilloscope to display a sinusoidal envelope. Then envelope should go from zero, to full scale, and back to zero in 0.50 seconds. The display will show exactly 2 envelope waveforms.

Single-Speed Measurement (API) Internal Reference Checkout Procedure

a. Set up equipment as shown in Figure 6.

b. Program DUT using the following command strings:

SD1 REF_SOURCE INT
REF_GEN1 FREQ 400.00
REF_GEN1 VOLT 115.0
SD1 MODE SYN
SD1 STATE CLOSED
REF_GEN1 STATE CLOSE

c. Setup Model 5300 Simulator to External Reference, 400Hz, 90V L-L, Synchro mode. Press Model 5300 CAL button.

d. For each angle listed below, set the Model 5300 Simulator Output Angle, and read the DUT under test using the **SD1 ANGLE?** command.

Nominal Angle
0.000
45.00
90.00
135.0
180.0
225.0
270.0
315.0

e. Verify that all angle readings are within the following limit:

Limit: 0.0050°

f. Set Model 5300 to 26V Reference, 11.8V L-L, Resolver mode. Press Model 5300 CAL button.

g. Set DUT to 26V Reference, 11.8V L-L , Resolver mode with the following program string:

REF_GEN1 VOLT 26.0
SD1 MODE RSL

h. Repeat steps (d) through (e) above.

i. Set Model 5300 to 6V Reference, 1.0V L-L, 2000Hz. Press Model 5300 CAL button.

j. Set DUT to 6V Reference, 1.0V L-L, 2000Hz with the following program string:

REF_GEN1 VOLT 6.0
REF_GEN1 FREQ 2000.00

o. Repeat steps (d) through (e) above but use the following limits.

Limit: ±0.0240°

Single-Speed Measurement (API) External Reference Checkout Procedure

a. Set up equipment as shown in Figure 7.

b. Program DUT using the following command strings (Note, 47Hz test for 5395-F2 only):

SD1 REF_SOURCE EXT
SD1 MODE SYN
SD2 RATIO 1
SD1 STATE CLOSED

c. Setup Model 5300 Simulator to Internal Reference, 47Hz, 90V L-L, Synchro mode. Press Model 5300 CAL button.

d. For each angle listed below, set the Model 5300 Simulator Output Angle, and read the DUT under test using the **SD1 ANGLE?** command

Nominal Angle
0.000
45.00
90.00
135.0
180.0
225.0
270.0
315.0

e. Verify that all angle readings are within the following limit:

Limit: 0.0120°

f. Set Model 5300 to 26V L-L, Resolver mode. Press Model 5300 CAL button.

g. Set DUT to 400Hz, 26V Reference, 26V L-L, Resolver mode with the following program string:

REF_GEN1 STATE OPEN
SD1 MODE RSL

h. Repeat steps (d) through (e) above but use the following limits:

Limit: ±0.005°

i. Set Model 5300 to 11.8V L-L, 2000Hz. Press Model 5300 CAL button.

j. Repeat steps (d) through (e).

Two-Speed Measurement (API) Checkout Procedure

a. Set up equipment as shown in Figure 8.

b. Program DUT using the following command strings:

SD1 REF_SOURCE EXT
REF_GEN1 STATE OPEN
SD1 MODE RSL
SD2 MODE RSL
SD1 STATE CLOSED
REF_GEN1 STATE CLOSED

c. Setup Model 5300 Simulator #1 (connected to 1X outputs) to **Internal** Reference, 115V Reference, 400Hz, 90V L-L, Resolver. Press Model 5300 CAL button.

d. Setup Model 5300 Simulator #2 (connected to NX outputs) to **External** Reference, 90V L-L, Resolver. Press Model 5300 CAL button.

e. Program DUT to speed ratio of 2 using the following command string.

SD2 RATIO 2

f. For each angle listed below, set the Model 5300 Simulator #1 and Model 5300 Simulator #2 Output Angle, and read the DUT under test using the **SD1 ANGLE?** command.

Nominal Angle
0.000
45.00
90.00
135.0
180.0
225.0
270.0
315.0

g. Verify that each reading is within the following limit: ±0.003°

h. Program DUT to speed ratio of 15 using the following command string.

SD1 RATIO 15

i. Repeat step (f) and (g) above.

h. Program DUT to speed ratio of 16 using the following command string.

SD1 RATIO 16

i. Repeat step (f) and (g) above.

h. Program DUT to speed ratio of 50 using the following command string.

SD1 RATIO 50

i. Repeat step (f) and (g) above.

Generator (Simulator) DC Rate Output Checkout Procedure

a. Set up equipment as shown in Figure 9.

b. Program DUT using the following command strings:

DS1 REF_SOURCE INT
REF_GEN1 FREQ 400.00
REF_GEN1 VOLT 26.0
DS1 VLL_VOLT 11.8
DS1 MODE RSL
DS2 RATIO 1
DS1 ROT_RATE 500
DS1 ROT_MODE CONT
DS1 DC_SCALE 1000
SD1 STATE CLOSED
DS1 ROT_INIT

c. Setup DMM to read DC volts.

d. DMM should read nominal voltage of 5.00V DC.

FIELD ALIGNMENT

To mitigate offset and gain effects, due to temperature deviations and aging effects, the following optional alignment procedure may be initiated (note, communication level timeout "TMO" for each command/response is 3 seconds):

1. First Time (after initial power-up)
   Write ***rreg 2224**\n
   will yield read response:
   4660\r\n (returns 0x1234 => "Waiting for Alignment")
2. First Time (after initial power-up)
   Write ***rreg 5296**\n
   will yield read response:
   4660\r\n (returns 0x1234 => "Waiting for Alignment")
3. Command ***CALL**. Unit will respond by entering alignment mode as indicated by the unit TEST front panel indicator flashing @ 1Hz rate. Unit will continue in alignment mode for approximately 8 minutes with a maximum limit of 10 minutes. If unit remains within alignment mode for greater than 10 minutes the unit is deemed "failed" and should be returned to factory for repair.
4. A subsequent response (while unit is in alignment mode)
   Write ***rreg 2224**\n
   will yield read response:
   32382\r\n (returns 0x7E7E => "Aligning")
5. A subsequent response (while unit is in alignment mode)
   Write ***rreg 5296**\n
   will yield read response:
   32382\r\n (returns 0x7E7E => "Aligning")
6. The unit alignment sequence is considered complete (not stored – just completed) when the unit TEST front panel stops flashing and/or both the following command write/read responses are as follows:

   A. Write ***rreg 2224**\n

   will yield read response:
   42405\r\n (returns 0xA5A5 => "Alignment Completed")

   B. Write ***rreg 5296**\n

   will yield read response:
   42405\r\n (returns 0xA5A5 => "Alignment Completed")

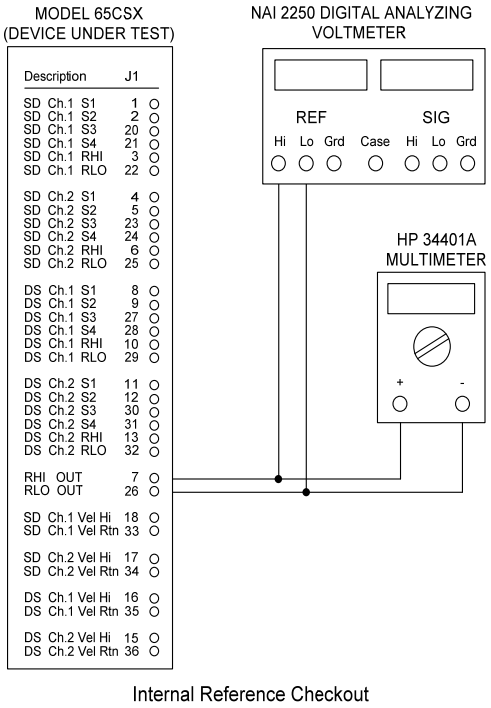
7. Command ***CALS**
8. A response to ***CAL?** command will return `alignment values` **"STORED"**

This optional alignment can be initiated at any time. This alignment is an internal self-alignment which does not require any external instruments/equipment. After alignment, unit will remain in default set-up; re-initialize operating parameters if applicable. Suggested factors / timing for periodic operational alignment:

1. Weekly
2. Ambient temperature deviations exceeding +/- 10° C during an operational period.

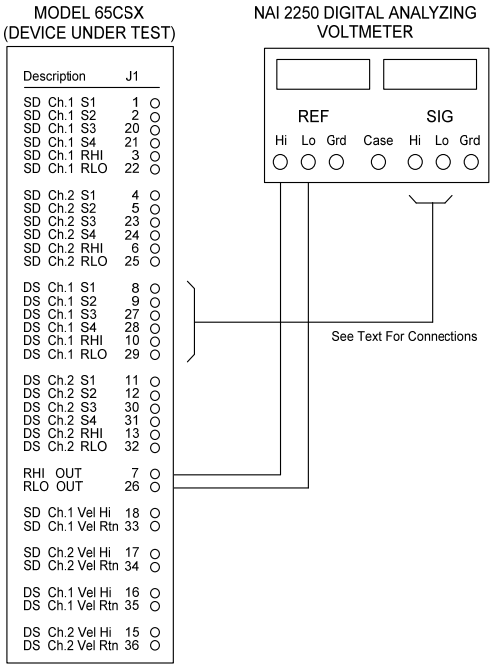
Figures for Calibration Verification Test Set-up

(Note: The following North Atlantic Industries test equipment/standards were utilized:
NAI 2250, NAI 5300, NAI 8810 and/or NAI 8810A).



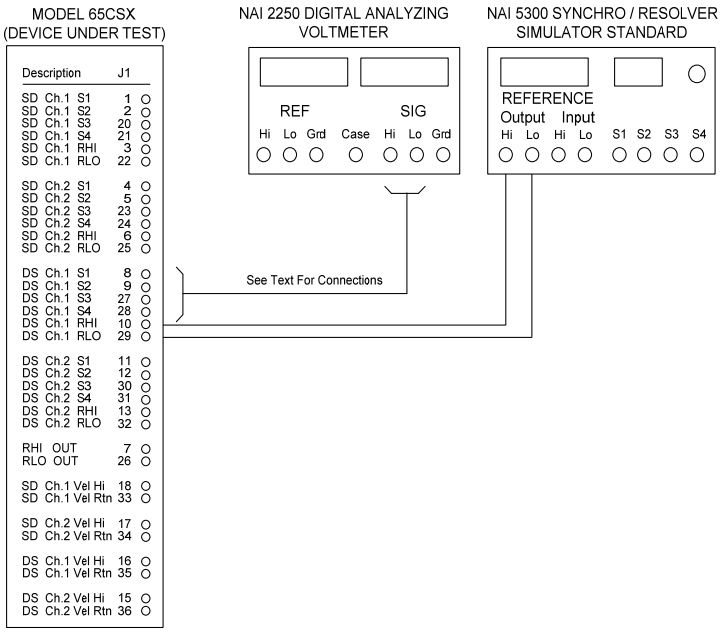
Internal Reference Checkout

Figure 1



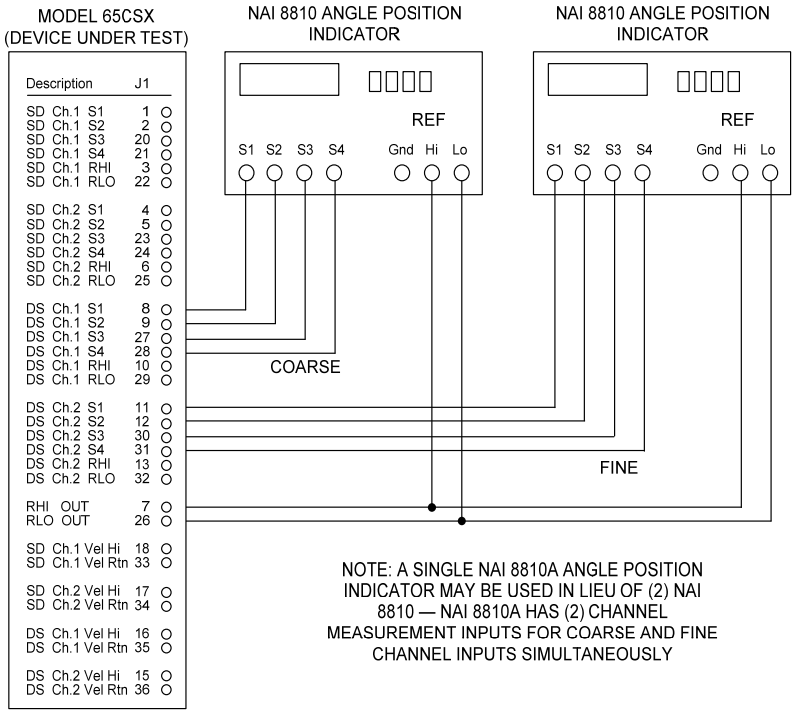
Single-Speed Simulator with Internal Reference Checkout

Figure 2



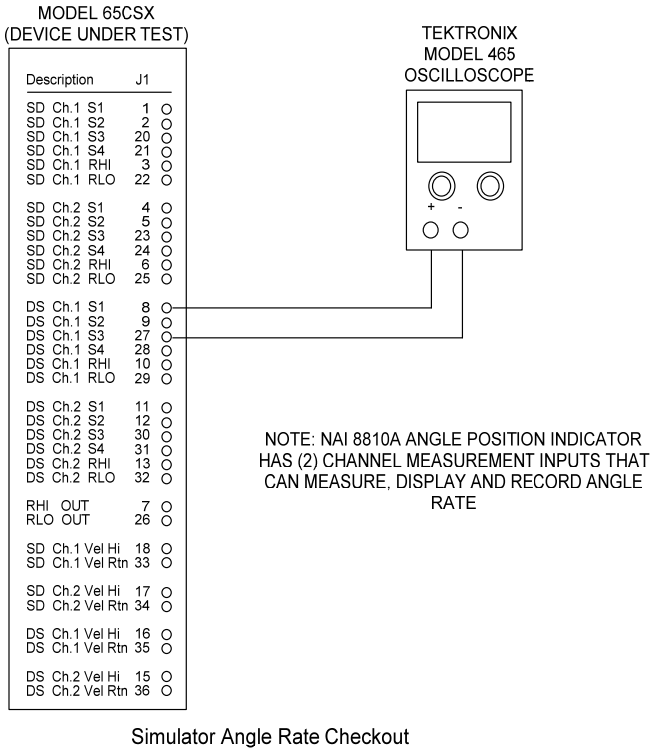
Single-Speed Simulator with External Reference Checkout

Figure 3



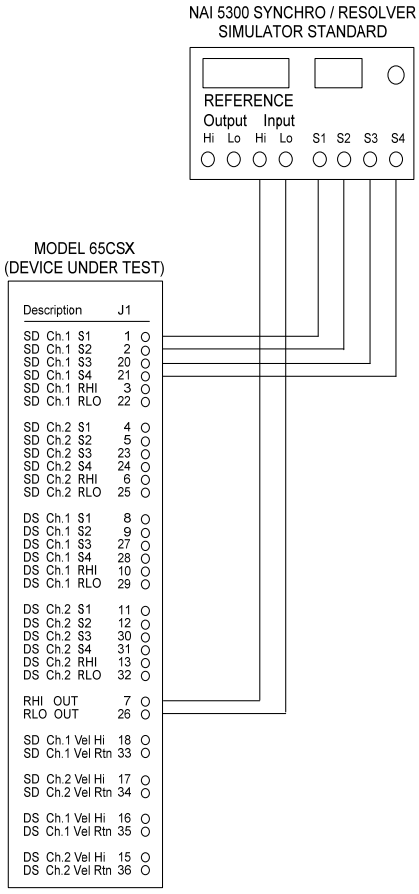
Two-Speed Simulator with Internal Reference Checkout

Figure 4



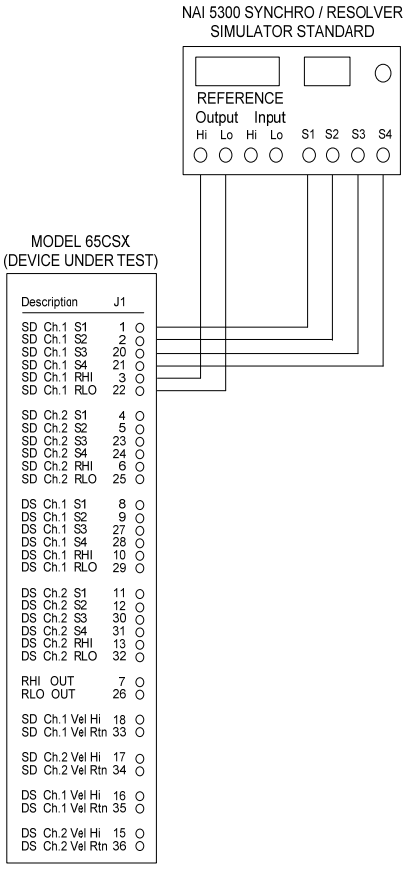
Simulator Angle Rate Checkout

Figure 5



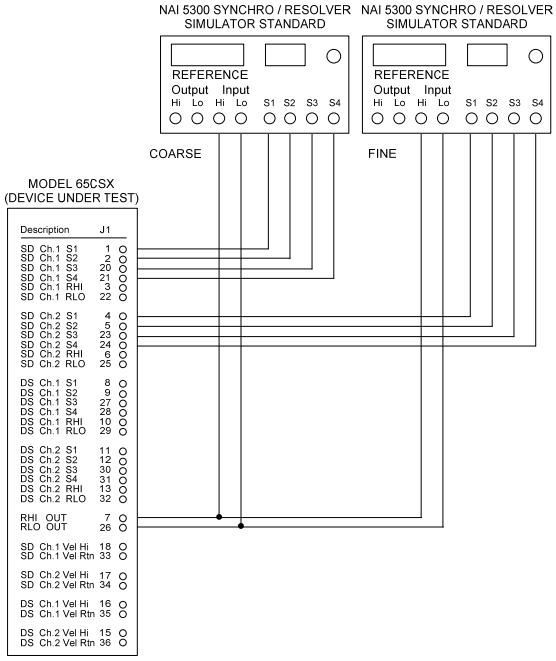
Single-Speed Measurement with Internal Reference Checkout

Figure 6



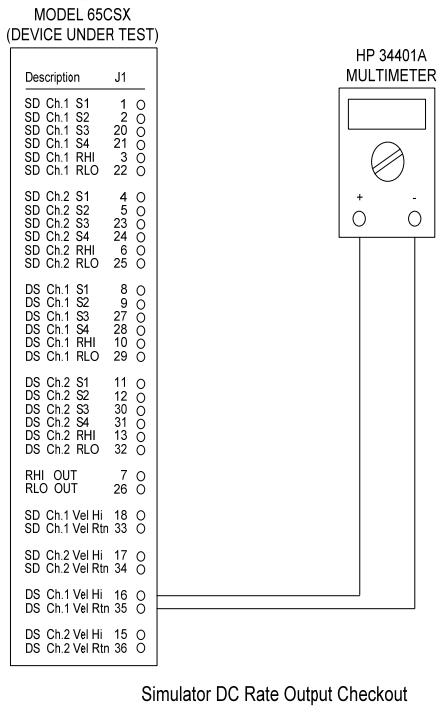
Single-Speed Measurement with External Reference Checkout

Figure 7



Two-Speed Measurement with Internal Reference Checkout

Figure 8



Simulator DC Rate Output Checkout

Figure 9

(Note: The following North Atlantic Industries test equipment/standards were utilized:
NAI 2250, NAI 5300, NAI 8810 and/or NAI 8810A).

CONNECTOR CONFIGURATION

Connector Pin-out is dependant upon ordered card configuration (see part number).
Daughter Board #1 populates connector J1. Daughter Board #2 populates connector J2.
Instrument Grade connector has 37 pins. Conventional Grade connector has 78 pins.
Mating connectors are not supplied. Pin-out is sorted by Function

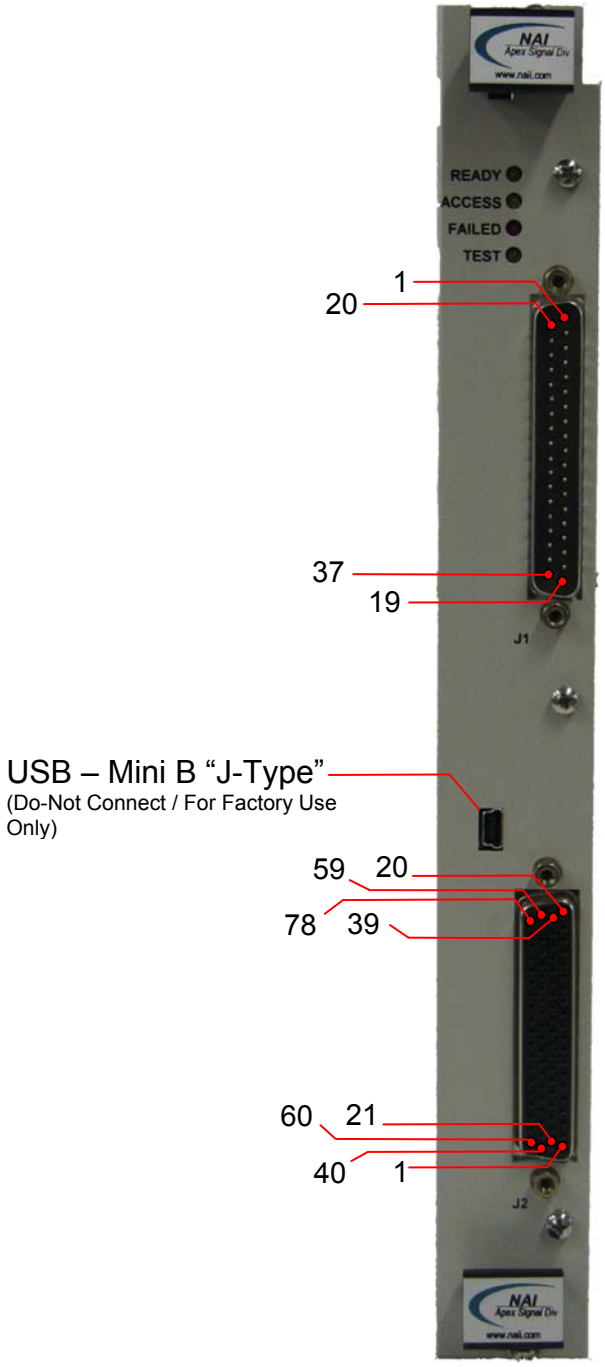
Instrument Grade Connector
DC37P / Mate DC37S or equivalent

PIN	DESCRIPTION
1	SD Ch.1 S1
2	SD Ch.1 S2
20	SD Ch.1 S3
21	SD Ch.1 S4
3	SD Ch.1 RHI
22	SD Ch.1 RLO
4	SD Ch.2 S1
5	SD Ch.2 S2
23	SD Ch.2 S3
24	SD Ch.2 S4
6	SD Ch.2 RHI
25	SD Ch.2 RLO
8	DS Ch.1 S1
9	DS Ch.1 S2
27	DS Ch.1 S3
28	DS Ch.1 S4
10	DS Ch.1 RHI
29	DS Ch.1 RLO
11	DS Ch.2 S1
12	DS Ch.2 S2
30	DS Ch.2 S3
31	DS Ch.2 S4
13	DS Ch.2 RHI
32	DS Ch.2 RLO
7	RHI 1 OUT
26	RLO 1 OUT
18	SD Ch.1 Velocity Hi
17	SD Ch.2 Velocity Hi
16	DS Ch.1 Velocity Hi
15	DS Ch.2 Velocity Hi
33	SD Ch.1 Velocity Return
34	SD Ch.2 Velocity Return
35	DS Ch.1 Velocity Return
36	DS Ch.2 Velocity Return
19	Trigger -
37	Trigger +

Embedded Grade Connector
HDL78SLB / Mate HDT78PD or equivalent

PIN	DESCRIPTION
4	DS Ch.1 S1
42	DS Ch.1 S2
3	DS Ch.1 S3
43	DS Ch.1 S4
22	DS Ch.1 RHI
61	DS Ch.1 RLO
6	DS Ch.2 S1
44	DS Ch.2 S2
5	DS Ch.2 S3
45	DS Ch.2 S4
24	DS Ch.2 RHI
63	DS Ch.2 RLO
8	DS Ch.3 S1
46	DS Ch.3 S2
7	DS Ch.3 S3
47	DS Ch.3 S4
26	DS Ch.3 RHI
65	DS Ch.3 RLO
10	DS Ch.4 S1
48	DS Ch.4 S2
9	DS Ch.4 S3
49	DS Ch.4 S4
28	DS Ch.4 RHI
67	DS Ch.4 RLO
12	DS Ch.5 S1
50	DS Ch.5 S2
11	DS Ch.5 S3
51	DS Ch.5 S4
30	DS Ch.5 RHI
69	DS Ch.5 RLO
14	DS Ch.6 S1
52	DS Ch.6 S2
13	DS Ch.6 S3
53	DS Ch.6 S4
32	DS Ch.6 RHI
71	DS Ch.6 RLO
16	DS Ch.7 S1
54	DS Ch.7 S2
15	DS Ch.7 S3
55	DS Ch.7 S4
34	DS Ch.7 RHI
73	DS Ch.7 RLO
18	DS Ch.8 S1
56	DS Ch.8 S2
17	DS Ch.8 S3
57	DS Ch.8 S4
36	DS Ch.8 RHI
75	DS Ch.8 RLO
59	RHI 2 OUT
20	RLO 2 OUT

Front Panel Connector Placements / Designations



Instrument Grade Connector
DC37P / Mate DC37S
(or equivalent)

Embedded Grade Connector
HDL78SLB / Mate HDT78PD
(or equivalent)

Photo – Sample Connector Configuration

PART NUMBER DESIGNATION

65CS4 – XXXXXXX – XXXXXXX – X – XX

DAUGHTER BOARD #1
- AXXX0XX = Instrument Grade D/S, S/D and Reference (see configurator)
- BXXXXXX = Embedded Grade D/S and Reference (see configurator)
- Z000000 = no daughter board #1

DAUGHTER BOARD #2
- AXXX0XX = Instrument Grade D/S, S/D and Reference (see configurator)
- BXXXXXX = Embedded Grade D/S and Reference (see configurator)
- Z000000 = no daughter board #2

INTERFACE
- N = Native (standard)
- M = MATE/CIIL (for select configurations only/contact factory)

Note: For replacement of 5410C-89, order P/N 65CS4-A2200G0-A2100G0-M and cable harness 07-0018.
For replacement of B5410C-89-1, order P/N 65CS4-A2200G0-A2101G0-M and cable harness 07-0021.

CODE NUMBER (For special customer configuration/enhancements – leave blank for standard)

DAUGHTER BOARD CONFIGURATOR:

A X X X X X 0 = INSTRUMENT Grade S/D, D/S and Reference

- **0** = 2.2 VA Reference Supply Power Output
- FREQUENCY RANGE
  - **A** = 360 Hz to 2 KHz
  - **B** = 360 Hz to 4 KHz
  - **C** = 47 Hz to 2 KHz
  - **D** = 47 Hz to 4 KHz
  - **E** = 47 Hz to 10 KHz (contact factory)
  - **F** = 47 Hz to 20 KHz (contact factory)
  - **G** = 360 Hz to 5 KHz
  - **H** = 360 Hz to 10 KHz
- 0 = 37-pin connector (default)
  1 = 78-pin connector (only for x5410C replacements)
- # of REFERENCE supplies (**0** or **1**)*1
- # of D/S channels (**0**, **1** or **2**)*2
- # of S/D channels (**0** or **2**)*3

Note(s):
*1 If > 2 Reference supplies are required for the total system, the additional Reference(s) will replace Stimulus Channels (contact factory for special configurations).
*2 must => "1" if S/D Channel(s) are specified
*3 must = "2" if D/S Channel(s) are specified

B X X X X X X = EMBEDDED Grade D/S and Reference

- FREQUENCY RANGE
  - **A** = 360 Hz to 2 KHz
  - **B** = 360 Hz to 4 KHz
  - **C** = 47 Hz to 2 KHz
  - **D** = 47 Hz to 4 KHz
  - **E** = 47 Hz to 10 KHz (contact factory)
  - **F** = 47 Hz to 20 KHz (contact factory)
- Reference Supply
  - **0** = no reference
  - **1** = low voltage (2-28 V_{AC} rms) (contact factory)
  - **2** = high voltage (115 V_{AC} rms fixed) (contact factory)
- D/S #7 AND #8 (see D/S #1 and #2 below)
- D/S #5 AND #6 (see D/S #1 and #2 below)
- D/S #3 AND #4 (see D/S #1 and #2 below)
- D/S #1 AND #2
  - **0** = none
  - **1** = low voltage (Lo V), 2.2 VA, 2 to 28 V_{LL} (Programmable)
  - **2** = high voltage (Hi V), 2.2 VA, 29 to 90 V_{LL} (Programmable)

Example: Part Number **65CS4-A2210C0-B12000A-N** indicates;
65CS4 motherboard (Native Interface) populated with:
1. Instrument Grade Daughter Board 1; 2 S/D channels, 2 D/S channels, (1) 2.2 VA Ref supply, 47-2K Hz
2. Embedded Grade Daughter Board 2; 2 D/S channels (Lo V), 2 D/S channels (Hi V), 360-2K Hz

APPENDIX A – CE

INFORMATION FOR UNITS SOLD WITHIN THE EUROPEAN UNION

GENERAL

Information contained within the following paragraphs supplements and in some cases supersedes information contained throughout this Manual. Where there is a conflict between information contained in these paragraphs and information contained elsewhere in the manual, these paragraphs take precedence for units sold within the European Union.

CLASSIFICATION

The 65 series model is defined for CATEGORY I installation and usage in a POLLUTION DEGREE 1 environment.

INSTALLATION

The 65 series model is designed for installation in a VXI standard card cage. Only the front panel is accessible to the OPERATOR during normal usage.

SAFETY GROUNDING

For safety from electrical shock and fire, the mounting surface (rear) of the front panel must be kept free of contamination and the unit must be mounted in a VXI card cage with the mounting screws properly tightened. The VXI card cage frame must be properly connected to a safety earth ground.

IMPROPER USAGE

If the equipment is installed or used in a manner not specified safety may be impaired. The equipment may not be used in CATEGORY II, III or IV installation.

MAINTENANCE

The OPERATOR only has access to the exterior of the unit. All maintenance, including any procedures that require removal of covers, must be referred to qualified maintenance personnel

TECHNICAL ASSISTANCE

Contact your local Sales Representative for any technical assistance. Alternatively, contact the Factory at:

North Atlantic Industries
110 Wilbur Place
Bohemia, NY 11716 USA

Telephone: (631) 567-1100
Fax: (631) 567-1823
Web: www.naii.com

North Atlantic Industries

North Atlantic Industries

DECLARATION OF CONFORMITY

We **NORTH ATLANTIC INDUSTRIES, INC.**
110 WILBUR PLACE,
BOHEMIA, NY 11716-2416

declare under our sole responsibility that the following products

65 SERIES

To which this declaration relates is in conformity with the following standard(s) or other normative document(s):

EMISSIONS PER EN 61326:1997/A1:1998/A2:2001

CISPR16:1999	Class A, Conducted Emissions
CISPR16:1999	Class A, Radiated Emissions
IEC 61000-3-2:2000	Harmonics
IEC 61000-3-3:1994	Flicker

IMMUNITY PER EN 61326:1997/A1:1998/A2:2001

IEC 1000-4-2:1995	Electrostatic Discharge
IEC 1000-4-3:1995	Radiated Immunity
IEC 1000-4-4:1995	EFT/Burst, Power and I/O Leads
IEC 1000-4-5:1995	Surge Immunity, Power Leads
IEC 1000-4-6:1996	Conducted Immunity, Power and I/O Leads
IEC 1000-4-11:1994	Voltage Dips and Interrupts

SAFETY PER EN 61010-1:2001

IEC 61010-1:2001	Safety

Following the provisions of COUNCIL DIRECTIVE 89/336/EEC
2006/95/EC

Place Bohemia NY, USA

Date 5/27/05

(original on file)
(Signature)
Roger Maurizio
(Full Name)
Quality Manager
(Position)

REVISION HISTORY

Revision	Description of Change	Eng/Aprv	Date
2	Initial Release	FH	3/22/05
3	PN updated	GS	3/24/5
4	PN updated with Frequency Ranges	GS	3/31/5
4.1	Adds MODEL VXI- to Title. For consistency, used Converter Grade terminology through out.	GS	4/7/5
5.0	Resolver Measurement Input Voltage range is 1.0-90 VL-L (not 2-90)	GS	4/19/5
5.1	Maps J1 and J2 to Instrument and/or Conventional Grade Connector pin-out.	GS	5/12/5
5.2	Updates number of references	GS	6/20/5
5.3	Added continuous background calibration; 2.2 VA or 5.2 VA REF; corrected typos	FH/as	6/20/05
5.4	Re-structured; Added grade structure “H” and “L” for programming S/D and D/S modules	AS	01 Dec 05
5.5	Added notes; calibration test set-up (pg 17)	AS	26 Feb 06
5.5.1	Corrected typo, example part number, removed 5.2 VA ref option, pg 27	AS	24 May 06
5.5.2	Defined # of channels for part number (D/S, S/D), pg 28; 0 or 2 CH HA S/D selection only in part number	AS	6 Jun 06
5.5.3	Clarification of channel selection in P/N; Clarification of Test Equipment in Cal Verification Test Figures; D/S Rotation complete query return corrected – From "RT_DONE?" is "YES" or "NO" to “DONE” or “NOT_DONE” respectively (pg. 12); Added connector placement/figure; Ref freq VLL accuracy 6% > 7.5 KHz (pg 7); Removed extended reference supply quantity notations – when > 2 reference supplies are required, contact factory for special options. Added D/S rotation trigger definitions (pg 13/14).	AS	11/02/06
5.5.4	CHANGED ADDRESS	DD	05/07/07
A	Added power matrix (pg. 10);Clarified S/D channel minimum configuration/notes, embedded grade REF and other syntax language options noted as “contact factory” in part number(pg 30); Initial Release to Agile	AS	04/02/08
B	Added Option P (Native or MATE/CIIL programmable) to part number,added option G, added CIIL Syntax Diagram	FH	07/10/08
B1	Added information on replacement of B5410C-89-1	FH	08/26/08
B2	Removed Interface “P”	FH	02/24/09
B3	Modification to P/N notes, added Field Alignment procedure.	FH	02/26/09
B4	1) S/D reference max input from 115 VAC to 130 VAC 2) Cable Harness part number from 07-0020 to 07-0018 3) Corrections to field alignment procedure	FH	03/12/09
B5	Added Common Mode note for Instrument Grade Measurement	FH	03/16/09
B6	Clarified temperature and altitude specifications.	FH	03/31/09
C2	Corrected 5410C-89 and B5410C-89 replacement information – part number and cable harness ; Removed instrument grade pin 14 designation (DS Ch.5 RLO 115 Vrms); Instrument grade rotation specification clarified to reflect as-built configuration (+/-10000 deg/sec with 0.01 deg/sec resolution); Instrument grade measurement input voltage design verified for operation to 100 V input max. for 64CS4-A2200G0-A2100G0-M;	FH/as	09/16/09
C3	Added Instrument Grade Frequency option “H” – 360 Hz-10 KHz operation – clarified accuracy specifications for Instrument grade D/S – load/frequency vs VLL	RA/as	09/23/09
C4	Released to Agile; Updated Instrument Grade measurement: Resolver: ±0.0167º at 10.0 KHz (2-- 28 V_{L-L})	AS	09/30/10
C5	1. Clarified SIM command Input Reference Voltage (pg. 12) – removed “not required for Internal Reference source “indication from descriptor (command required regardless of REF input source Internal or External); 2. Removed SCPI interface option from P/N designator; 3. Changed Instrument Grade Measurement “Tracking Rate” specifications from +/- 4.68 rps to +/- 10000 deg/sec (27.7 rps) (max).	AS	02/20/13
C6	Changed SIM command “Rotation Rate” from “0.15 to13.60” to” ±10000°/sec. (±27.7 rps)”	RS	08/14/13