SIXTEEN (16) SYNCHRO/RESOLVER-to-DIGITAL

TWO-SPEED or SINGLE-SPEED or COMBINATION (PROGRAMMABLE)

ON-BOARD PROGRAMMABLE REFERENCE SUPPLY

TO COMMERCIAL OR MILITARY SPECIFICATIONS

- 16-bit resolution (optional 24 bits combined)
- ±1 arc-minute accuracy
- Continuous background BIT testing with Reference and Signal loss detection
- **Self-calibrating. Does not require removal for calibration**
- 50 Hz to 10 kHz operation
- Tracking rate to 150 RPS
- 16, 12, 8, 4 and 2-channel versions available
- Programmable 2-speed ratios: 2 to 255
- Power-On Self-Test (POST)
- Accurate Digital Velocity outputs
- Optional programmable encoder (A & B) plus index outputs
- Optional equivalent Hall Effect (A, B, C) commutation outputs
- Optional on-board programmable reference supply
- Watchdog timer and soft reset
- Angle change alert
- Transformer isolated
- Synthetic reference compensates for ±60° phase shift
- Optional conduction cooling with wedgelocks
- I/O via front panel, P2 or both
- Latch feature
- No adjustments or trimming required
- Part number, S/N, Date Code and Revision in permanent memory

DESCRIPTION:

This high density intelligent DSP-based card incorporates up to sixteen (16) single-speed or eight (8) two-speed transformer isolated Synchro/Resolver-to-Digital tracking converters with extensive diagnostics, digital velocity outputs, angle change alert, and optional programmable reference supply. Any combination of two-speed and single-speed channels can be field programmed to any ratio between 2 and 255. Each channel also produces differential (A & B) incremental encoder outputs (with programmable resolution) and a zero degree marker pulse. Alternatively, commutation outputs are available for 4, 6, or 8 pole brushless DC motors that eliminate the need for Hall Effect sensors on the motor, thus eliminating processor time and reducing bus traffic. For 2-speed usage, ambiguity circuits maintain monotonic outputs by compensating for misalignment between the Coarse and Fine Synchros. However, the processor will set a flag when it senses that the maximum allowable misalignment of 90°/gear ratio is exceeded.
This card, even when large accelerations are encountered, never looses tracking, because it incorporates the unique capability to automatically shift to higher bandwidths. The shifting is smooth and continuous with no glitches. Tracking rates are only limited to bandwidth restrictions, up to 150 RPS, at 16-bit resolution. The LATCH feature permits the user to read all channels at the same time. Reading will unlatch that channel. The angle alert monitors each channel for the programmed angle difference and sets an interrupt as soon as that threshold is reached. Thus, no polling of the angle registers is required until an angle has reached the specified difference. The use of Type II servo loop processing techniques enables tracking, at full accuracy, up to the specified rate. A step input will not cause any hang-up condition. Intermediate transparent latches, on all angle and velocity outputs, assure that valid data is always available without interrupts or waiting time. Our synthetic reference compensates for ±60° phase shifts, thus eliminating the need for individual compensation networks. Each channel can be specified for a different voltage or frequency. A watchdog timer is provided to monitor the processor. Part number, S/N, Date Code and Revision are stored in permanent memory.

This board can operate over a "C" or "M" operating temperature range (see part number). The "C" version (0°C to +70°C) uses standard high quality commercial semiconductors. The "M" version (-55°C to +85°C), used for severe environmental conditions, uses high quality extended temperature semiconductors. Conduction cooling, using a thermal plane and wedge locks, can be specified in the part number.

This board incorporates major diagnostics that offer substantial improvements to system reliability, because the user is alerted to channel malfunction. This approach reduces bus traffic, because the Status Registers need not be constantly polled. Three different tests, one on-line and two off-line, can be selected:

The (D2) Test initiates automatic background BIT testing. Each channel is checked every 5° to a testing accuracy of 0.05° and each Signal and Reference is always monitored. Any failure triggers an Interrupt (if enabled) and the results are available in Status Registers. The testing is totally transparent to the user, requires no external programming, has no effect on the standard operation of the card, and can be enabled or disabled via the bus.

The (D3) Test initiates a BIT test that disconnects all channels from the outside world and connects them across an internal stimulus that generates and tests 72 different angles to a test accuracy of 0.05°. Results can be read from registers and external reference is not required. Any failure triggers an Interrupt (if enabled). The testing requires no external programming, and can be initiated or stopped via the bus.

The (D0) Test is used to check the card and the VME interface. All channels are disconnected from the outside world, allowing the user to write any number of input angles to the card and then to read the data from the interface. External reference is not required.

Power-On Self-Test (POST): When enabled and saved, POST will initiate the D3 Test upon power-on.

SPECIFICATIONS:

Resolution:	16 bits (up to 24 bits optional for two-speed configuration)
Accuracy:	±1 arc-minute for single speed inputs ±1 arc-minute divided by the gear ratio for two-speed inputs
VME Data transfer:	Data transfers within 200 ns.
Tracking Rate:	18.5 RPS max. at 60 Hz; 150 RPS max. above 400 Hz. Referred to Fine input in a two-speed configuration
Bandwidth:	Normal is 10 Hz at 60 Hz; 40 Hz at 400 Hz, and 100 Hz above 1 kHz. Can be readily customized
Input format:	Synchro or Resolver, (see part number)
Gear ratio:	Each channel pair is programmable from 2 to 255
Input voltage:	Resolver: 2-28 V_{L-L} Autoranging, 90 V_{L-L} ; Synchro: 11.8 V_{L-L} , 90 V_{L-L} Resolver and Synchro are Transformer isolated
Input Impedance:	40 kΩ min. up to 28 V_{L-L} , 100 kΩ min. at 90 V_{L-L}
Reference:	2-28 Vrms, Autoranging or 115 Vrms. Transformer isolated.
Reference Zin	100 kΩ min.
Frequency:	50 Hz to 10 kHz (see part number)
Encoder outputs:	Either 12,13,14,15, or 16-bit resolution, (field programmable) and Index marker. 12-bit resolution is equivalent to 1,024 cycles (4,096 transitions) etc. Differential outputs. The encoder resolution is fixed and does not change with speed. (Optional, see P/N).
Commutation outputs:	Equivalent to the A, B, C outputs from Hall Effect Sensors for 4, 6 or 8 pole motors
Angle change alert:	Each channel can be set to a different angle differential. When that differential is exceeded, an interrupt (if enabled) is triggered. Default: “Ch. Disabled”. MSB=180°; Min. differential is 0.05°. Max differential that can be programmed is 179.9 degrees.
Phase shift:	The synthetic reference circuit automatically compensates for phase shifts between the transducer excitation and output up to ±60°.
Velocity, Digital:	16-bit resolution; Linearity: 0.1%. Scalable to 0.1°/sec resolution.
Wrap around Self Test:	The three different powerful test methods are detailed in the Description section and further described in the Programming Instructions.
Interrupts:	One Interrupt capability is implemented. One of seven priority lines can be specified.
Power:	+ 5 VDC: 0.350 A for 16 channels; ±12 VDC: 0.08 A without Reference; .600 A with 5 VA out.
Temperature, operating:	"C" 0°C to +70°C; "M" -55°C to +85°C (see part number)
Storage temperature:	-55°C to +105°C.
Conformal coating:	Both sides of the board can be conformal coated (see part number).
Burn-in:	All “M” boards are burned in for 24 hours and cycled from -55°C to +85°C.
Size:	6U (9.2") height, 4HP (0.8") width. 233.4 mm x 20.3 mm x 160 mm deep
Weight:	22 oz.

REFERENCE:	Optional. (see part number).
Voltage:	2.0-28 Vrms programmable (resolution 0.1 Vrms) or 115 Vrms fixed. Accuracy ±2%.
Frequency:	360 Hz to 10 kHz ±1% with 1 Hz resolution.
Regulation:	10% max. No load to full load.
Output power:	5 VA max. at 40° min. inductive.

PROGRAMMING INSTRUCTIONS:

This card offers many options. Any option that is not required may be ignored. For ease of use, all channels are referred to as 1 to 16. For two-speed applications, we generally refer to Coarse and Fine inputs. Therefore, channel 1 becomes 1 Coarse, channel 2 becomes 1 Fine, channel 3 becomes 2 Coarse, etc.

I/O CONFIGURATION:

The VMEbus interface will respond to A32:D16, A24:D16 and A16:D16 DTB cycles.

A32 mode: Unit responds to address modifiers 0A, 0D, 0E and 09. Base address can be set anywhere in the 4 Gigabyte address space on 256 byte boundaries (Standard), or 512 byte boundaries, when offset addresses above 100 are enabled.

A24 mode: Responds to address modifiers 3A, 3D, 3E and 39. Base address can be set anywhere in the 16 Megabyte address space on 256 byte boundaries (Standard), or 512 byte boundaries, when offset addresses above 100 are enabled

A16 mode: Responds to address modifiers 2A, 2D, 2E and 29. Base address can be set anywhere in the 64 K byte address space on 256 byte boundaries (Standard), or 512 byte boundaries, when offset addresses above 100 are enabled.

Note: Address switch A8 must be set to "ON" (logic 0*)* for 512 byte boundaries.

ADDRESS = BASE + OFFSET

00	Ch.1 read	44	Rev level read	88	Angle Δ Ch.11 read/write	CC	(A&B) or A,B,C, Ch.11 read/write
02	Ch.2 (Hi) read	46	Status, Test, read	8A	Angle Δ Ch.12 read/write	CE	(A&B) or A,B,C, Ch.12 read/write
04	Ch.3 read	48	Active channels, read/write	8C	Angle Δ Ch.13 read/write	D0	(A&B) or A,B,C, Ch.13 read/write
06	Ch.4 (Hi) read	4A	Save read/write	8E	Angle Δ Ch.14 read/write	D2	(A&B) or A,B,C, Ch.14 read/write
08	Ch.5 read	4C	Test (D2) verify read/write	90	Angle Δ Ch.15 read/write	D4	(A&B) or A,B,C, Ch.15 read/write
0A	Ch.6 (Hi) read	4E	Interrupt priority read/write	92	Angle Δ Ch.16 read/write	D6	(A&B) or A,B,C, Ch.16 read/write
0C	Test read/write	50	Interrupt vector 1 read/write	94	Angle Δ initiate read/write	D8	Velocity, scale Ch.1 read/write
0E	Status, Sig. read	52	Interrupt vector 2 read/write	96	Angle change alert read	DA	Velocity, scale Ch.2 read/write
10	Ch.7 read	54	Ratio Ch 2/ Ch 1 read/write	98	(A & B) res. Ch.1 read/write	DC	Velocity, scale Ch.3 read/write
12	Ch.8 (Hi) read	56	Ratio Ch 4/ Ch 3 read/write	9A	(A & B) res. Ch.2 read/write	DE	Velocity, scale Ch.4 read/write
14	Latch write	58	Ratio Ch 6/ Ch 5 read/write	9C	(A & B) res. Ch.3 read/write	E0	Velocity, scale Ch.5 read/write
16	Ch.9 read	5A	Ratio Ch 8/ Ch 7 read/write	9E	(A & B) res. Ch.4 read/write	E2	Velocity, scale Ch.6 read/write
18	Ch.10 (Hi) read	5C	Ratio Ch 10/ Ch 9 read/write	A0	(A & B) res. Ch.5 read/write	E4	Velocity, scale Ch.7 read/write
1A	Status, Ref read	5E	Ratio Ch 12/ Ch 11 read/write	A2	(A & B) res. Ch.6 read/write	E6	Velocity, scale Ch.8 read/write
1C	Vel.1 read	60	Ratio Ch 14/ Ch 13 read/write	A4	(A & B) res. Ch.7 read/write	E8	Velocity, scale Ch.9 read/write
1E	Vel.2 read	62	Ratio Ch 16/ Ch 15 read/write	A6	(A & B) res. Ch.8 read/write	EA	Velocity, scale Ch.10 read/write
20	Vel.3 read	64	Ch.13 read	A8	(A & B) res. Ch.9 read/write	EC	Velocity, scale Ch.11 read/write
22	Vel.4 read	66	Ch.14 (Hi) read	AA	(A & B) res. Ch.10 read/write	EE	Velocity, scale Ch.12 read/write
24	Vel.5 read	68	Ch.15 read	AC	(A & B) res. Ch.11 read/write	F0	Velocity, scale Ch.13 read/write
26	Vel.6 read	6A	Ch.16 (Hi) read	AE	(A & B) res. Ch.12 read/write	F2	Velocity, scale Ch.14 read/write
28	Vel.7 read	6C	Vel.13 read	B0	(A & B) res. Ch.13 read/write	F4	Velocity, scale Ch.15 read/write
2A	Vel.8 read	6E	Vel.14 read	B2	(A & B) res. Ch.14 read/write	F6	Velocity, scale Ch.16 read/write
2C	Vel.9 read	70	Vel.15 read	B4	(A & B) res. Ch.15 read/write	F8	(POST) test enable read/write
2E	Vel.10 read	72	Vel.16 read	B6	(A & B) res. Ch.16 read/write	FA	Two speed lock loss read
30	Vel.11 read	74	Angle Δ Ch.1 read/write	B8	(A&B) or A,B,C, Ch.1 read/write	FC	Watchdog timer read/write
32	Vel.12 read	76	Angle Δ Ch.2 read/write	BA	(A&B) or A,B,C, Ch.2 read/write	FE	Soft reset write
34	Test ∠ write	78	Angle Δ Ch.3 read/write	BC	(A&B) or A,B,C, Ch.3 read/write	102	Ch.2 (Lo) ✹ read
36	Ch.11 read	7A	Angle Δ Ch.4 read/write	BE	(A&B) or A,B,C, Ch.4 read/write	104	Ch.4 (Lo) ✹ read
38	Ch.12 (Hi) read	7C	Angle Δ Ch.5 read/write	C0	(A&B) or A,B,C, Ch.5 read/write	106	Ch.6 (Lo) ✹ read
3A	Freq. read/write	7E	Angle Δ Ch.6 read/write	C2	(A&B) or A,B,C, Ch.6 read/write	108	Ch.8 (Lo) ✹ read
3C	Eo read/write	80	Angle Δ Ch.7 read/write	C4	(A&B) or A,B,C, Ch.7 read/write	10A	Ch.10 (Lo) ✹ read
3E	Part # read	82	Angle Δ Ch.8 read/write	C6	(A&B) or A,B,C, Ch.8 read/write	10C	Ch.12 (Lo) ✹ read
40	Serial # read	84	Angle Δ Ch.9 read/write	C8	(A&B) or A,B,C, Ch.9 read/write	10E	Ch.14 (Lo) ✹ read
42	Date code read	86	Angle Δ Ch.10 read/write	CA	(A&B) or A,B,C, Ch.10 read/write	110	Ch.16 (Lo) ✹ read

✹ Optional registers for 2-speed, extended resolution. (see Part Number)

	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Data° (Hi)	180	90	45	22.5	11.25	5.625	2.813	1.406	703	.352	.176	.088	.044	.022	.011	.0055
Data° (Lo)	.00274	.00137	.00068	.00034	.00017	.00008	.00004	.00002	X	X	X	X	X	X	X	X
Test Enable	X	X	X	X	X	X	X	X	X	X	X	X	D3	D2	X	D1
Status, Test	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	Ch.10	Ch.11	Ch.12	Ch.13	Ch.14	Ch.15	Ch.16
Status, Reference	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	Ch.10	Ch.11	Ch.12	Ch.13	Ch.14	Ch.15	Ch.16
Status, Signal	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	Ch.10	Ch.11	Ch.12	Ch.13	Ch.14	Ch.15	Ch.16
Angle change alert	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	Ch.10	Ch.11	Ch.12	Ch.13	Ch.14	Ch.15	Ch.16
Active channels	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	Ch.10	Ch.11	Ch.12	Ch.13	Ch.14	Ch.15	Ch.16
Two-speed lock	X	Ch1/2	X	Ch3/4	X	Ch5/6	X	Ch7/8	X	9/10	X	11/12	X	13/14	X	15/16
(A & B) resolution	X	X	X	X	X	X	X	X	X	X	X	X	X	**D2**	**D1**	**D0**

Commutation outputs

4	**16 bit**	0	0	0
6	**15 bit**	0	0	1
8	**14 bit**	0	1	0
	13 bit	0	1	1
	12 bit	1	0	0

Encoder outputs

At **Power-ON** or **System Reset**, all parameters are restored to last saved setup and, if POST is enabled, a D3 Test is initiated.

Enter Active Channels: Set the bit corresponding to each channel to be monitored during BIT testing in the Active Channel Register at 48h. "1"=active; "0"=not used. Omitting this step will produce false alarms, because unused channels will set faults.

Save Setup: The current setup can be saved by writing 5555h to the Save Register at 4Ah. This location will automatically clear to 0000h when the save is completed (within 5 seconds). When save is elected, all parameters are saved. However, any parameter can be changed at will. Saving is optional. If not saved, reenter parameters at each power up.

To restore factory shipped parameters, write AAAAh to the Save Register at 4Ah, followed by System Reset. Note: After a SAVE or RESTORE, poll 4Ah and do not perform any other operation until word is at "0".

Read: For single-speed applications (Ratio=1), read individual channels: 1, 2, 3, 4 etc. For two-speed applications, read only channels (2, 4, 6, 8, etc.) for the combined output. For resolution up to 24-bit, read Hi word, then Lo word. Hi word, when read, latches Lo word. 24 bit resolution, along with carrier frequency etc., will determine how many of the 16 channels are available…consult factory for specifics.

Latch: All channels may be latched by writing "1" to D1 of Latch Register at 14h. Reading channel will disengage latch for that channel.

Ratio: Enter the desired ratio, as a binary number, in the Ratio Register corresponding to the pair of channels to be used for a two-speed channel. Example: Single speed = 1; 36:1 = 100100.

Two-Speed Lock-Loss: When two Synchros are geared to each other, either electrically or mechanically, in order to achieve higher accuracy, the misalignment of the Coarse and Fine Synchros must not exceed 90°/gear ratio or the digital angle output may not be valid. Should this problem occur, with a given channel pair, the corresponding bit in the Two-Speed Lock-Loss Register at FAh will be set to "0".

Velocity Scale Factor: To scale the Max Velocity word for 150 RPS set Velocity Scale Factor = 4095 in HEX (max velocity word of 7FFFh being max. CW rotation, and 8000h being max. CCW rotation.
Scaling effects only the Velocity output word and not the dynamic performance.

Ex: To get max. velocity word @ 150 rps: 4095(150/150) = 4095 (0FFFh) This is also the Factory setting.
To get max. velocity word @ 50 rps. 4095(150/50) = 12,285 (2FFDh)
To get max. velocity word @ 9.375rps. 4095(150/9.375) = 65,520 (FFF0h) This is also the lowest setting

Velocity Output: Read Velocity Registers of each channel as a 2's complement word, with 7FFFh being maximum CW rotation, and 8000h being maximum CCW rotation.

When max. velocity is set to 150 RPS, an actual speed of 10 RPS CW would be read as 0888h.
When max. velocity is set to 150 RPS, an actual speed of 10 RPS CCW would be read as F778h.
When max. velocity is set to 50 RPS, an actual speed of 10 RPS CW would be read as 1999h.
When max. velocity is set to 50 RPS, an actual speed of 10 RPS CCW would be read as E667h.

To convert a velocity word (for example E667h) into RPS: If maximum velocity, set to 50 RPS, then
RPS = 50 x E667h / 32,768 = 50 x -6,553 / 32,768 = -10 RPS

Power-On Self-Test (POST): Will initiate the D3 Test upon power-on, if POST is enabled and saved. Enable by writing "1" to POST Register at F8h. Disable by writing "0" at F8h and then save setup.

D2 Test Enable: Writing "1" to D2 of Test Register at 0Ch initiates automatic background BIT testing that checks each channel every 5° to a test accuracy of 0.05° and monitors each Signal and Reference. An Interrupt (if enabled) will be set to indicate an accuracy problem or Signal or Reference loss and the results are available in Status Registers (Signal or Reference loss within 2 sec, accuracy within 45 sec). A "0" deactivates this test. The testing is totally transparent to the user, requires no external programming, has no effect on the standard operation of this card and can be enabled or disabled. Card will (every 30 seconds) write 55h at address 4Ch when D2 is enabled. User can periodically clear to 0000h and then read 4Ch again, after 30 seconds, to verify that background BIT testing is activated.

D3 Test Enable: Writing “1” to D3 of Test Register at 0Ch, initiates a BIT test that disconnects all channels from the outside world and connects them across an internal stimulus that generates and tests 72 different angles to a test accuracy of 0.05°. External reference is not required. Test cycle is completed within 45 seconds and results can be read from the Status Registers. D3 changes from “1” to “0” when test is complete. A failure will trigger an Interrupt (if enabled). The testing requires no external programming, and can be initiated by writing "1" at D3 or terminated by writing "0" at D3.

D0 Test Enable: Checks card and VME interface. Writing “1” to D0 of Test Register at 0Ch disconnects all channels from the outside world, enabling user to write any number of angles to the card at 34h. Data is then read from the VME interface (after writing, allow 400 ms before reading). Test accuracy to be <.05°. Disable by setting D0 to “0”. Upon writing “1”, the default test angle of D0 is 30°. External reference is not required. (ex. 330°=1110101010101011).

Status, Test: Check the corresponding bit of the Test Status Register at 46h, for status of BIT testing for each active channel. A ”1” means Accuracy OK; “0” means failed. (test cycle takes 45 seconds for accuracy error).

Status, Ref: Check the corresponding bit of the Ref Status Register at 1Ah, for status of the reference input for each active channel. A ”1” =Ref. ON, “0” = Ref. Loss. (Reference loss is detected after 2 seconds).

Status, Sig: Check the corresponding bit of the Sig Status Register at 0Eh, for status of the input signals for each active channel. A "1" = Signal ON, “0” = Signal loss. (Signal loss is detected after 2 seconds).

Interrupt: Enter requirements into 4Eh as an 8-bit binary number. 0= no interrupt; 1-7 indicates priority levels. Any error will latch Status Register and trigger an Interrupt. When Interrupt is acknowledged, additional errors will set another Interrupt. Reading will unlatch registers. Now, let us consider what happens when a status bit changes before registers are read. For example, if a reference loss was detected and latched into registers and subsequent scans find that the reference was reconnected, then this status change will be held in background until registers are read. Within 250ms registers will be updated with the background data. Allow 250 ms to scan all channels.

Interrupt Vector 1: Write 8-bit word (0-255). Used for failure reports.

Interrupt Vector 2: Write 8-bit word (0-255). Used for angle change alert reports.

Angle Change Alert: Write a 16-bit word to each channel, to represent the minimum differential required. MSB=180°; minimum differential is 0.05°. Setting to zero disables the Angle Change Alert for a given channel. Initiate monitoring by writing “1” to Angle Change Initiate Register at 94h. When that differential is exceeded, on any monitored channel, an interrupt is generated. Read Angle Change Alert Flag Register at 96h for status of each channel ("0" = no change, "1" = change)

Soft Reset: (Level sensitive): Writing a “1” to FEh initiates and holds software in reset state. Then, writing “0” initiates reboot (takes 400 ms). Status Registers cleared; Watchdog Timer functional; Failure bit at "0"; Saved parameters remain saved; Angle outputs held at last update; Interrupts disabled.

Watchdog Timer: This feature monitors the Watchdog Timer Register (FCh). When it detects that a code has been received, that code will be inverted within 100 µSec. The inverted code stays in the register until replaced by a new code. User, after 100 µSec, should look for the inverted code to confirm that the processor is operating.

Optional Reference Supply: For frequency, write a 16-bit word (Ex: 400 Hz = 1 1001 0000) to address 3A. For voltage, write a word (Ex: 26.1 Vrms =1 0000 0101) with LSB=0.1 Vrms, to address 3C. It is recommended that user program the required frequency before setting the output voltage.

Optional (A&B) Encoder Resolution: Enter required resolution, for each channel, per above table. Can be changed on the fly. Also set corresponding [(A&B) or A, B, C] register to “0”. Encoder/Commutation outputs are optional, see part ordering information. Default is 12-bit encoder mode.

Optional Commutation Outputs (A,B,C): Set channels that should produce commutation outputs to “1” in the appropriate [(A&B) or A, B, C] register. Then, set the required motor poles (per above table) in the equivalent (A&B) resolution registers. Encoder/Commutation outputs are optional, see part ordering information.

Serial Number: At 40h, is read as a 16-bit binary word.

Date Code: Read as a decimal number at 42h. The four digits represent YYWW (Year,Year,Week.Week)

Rev: At 44h.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Example

0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	1
DSP Rev 1.1						FPGA Rev 3						PC Rev 1			

Front panel Connectors:

J1: DC37P; Mate: DC37S (not supplied)

37	S1 Ch. 1	15	S4 Ch. 2	28	S1 Ch. 4	6	S4 Ch. 5		
36	S3 Ch. 1	32	RHi Ch. 2	27	S3 Ch. 4	23	RHi Ch. 5		
19	S2 Ch. 1	14	RLo Ch. 2	10	S2 Ch. 4	5	RLo Ch. 5		
18	S4 Ch. 1	31	S1 Ch. 3	9	S4 Ch. 4	22	S1 Ch. 6		
35	RHi Ch. 1	30	S3 Ch. 3	26	RHi Ch. 4	21	S3 Ch. 6		
17	RLo Ch. 1	13	S2 Ch. 3	8	RLo Ch. 4	4	S2 Ch. 6		
34	S1 Ch. 2	12	S4 Ch. 3	25	S1 Ch. 5	3	S4 Ch. 6		
33	S3 Ch. 2	29	RHi Ch. 3	24	S3 Ch. 5	20	RHi Ch. 6		
16	S2 Ch. 2	11	RLo Ch. 3	7	S2 Ch. 5	2	RLo Ch. 6		
						1	Chassis		

J2: DC37P; Mate: DC37S (not supplied)

37	S1 Ch. 7	15	S4 Ch. 8	28	S1 Ch.10	6	S4 Ch.11		
36	S3 Ch. 7	32	RHi Ch. 8	27	S3 Ch.10	23	RHi Ch.11		
19	S2 Ch. 7	14	RLo Ch. 8	10	S2 Ch.10	5	RLo Ch.11		
18	S4 Ch. 7	31	S1 Ch. 9	9	S4 Ch.10	22	S1 Ch.12		
35	RHi Ch. 7	30	S3 Ch. 9	26	RHi Ch.10	21	S3 Ch.12		
17	RLo Ch. 7	13	S2 Ch. 9	8	RLo Ch.10	4	S2 Ch.12		
34	S1 Ch. 8	12	S4 Ch. 9	25	S1 Ch.11	3	S4 Ch.12		
33	S3 Ch. 8	29	RHi Ch. 9	24	S3 Ch.11	20	RHi Ch.12		
16	S2 Ch. 8	11	RLo Ch. 9	7	S2 Ch.11	2	RLo Ch.12		
						1	Chassis		

J3: DB25P; Mate: DB25S

Pin		Pin		Pin		Pin		Pin		Pin		Pin		Pin	
1	S1 Ch.13	14	S4 Ch.13	4	S1 Ch.14	17	S4 Ch.14	7	S1 Ch.15	20	S4 Ch.15	10	S1 Ch.16	23	S4 Ch.16	13	Chassis
2	S3 Ch.13	15	RHi Ch.13	5	S3 Ch.14	18	RHi Ch.14	8	S3 Ch.15	21	RHi Ch.15	11	S3 Ch.16	24	RHi Ch.16		
3	S2 Ch.13	16	RLo Ch.13	6	S2 Ch.14	19	RLo Ch.14	9	S2 Ch.15	22	RLoCh.15	12	S2 Ch.16	25	RLo Ch.16		

P2 Connector: Uses a 5 row 160 pin connector

Pin	Designation	Pin	Designation	Pin	Designation	Pin	Designation	Pin	Designation	Pin	Designation
18c	S1 Ch. 1	30a	RLo Ch. 3	21a	RHi Ch. 6	4c	S4 Ch. 9	11d	S2 Ch. 12	28d	S3 Ch. 15
22c	S3 Ch. 1	18a	S1 Ch. 4	23a	RLo Ch. 6	1a	RHi Ch. 9	12d	S4 Ch. 12	29d	S2 Ch. 15
20c	S2 Ch. 1	22a	S3 Ch. 4	11a	S1 Ch. 7	2a	RLo Ch. 9	13d	RHi Ch. 12	30d	S4 Ch. 15
24c	S4 Ch. 1	20a	S2 Ch. 4	15a	S3 Ch. 7	5c	S1 Ch. 10	14d	RLo Ch. 12	5z	RHi Ch. 15
29c	RHi Ch. 1	24a	S4 Ch. 4	13a	S2 Ch. 7	6c	S3 Ch. 10	15d	S1 Ch. 13	7z	RLo Ch. 15
27c	RLo Ch. 1	27a	RHi Ch. 4	17a	S4 Ch. 7	7c	S2 Ch. 10	16d	S3 Ch. 13	9z	S1 Ch. 16
10c	S1 Ch. 2	29a	RLo Ch. 4	8a	RHi Ch. 7	8c	S4 Ch. 10	17d	S2 Ch. 13	11z	S3 Ch. 16
14c	S3 Ch. 2	10a	S1 Ch. 5	9a	RLo Ch. 7	3a	RHi Ch. 10	18d	S4 Ch. 13	13z	S2 Ch. 16
12c	S2 Ch. 2	14a	S3 Ch. 5	11c	S1 Ch. 8	4a	RLo Ch. 10	19d	RHi Ch. 13	15z	S4 Ch. 16
16c	S4 Ch. 2	12a	S2 Ch. 5	15c	S3 Ch. 8	3d	S1 Ch. 11	20d	RLo Ch. 13	17z	RHi Ch. 16
30c	RHi Ch. 2	16a	S4 Ch. 5	13c	S2 Ch. 8	4d	S3 Ch. 11	21d	S1 Ch. 14	19z	RLo Ch. 16
28c	RLo Ch. 2	21c	RHi Ch. 5	17c	S4 Ch. 8	5d	S2 Ch. 11	22d	S3 Ch. 14	19a	Int. Ref. Output Hi
25c	S1 Ch. 3	23c	RLo Ch. 5	6a	RHi Ch. 8	6d	S4 Ch. 11	23d	S2 Ch. 14	19c	Int. Ref. Output Lo
32c	S3 Ch. 3	25a	S1 Ch. 6	7a	RLo Ch. 8	7d	RHi Ch. 11	24d	S4 Ch. 14		
26c	S2 Ch. 3	32a	S3 Ch. 6	1c	S1 Ch. 9	8d	RLo Ch. 11	25d	RHi Ch. 14		
31c	S4 Ch. 3	26a	S2 Ch. 6	2c	S3 Ch. 9	9d	S1 Ch. 12	26d	RLo Ch. 14		
28a	RHi Ch. 3	31a	S4 Ch. 6	3c	S2 Ch. 9	10d	S3 Ch. 12	27d	S1 Ch. 15		

S4 pins are used only with Resolvers. Do not connect to any undesignated pins.

NOTE: P2 is always active

P0 Connector: Only supplied when (A & B) outputs are specified

1e	Ch.1 A Hi	4b	Ch.3 Index Hi	7a	Ch.6 B Hi	10d	Ch.9 A Hi	13c	Ch.11 Index Hi	17e	Ch.14 B Hi
1d	Ch.1 A Lo	4a	Ch.3 Index Lo	7b	Ch.6 B Lo	10e	Ch.9 A Lo	14c	Ch.11 Index Lo	17d	Ch.14 B Lo
1a	Ch.1 B Hi	4d	Ch.4 A Hi	7c	Ch.6 Index Hi	11e	Ch.9 B Hi	14b	Ch.12 A Hi	17a	Ch.14 Index Hi
1b	Ch.1 B Lo	4e	Ch.4 A Lo	8c	Ch.6 Index Lo	11d	Ch.9 B Lo	14a	Ch.12 A Lo	17b	Ch.14 Index Lo
1c	Ch.1 Index Hi	5e	Ch.4 B Hi	8b	Ch.7 A Hi	11a	Ch.9 Index Hi	14d	Ch.12 B Hi	17c	Ch.15 A Hi
2c	Ch.1 Index Lo	5d	Ch.4 B Lo	8a	Ch.7 A Lo	11b	Ch.9 Index Lo	14e	Ch.12 B Lo	18c	Ch.15 A Lo
2b	Ch.2 A Hi	5a	Ch.4 Index Hi	8d	Ch.7 B Hi	11c	Ch.10 A Hi	15e	Ch.12 Index Hi	18b	Ch.15 B Hi
2a	Ch.2 A Lo	5b	Ch.4 Index Lo	8e	Ch.7 B Lo	12c	Ch.10 A Lo	15d	Ch.12 Index Lo	18a	Ch.15 B Lo
2d	Ch.2 B Hi	5c	Ch.5 A Hi	9e	Ch.7 Index Hi	12b	Ch.10 B Hi	15a	Ch.13 A Hi	18d	Ch.15 Index Hi
2e	Ch.2 B Lo	6c	Ch.5 A Lo	9d	Ch.7 Index Lo	12a	Ch.10 B Lo	15b	Ch.13 A Lo	18e	Ch.15 Index Lo
3e	Ch.2 Index Hi	6b	Ch.5 B Hi	9a	Ch.8 A Hi	12d	Ch.10 Index Hi	15c	Ch.13 B Hi	19e	Ch.16 A Hi
3d	Ch.2 Index Lo	6a	Ch.5 B Lo	9b	Ch.8 A Lo	12e	Ch.10 Index Lo	16c	Ch.13 B Lo	19d	Ch.16 A Lo
3a	Ch.3 A Hi	6d	Ch.5 Index Hi	9c	Ch.8 B Hi	13e	Ch.11 A Hi	16b	Ch.13 Index Hi	19a	Ch.16 B Hi
3b	Ch.3 A Lo	6e	Ch.5 Index Lo	10c	Ch.8 B Lo	13d	Ch.11 A Lo	16a	Ch.13 Index Lo	19b	Ch.16 B Lo
3c	Ch.3 B Hi	7e	Ch.6 A Hi	10b	Ch.8 Index Hi	13a	Ch.11 B Hi	16d	Ch.14 A Hi	P2-1z	Ch.16 Index Hi
4c	Ch.3 B Lo	7d	Ch.6 A Lo	10a	Ch.8 Index Lo	13b	Ch.11 B Lo	16e	Ch.14 A Lo	P2-3z	Ch.16 Index Lo

NOTE: For commutation (A,B,C) outputs: A Hi becomes A, B Hi becomes B, and Index Hi becomes C.

The board contains two green LED's (D8 & D9) that are for factory use only. Both will be ON during normal operation. Miniature test connector, JP2 is used to download programming data and JP3 is a ground. Do not interface to these two connectors unless factory instructed to be used for field modification.

Resolver: 2-28 V_{L-L} Autoranging, 90 V_{L-L}
Synchro: 11.8 V_{L-L} , 90 V_{L-L}

Code Table

Code	Input (VL-L)	Ref (Vrms)	Frequency (Hz)	Notes
01	11.8	26	400	
02	90	115	400	
03	90	115	50/400	
04	2-26	2-26	400	
05	2-26	2-26	800	
06	2-26	2-26	1000	
07	2-26	2-26	1200	
08	2-26	2-26	1600	
09	2-26	2-26	2000	
10	2-26	2-26	2500	
11	2-26	2-26	3000	
12	2-26	2-26	4000	This code is available for card with a maximum of 12 channels
13	2-26	2-26	5000	This code is available for card with a maximum of 12 channels
14	2-26	2-26	6500	This code is available for card with a maximum of 12 channels
15	2-26	2-26	7000	This code is available for card with a maximum of 12 channels
16	2-26	2-26	10000	This code is available for card with a maximum of 6 channels
17	2-26	115	400	
50	90 11.8	115 26	400 400	Channel 1 to Channel 4 Channel 5 to Channel 8
51	2-26	2-26	6000	This code is available for card with a maximum of 12 channels
52	3	6	2950	2 chan r/d w/special software for ref loss detection
53	26	26	400	Special synchro L/L

Contact factory for other combinations.
IMPORTANT: Tracking rate and bandwidth can easily be customized to meet your specific requirements.

PART NUMBER DESIGNATION

64SD1- XX X X X X - XX

TOTAL NUMBER OF CHANNELS(*)
02 – 2 S/D Channels
04 – 4 S/D Channels
08 – 8 S/D Channels
12 – 12 S/D Channels
16 – 16 S/D Channels

ENVIRONMENTAL
C = 0°C to +70°C
M = -55°C to +85°C
H = M With Removable Conformal Coating
J = M With Permanent Conformal Coating
K = C With Removable Conformal Coating

FORMAT
S = Synchro
R = Resolver
M = Mixed (See Code Table)

(*) Number of 24 bit channels is dependant upon carrier frequency etc…consult factory for specifics

CODE (See Code Table)

OPTIONS

With On-Board Reference:
1 = One Common Reference Input Tied to On-Board Reference Supply
2 = Individual Reference Inputs
3 = One Common Reference Input Tied to On-Board Reference Supply; Programmable Encoder (A & B) and Index/Commutation
4 = Individual Reference Inputs; Programmable Encoder (A & B) and Index/Commutation

Without On-Board Reference:
5 = One Common Reference Input
6 = Individual Reference Inputs
7 = One Common Reference Input; Programmable Encoder (A & B) and Index/Commutation
8 = Individual Reference Inputs; Programmable Encoder (A & B) and Index/Commutation

Custom Design:
9 = Custom Design (See Separate Spec)

MECHANICAL
F = Front Panel I/O and P2 I/O
P = P2 I/O only
W = P With Wedgelocks
V = VME64 Front Panel I/O