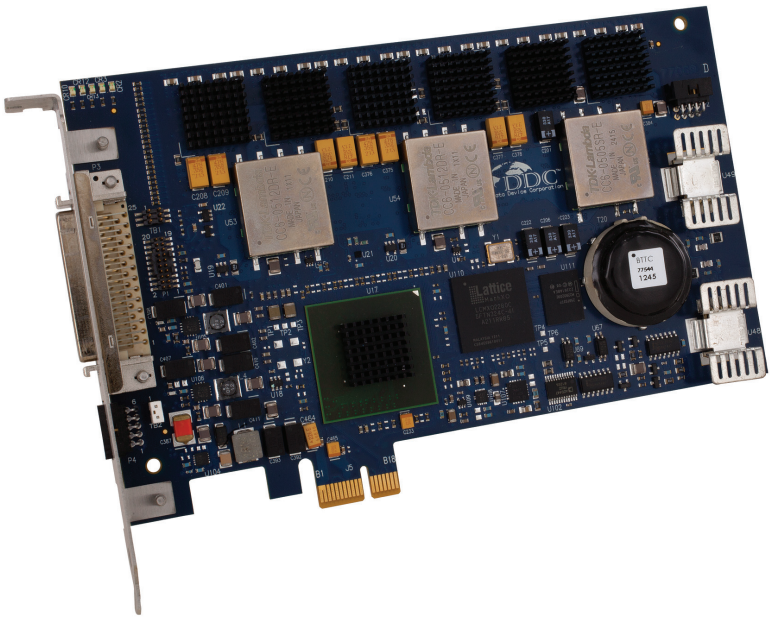
Digital-to-Synchro/Resolver PCI Express Card

Hardware Manual

Model: SB-3623XKX



DDC's PCIe card provides ideal compatibility with modern desktop computers, retaining high performance accuracy with six independent channels each.

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- Machine Tool Control
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Synchro, Resolver, LVDT, RVDT, Inductosyn, MR, and Hall Conversion Solutions

Since introducing the first synchro converter module in 1968, DDC has taken a leadership role in the design and manufacture of modern data conversion products.

DDC offers a complete line of Synchro/Resolver instrument-grade cards and test equipment including angle position indication and simulation, plus a variety of hardware and software to meet today's civil, military, and COTS/MOTS requirements. DDC is a leading supplier of Synchro/Resolver-to-Digital and Digital-to-Synchro/Resolver components—the smallest, most accurate synchro/resolver-to-digital and digital-to-synchro/resolver converters available today. Most of these single chip and hybrid converters are based on ASIC designs, yielding the most reliable and affordable converters ever offered, and are the building blocks for DDC's card-level products.

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SB-36230KX DIGITAL-TO-SYNCHRO/RESOLVER PCI EXPRESS CARD HARDWARE/SOFTWARE MANUAL

MN-36230KX-001

105 Wilbur Place
Bohemia, New York 11716-2426
Tel: (631) 567-5600, Fax: (631) 567-7358
World Wide Web - http://www.ddc-web.com

For Technical Support - 1-800-DDC-5757 ext. 7771
United Kingdom - Tel: +44-(0)1635-811140, Fax: +44-(0)1635-32264
France - Tel: +33-(0)1-41-16-3424, Fax: +33-(0)1-41-16-3425
Germany - Tel: +49-(0)89-15 00 12-11, Fax: +49-(0)89-15 00 12-22
Japan - Tel: +81-(0)3-3814-7688, Fax: +81-(0)3-3814-7689
Asia - Tel: +65 6489 4801
India - Tel: +91 80 46797 0368

Revision	Date	Pages	Description
Rev A	Apr. 2011	All	Initial Release
Rev B	May 2011	9-10, 22, 24-25, 33, 36-38, 40-41	Loss-of-Reference threshold modified. GUI screenshots updated. GUI LED descriptions clarified. Added GUI increment angle feature. Other minor updates on indicated pages.
Rev C	June 2016	2,10, 21, 36, 56-58,88	Updated System Requirements, Updated LED section, Added Linux section, Added LabView support section, Updated Program Amplitude and Program Frequency, Updated Software Ordering Info
Rev D	August, 2017	3, 29, 56, 58, 88	Text update in section 2.1, Updated to tables 6 and 7, Update to input data on page 56 & 58, transformer ratio and note 4 added to ordering info.
Rev E	March, 2018	29, 30	Added section 4.3.3 and figure 2
Rev F	February, 2019	20-25	Updated channel enumeration to align software. Removed sections 5, 6, 7, and 8.
Rev G	April, 2019	ii, 10,18, all pages	Minor edits, P2 mating connector part #s added, footer's fixed

1 PREFACE

This manual uses typographical conventions to assist the reader in understanding the content. This section will define the text formatting used in the rest of the manual

1.1 Text Usage

- **BOLD**–indicates important information and table, figure, and chapter references.
- ***BOLD ITALIC***–designates DDC Part Numbers.
- `Courier New`–indicates code examples.
- <…> - indicates user-entered text or commands.

1.2 Standard Definitions

PCIe **Peripheral Component Interconnect Express**

1.3 Special Handling and Cautions

The ***SB-36230KX*** uses state-of-the-art components, and proper care should be used to ensure that the device will not be damaged by Electrical Static Discharge (ESD), physical shock, or improper power surges and that precautions are taken to avoid electrocution.

Warnings: Turn off power to the computer hardware and unplug from wall.

NEVER insert or remove card with power turned on.

Ensure that standard ESD precautions are followed. As a minimum, one hand should be grounded to the power supply in order to equalize the static potential.

1.4 Trademarks

All trademarks are the property of their respective owners.

1.5 What is included in this manual?

This manual contains a complete description of hardware/software installation and use.

1.6 Supporting Documentation

- RD/RDC Series Converters Applications Manual (***MN-19220XX-001***)
- Synchro/Resolver Conversion Handbook
- Two-Speed Application Note (***AN/MFT-10***)

1.7 Technical Support

In the event that problems arise beyond the scope of this manual, you can contact DDC by the following:

US Toll Free Technical Support:
1-800-DDC-5757, ext. 7771

Outside of the US Technical Support:
1-631-567-5600, ext. 7771

Fax:
1-631-567-5758 to the attention of Motion Feedback Technologies Applications

DDC Website:
www.ddc-web.com/ContactUs/TechSupport.aspx

Please note that the latest revisions of Software and Documentation are available for download at DDC's Web Site, www.ddc-web.com.

2 OVERVIEW

The ***SB-36230KX*** is a half-length PCI Express x1 card which contains six fully independent Digital-to-Synchro/Resolver channels. This form factor is designed for use in standard desktops or servers that provide a standard height PCI Express slot. The PCI Express specifications require interoperability of the x1 card in any link width PCIe slot (x1, x4, x8 or x16) and any current PCIe generation (1.0a/1.1/2.0).

The operating temperature range for these environments is 0°C to +55°C with air exchange inside the enclosure. All I/O connections are made via a single connector on the standard I/O bracket.

Each channel can be software programmable for either Synchro or Resolver signal formats.

2.1 Features

- Half Length, Standard Height PCI Express x1 Form Factor
- Six independent Digital-to-Synchro/Resolver channels
  - Output amplitude options:
    - 0 to 13.6 Vrms Synchro/Resolver
    - 0 to 90 Vrms Synchro at 360 Hz to 1 kHz (transformer isolated)
  - DC to 10 kHz operating carrier frequency
  - 30 Arc seconds accuracy
  - 10 – 16 bit programmable resolution
  - Up to 15 mA max output drive (with 0-11.8V ordering option)
  - Programmable dynamic rotation (Up to 7099 rps)
  - Programmable two-speed simulation
  - Over-current/thermal protection
  - Loss-of-reference detection
  - Any Simulation Channel can be Used as a Sine Reference Oscillator
- On-board reference oscillator
  - Output types:
    - 0 to 26 Vrms (360 Hz to 11 kHz)
    - 0 to 115 Vrms (360 Hz to 1 kHz)
  - Up to 60 mA output drive (with 0-11.8V ordering option)
  - Transformer isolated

- Software programmable voltage and frequency

- Built-In self test
- RoHS Compliant & Lead-free
- Included Software

-Complete Synchro C SDK

- Plug-n-Play Windows drivers
- User API Library
  - Abstracts all low-level hardware memory/registers
  - Minimizes user application development effort

-Windows Graphical User Interface (GUI)

- User-friendly application that demonstrates full capabilities of the device

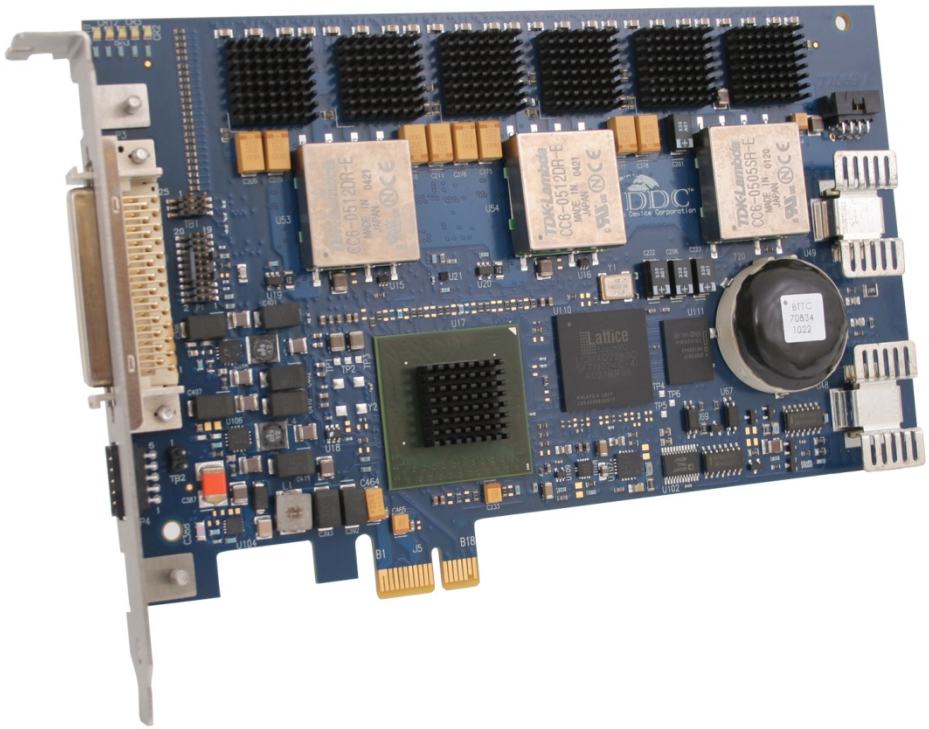

Figure 1. SB-3623XKX Synchro / Resolver PCI Express Output Card

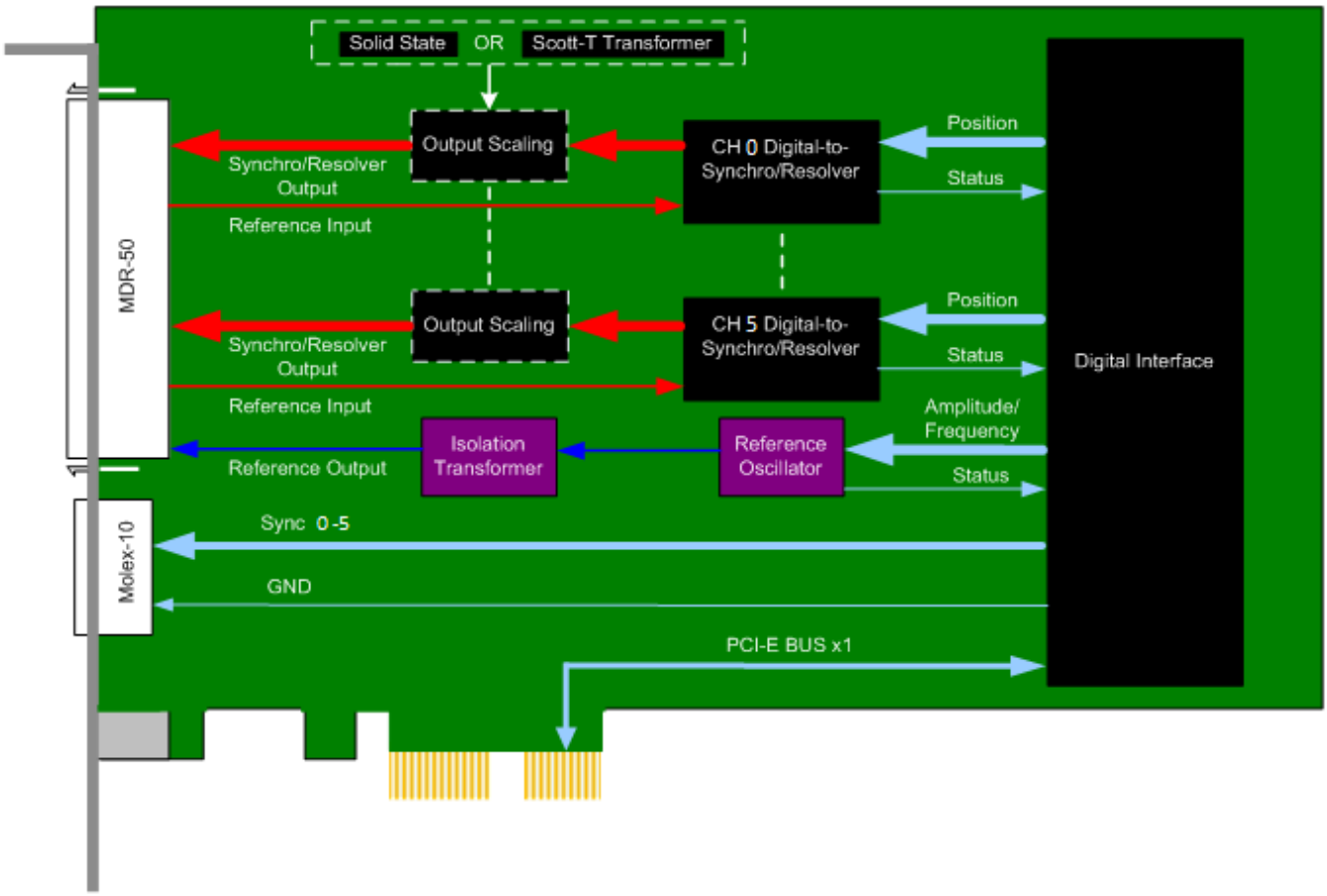

Figure 2. SB-36230KX Block Diagram

2.2 System Requirements

- Standard height PCIe 1.0a/1.1/2.0 compatible slot (dual-width slot required for 90V transformer isolated output option)
- One available PC peripheral power connector
- A supported operating system

2.3 Applications

The ***SB-36230KX*** is designed for high performance industrial and military control systems. Synchros and resolvers are used in applications where position feedback information is required. Providing accurate position information to simulate synchro/resolver outputs is essential to evaluate overall system performance. The ***SB-36230KX*** is ideal for test stands and simulators.

2.4 Mechanical Outline

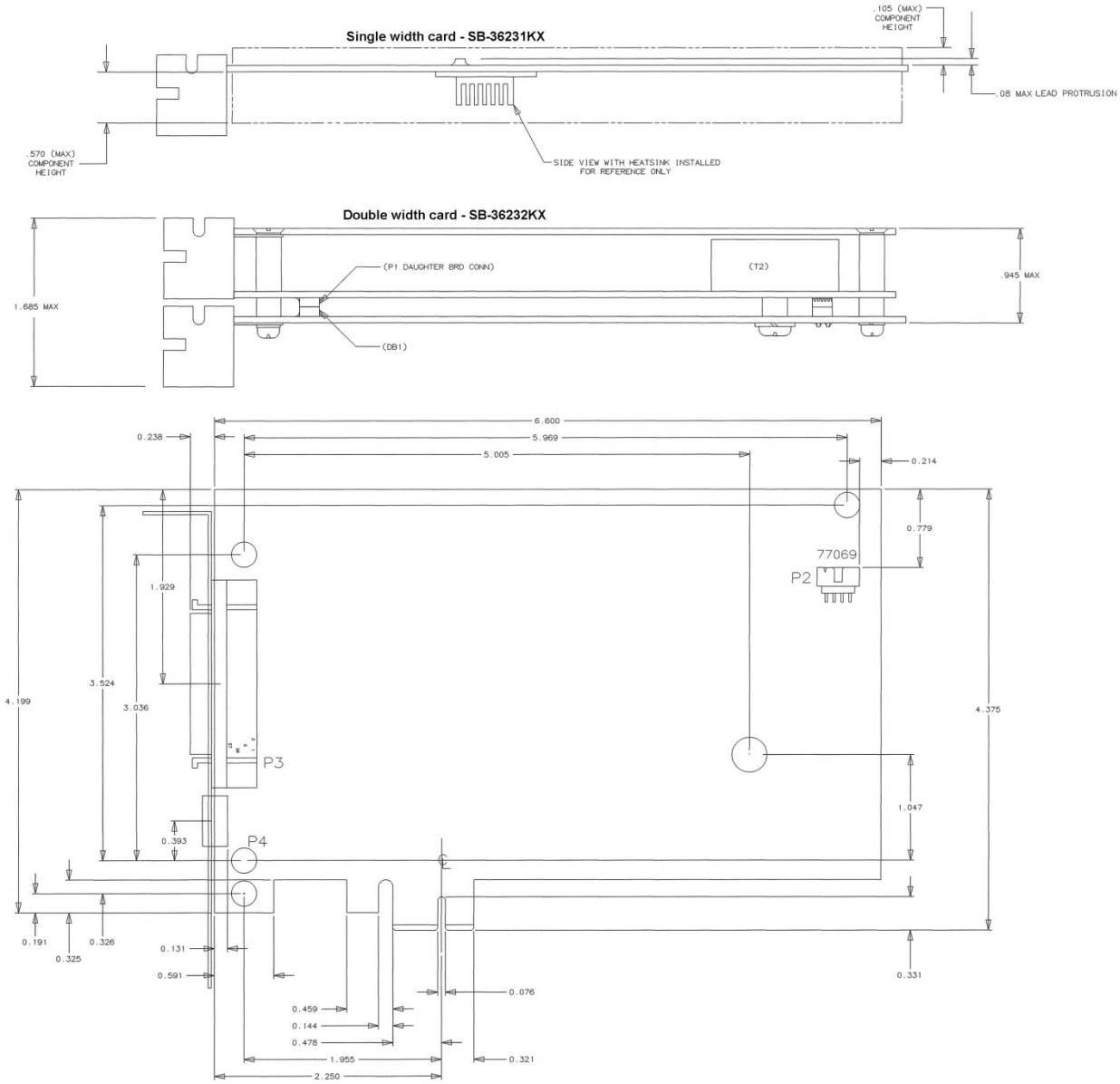

Figure 3. SB-36230KX Mechanical Outline

2.5 Specifications

Table 1. SB-36230KX Specification Table				
PARAMETER	**MIN**	**TYP**	**MAX**	**UNITS**
RESOLUTION (Note 2)		10 – 16		bits
ACCURACY (Note 3)		30		arc seconds
SIGNAL OUTPUT (Note 4)				
Option (*SB-36231KX*)				
Synchro / Resolver (Differential)	0	11.8	14.96	Vrms
Resolver (Single Ended)	0	6.8	7.48	Vrms
Output Drive			15	mA
DC Offset (Each Line to Ground)	-15		15	mV
Varies with angle				
Option (*SB-36232KX*)				
Synchro (Transformer Isolated)	0	90	99	Vrms
Output Drive			2	mA
DYNAMIC ROTATION (Max)				
10 bit resolution		7099.2		rps
11 bit resolution		3549.6		rps
12 bit resolution		1774.8		rps
13 bit resolution		887.4		rps
14 bit resolution		443.7		rps
15 bit resolution		221.8		rps
16 bit resolution		110.9		rps
REFERENCE INPUT (Solid-State)				
Option (*SB-36231KX*)				
Carrier Frequency (Note 5)	360		10k	Hz
Type		Differential		
Voltage (Nominal)		6.8 / 26		Vrms
Z_{in} single ended	99.5			kΩ
Z_{in} differential	199			kΩ
Common-mode Range (includes peak Reference signal)			15 / 50	V
Option (*SB-36232KX*)				
Carrier Frequency	360	400	1k	Hz
Type		Differential		
Voltage (Nominal)		115		Vrms
Z_{in} single ended	695			kΩ
Z_{in} differential	1.39			MΩ

Table 1. SB-36230KX Specification Table				
PARAMETER	**MIN**	**TYP**	**MAX**	**UNITS**
Common-mode Range (includes peak Reference signal)			240	V
REFERENCE OSCILLATOR **Option (*SB-36231KX*)** Voltage Carrier Frequency Output Drive **Option (*SB-36232KX*)** Voltage Carrier Frequency Output Drive	 0 360 0 360 	 	 26 10k 60 115 1k 13	 Vrms Hz mA Vrms Hz mA
DIGITAL OUTPUTS DRIVE CAPABILITY Sync Pulse	LVTTL +3.3V output 12 mA drive capability			
POWER SUPPLY Voltages/Tolerances (per PCIe CEM) +3.3 V +12 V Current +3.3 V +12 V Supplemental Connector Voltage (P2) +5 V Current +5 V 4 Ch full load with ext. reference 4 Ch full load with int. oscillator (Full load) 6 Ch full load with ext. reference 6 Ch full load with int. oscillator (Full load)	 3.003 11.04 4.75 	 3.3 12 5 	 3.597 12.96 0.5 0.1 5.25 2.5 4.2 3.3 5	 V V A A V A A A A
THERMAL Device Operating Temperature Storage Temperature	 0 -45	 	 +55 +85	 °C °C
FORM FACTOR/SPECIFICATION	Standard height, Half length PCI Express x1			

Table 1. SB-36230KX Specification Table				
PARAMETER	**MIN**	**TYP**	**MAX**	**UNITS**
PHYSICAL CHARACTERISTICS				
Dimensions (Note 6)		6.6 x 4.199 167.65 x 106.65		in. (mm)
Weight				
SB-36231K6		5.9 0.166		oz. (kg)
SB-36232K6		24.6 0.698		oz. (kg)

Notes:

1. These specifications apply over the rated power supply, temperature, and reference frequency ranges.
2. Resolution is 16 bits for all static angles and is software programmable for 10 – 16 bits for dynamic rotation.
3. Add 2 arc minutes max to specified accuracy with 90V transformer coupled option.
4. Typical output voltage assumes a nominal reference input voltage. The output voltage is scalable within the maximum voltage specified by adjusting the reference input. See Section 4.2.3 for more details.
5. Reference input carrier frequencies below 360 Hz down to DC are possible but are not characterized for accuracy. DC offset voltages will degrade accuracy if a DC reference is applied. LOR and frequency detection will indicate a fault with a DC reference.
6. A dual-width slot is required for the 90V transformer isolated output option.

3 HARDWARE INSTALLATION

3.1 Hardware Configuration

The ***SB-36230KX*** card is a PCI Express x1 1.0a compliant card that can be inserted in any standard height PCI Express 1.0a/1.1/2.0 compliant slot. A dual-width slot is required only with the ***SB-36232KX*** option.

When installing the card, the following should be observed:

- **NEVER** insert or remove the card with the power turned on.
- **ALWAYS** take proper precautions to guard against static damage.
- Use a wrist strap if available, or ensure proper static grounding by touching the power supply cover **WITH POWER OFF**.
- Insert the card and gently press into the PCI Express mating connector. Secure the rear I/O panel bracket with the proper hardware.
- **ALWAYS** secure both rear I/O panel brackets for the ***SB-36232KX*** option.
- Connect the required supplemental external power connector. See Section 3.2 for details.
- Make sure that adjacent cabling and wiring do not hinder the airflow around the card.

The card is a true Plug and Play device. Interrupts and memory selections will be performed by the operating system as the boot system progresses.

3.2 Supplemental External Power Connector

The ***SB-36230KX*** card requires a supplemental external +5V supply to be provided through the 8 pin “P2” Power Connector located at the end of the card, furthest from the I/O connectors. See Figure 4.

Plug a PC peripheral power connector cable into the power connector by using the supplied adapter cable. This adapter is used to convert a typical PC peripheral power connector into the 8 pin “P2” connector type.

The peripheral power connector cable is the 4-conductor cable attached to the PC’s power supply. The “peripheral power connector” terminology is used by the various ATX/EPS/etc. specifications. This cable is also known as the “4 pin Molex power cable” and is used to power PATA hard drives, PATA optical drives, etc. These connectors are keyed and can only go in one way.

If the PC does not have an unused “peripheral power connector” cable, please obtain a Y-cable. The Y-cable is used for splitting a used connection to provide one additional power connector.

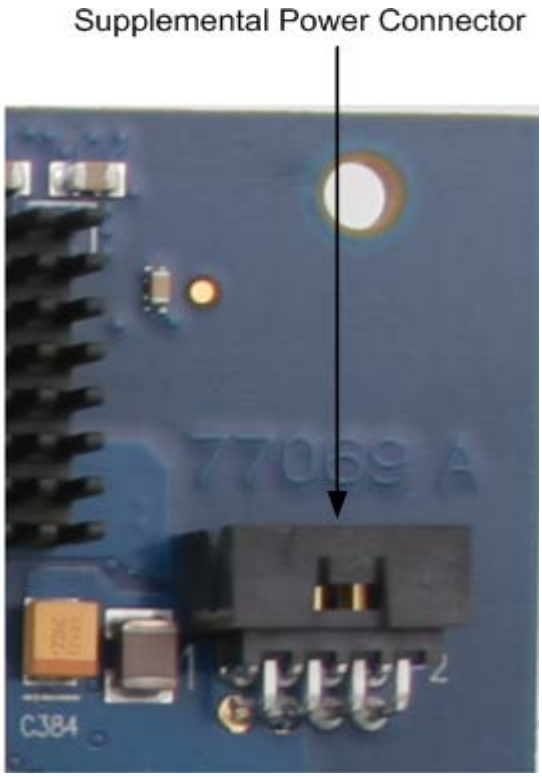

Figure 4. Supplemental Power Connector Location

3.3 SB-3623x LED status

SB-3623x has 5 LEDS located in the upper top left corner on the card. CR2, CR3, CR12, CR13, CR10. These LEDs are used to indicate the status of the cards FPGA during factory programming. These LED’s are intended for factory use only.

3.4 Synchro / Resolver Signal Connections

Each channel can be configured for either Synchro, Differential Resolver, or Single-Ended Resolver outputs. See Table 2 below for the different signal connections. Refer to Table 9 for the connector pinout.

Table 2. Signal Connections				
Mode	**Configuration**			
	S1	**S2**	**S3**	**S4**
Synchro	X	Z	Y	Disabled
Resolver	-SIN	+COS	+SIN	-COS
Single-Ended Resolver (Note 1)	Disabled	COS	SIN	Disabled

Note: When using single-ended configurations, S1 and S4 on the card's connector are disabled. Use associated analog ground on the card's connector per output channel as a return to ground for outputs S2(Cos) and S3(Sin).

4 DETAILED ARCHITECTURE

4.1 Digital to Synchro / Resolver Channels

4.1.1 Synchro / Resolver Interface

Each output channel can be configured through software to provide the following different signal types:

1. Synchro (S1, S2, S3)
2. Differential Resolver (S1, S2, S3, S4)
3. Single-ended Resolver (S2 - Cos, S3 - Sin)

Unused output legs are inactive (i.e., in Synchro mode, the “S4” output leg is turned off). The signal type is not configurable for the 90V Synchro output option (***SB-36232KX***). Refer to the **Set_D2rsChOutput()** function for more details.

Note: For the ***SB-36232KX*** option, the output type is configured for Differential Resolver (S1-S4) and is converted to a Synchro output using a Scott-T transformer. Therefore, the S4 output leg will be active.

4.1.1.1 Output Status

The active status of each specific output leg (S1-S4) for all channels is constantly monitored in an internal register that is accessible through software. This status is dependent on both the output type mode and if the output leg is in an over-temperature/over-current condition.

For example, if the output type selected is Synchro, S1-S3 should be active while S4 is inactive. If an over-temperature/over-current condition occurs on S1-S3, the leg(s) will go inactive. The leg(s) will become active again once the fault condition no longer exists.

See the **Get_D2rsOutputsStatus()** function for details.

4.1.2 Synchro / Resolver Output Signal Voltages

The output voltage for each channel is determined by the reference input voltage and transformation ratio. The transformation ratio is software programmable. See Table 3 for the different output voltage configurations. The output voltage configuration is programmable using the **Set_D2rsChOutput()** function.

Table 3. Output Voltage Configurations					
Board Part #	**Interface**	**Maximum Reference Input Voltage Required (Vrms)**	**Transformation Ratio (TR)**	**Nominal Output Voltage (Vrms)**	**Active Outputs**
SB-36231KX	Synchro/Resolver	26	0.4538	11.8	S1,S2,S3,S4*
	Single-ended Resolver	26	0.2615	6.8	S2,S3
	Single-ended Resolver	6.8	1	6.8	S2,S3
	Resolver	6.8	2	13.6	S1,S2,S3,S4
SB-36232KX	Synchro	115	0.7826	90	S1,S2,S3

Note: Do not attempt to scale for higher output voltages by inputting a reference voltage above the maximum specified voltage.
*S4 is active only in Resolver mode.

4.1.3 Scaling Lower Output Voltages

The output voltages can be scaled down by lowering the reference input voltage as follows:

Reference Input Voltage = Desired Output Voltage / TR

Example:

Desired Output Voltage = 10 Vrms

TR = 0.4538

Reference Input Voltage = 10 Vrms / 0.4538

Reference Input Voltage = 22 Vrms

4.1.4 Two Speed

Two speed allows resolutions greater than 16 bits to be achieved. Refer to the Two-Speed Application Note (***AN/MFT-10***), the RD/RDC Applications Manual (***MN-19220XX-001***) and the Synchro/Resolver Conversion Handbook. These documents are available at www.ddc-web.com.

4.1.5 Self Test

The device has a built-in self test capability which uses an internal DC reference to exercise all channels and indicates a pass or fail status for each channel. This

information is reported through a register that is accessible through software. See the **SelfTest()** function for details.

4.1.6 Reference Input Frequency Detector

Each channel is capable of reporting back the carrier frequency (Hz) that is being applied to its reference inputs (RH/RL). This information is accessible through software using the **Get_D2rsChRefFreq()** function. The tolerance on this reading is +/- 5%.

4.1.7 Loss-of-Reference Status

Each channel has the capability to detect for Loss-of-Reference (LOR). If the reference input to a channel falls below a threshold, an internal register flag will be set to a logic 1.

The threshold for the ***SB36231KX*** model card is dependent on the maximum reference input voltage of the output type selected (Refer to Table 3).

- For a maximum reference input voltage of 26 Vrms, the LOR threshold is 3.8 Vpeak.
- For a maximum reference input voltage of 6.8 Vrms, the LOR threshold is 1 Vpeak.

The threshold for the ***SB36232KX*** model card is 16.9 Vpeak.

This flag will return to a logic 0 once the reference input voltage goes above this threshold. See the **Get_D2rsRefStatus()** function for details.

4.1.8 DC-to-DC Converter Status

There are up to two DC-to-DC converters on the device that are used for the digital-to-Synchro / Resolver channels depending on the channel count (See Table 4). Each DC-to-DC converter has over current protection.

If either one goes into an over current condition, all channels on the device will shutdown. Once this occurs, a power cycle to the computer will be necessary to restore all channels.

Each DC-to-DC converter's active status is monitored in a register accessible through software. See the **Get_D2rsRefStatus()** function for details.

Table 4. DC-to-DC Converter Configuration		
Channel Count	**DC-to-DC Converter A**	**DC-to-DC Converter B**
4	Channels 0 and 1	Channels 2 and 3
6	Channels 0, 1 and 2	Channels 3, 4, and 5

4.1.9 Sync Pulse

A sync pulse output is available for each channel and is located on the P4 connector (See Table 10). The functionality of the sync pulse depends on whether the channel is in static mode (not rotating) or dynamic mode (rotating).

In static mode, a pulse will occur when an angle is written to the channel.

In dynamic mode, a pulse will occur when the output crosses 0°.

The sync pulse width is 100 µSec.

4.2 On-board Reference Sine Oscillator

The on-board oscillator may be used to take the place of an external drive oscillator for the excitation signal. This oscillator is available in two options, see Table 5 for details. The oscillator frequency and voltage are programmable through software. The oscillator output is transformer isolated. To use the on-board reference oscillator for a specific channel(s), the reference output signals OSC_RH_OUT and OSC_RL_OUT must be connected to the specific channel(s)' RH_IN and RL_IN on the connector P3.

The oscillator has a status output which is constantly monitored in an internal register that is accessible through software. This status is dependent on both the oscillator's enable/disable status and if the oscillator is in an over-temperature/over-current condition.

For example, if the oscillator is enabled and goes into an over-current/over-temperature condition, the oscillator will go inactive. The oscillator will become active again once the fault condition no longer exists.

See the **Get_D2rsRefStatus()** function for details.

Table 5. Reference Oscillator Options				
Board Part #	**Frequency Range**	**Frequency Resolution**	**Output Voltage Range**	**Output Voltage Resolution**
SB-36231KX	360 Hz – 10 kHz	3.78 Hz	0 – 26 Vrms	8.4 mV
SB-36232KX	360 Hz – 1 kHz	3.78 Hz	0 – 115 Vrms	37 mV

4.2.1 Set Oscillator Frequency

To change the Oscillator frequency, enter the bit multiplier. The bit multiplier, which is an integer, is determined by the following formula:

Frequency = (Hz/bit) X (bit multiplier)

Table 6. Oscillator Frequency

Board Type	Frequency Range (Hz)	Output Scaling (Hz/bit)	Bit Multiplier Range	Example
SB-36231	360 – 11,000	3.78	95 – 2910	3,780 Hz = 3.78 Hz/bit * 1000
SB-36232	360 – 1,000	3.78	95 – 265	567 Hz = 3.78 Hz/bit * 150

4.2.2 Set Amplitude

To change the Oscillator amplitude, enter the bit multiplier. The bit multiplier, which is an integer, is determined by the following formula:

Amplitude = (V/bit) X (bit multiplier)

Table 7. Oscillator Amplitude

Board Type	Voltage Range (V)	Output Scaling (V/bit)	Bit Multiplier Range	Example
SB-36231	0 – 32	0.0084	0 – 3810	16.8 V = 0.0084 V/bit * 2000
SB-36232	0 – 140	0.037	0 – 3784	58.312 V = 0.037 V/bit * 1576

4.2.3 Configuring a Simulation Channel as a Sine Reference Oscillator

Any simulation channel can be used as a sine reference oscillator by providing a DC voltage as the board's reference input. The specific channel is programmed to dynamic mode, simulating a constant rotation. The programmed rotation speed corresponds to a frequency of the AC output waveform, and results in a time-varying voltage waveform. For detailed information on the setup, see Application Note AN/MFT13, available for download at www.ddc-web.com.

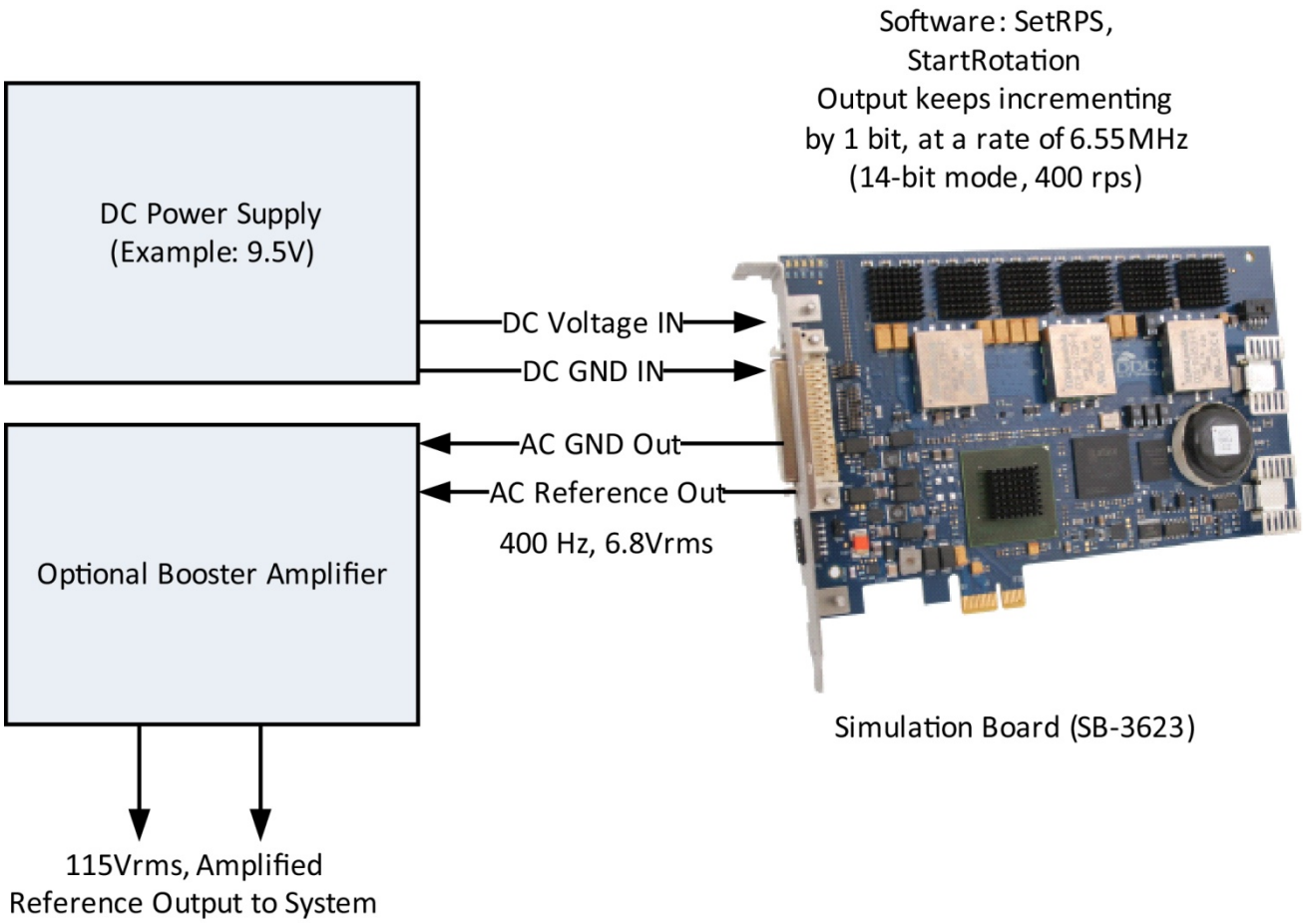

Figure 5. Simulation Board used as a Sine Reference Oscillator Block Diagram

4.3 Device Pinouts

This section delineates the user's pinouts for the ***SB-3623XKX***. The connectors described here are the two connectors on the I/O bracket.

4.3.1 I/O Connector Overview

The supplied mating connectors are listed in Table 8 below.

Table 8. DDC Supplied Mating Connectors

Description	Part Number	Qty
P2 Mating Connector Shell	(TE Connectivity) 1-480426-0	1
P2 Mating Connector Pin	(TE Connectivity) 350639-1	1
P3 Mating Connector	(3M) 10150-3000PE	1
P4 Mating Connector	(Molex) 51110-1060	1

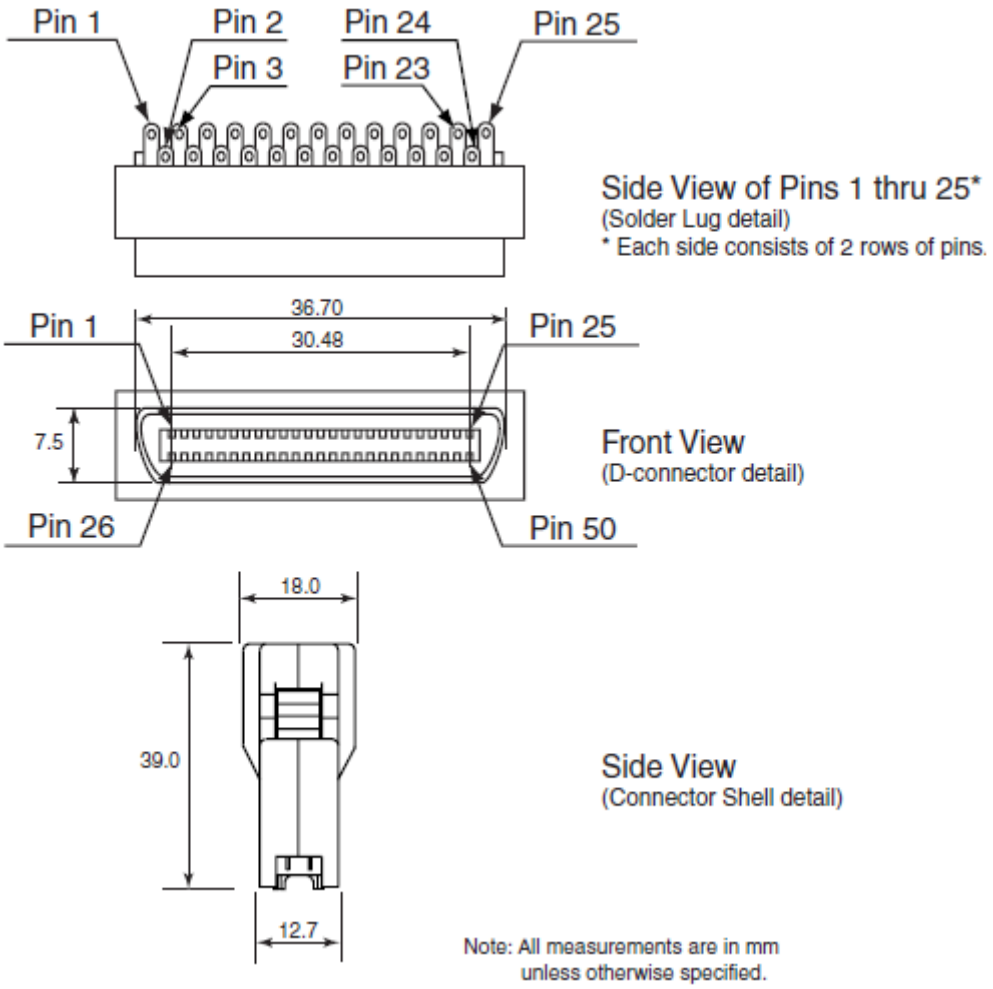

Figure 6. P3 Mating Connector

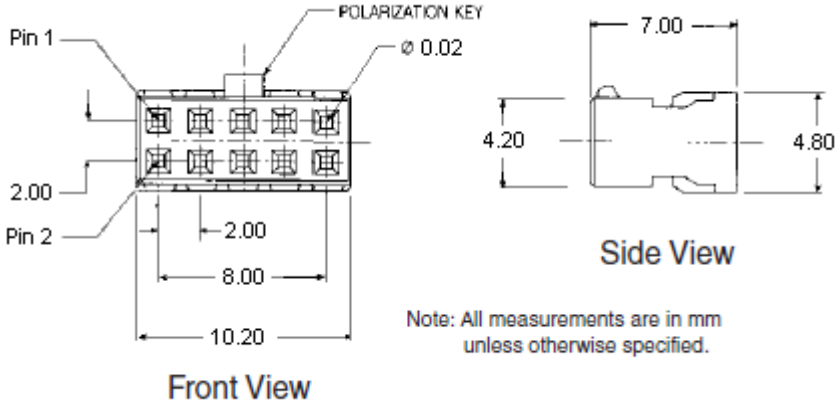

Figure 7. P4 Mating Connector

4.3.2 Signal Naming Convention for I/O Connector

The P3 connector is used for output channels 0 to 5. The connector's pinout is listed in Table 9.

Table 9. P3 Connector Pinouts

Pin	Signal Name	Description
1	CH4_RH_IN	Channel 4 – Reference excitation input high
2	CH4_RL_IN	Channel 4 – Reference excitation input low (respective to RH)
3	CH2_RH_IN	Channel 2 – Reference excitation input high
4	CH2_RL_IN	Channel 2 – Reference excitation input low (respective to RH)
5	CH0_RH_IN	Channel 0 – Reference excitation input high
6	CH0_RL_IN	Channel 0 – Reference excitation input low (respective to RH)
7	TP1	Factory test point. Do not connect.
8	TP2	Factory test point. Do not connect.
9	TP3	Factory test point. Do not connect.
10	DGND	Digital Ground
11	AGND	Analog Ground
12	CH4_S4_OUT	Channel 4 – Synchro/Resolver outputs. Refer to Table 2 for signal connections.
13	CH4_S3_OUT	
14	CH4_S2_OUT	
15	CH4_S1_OUT	
16	AGND	Analog Ground
17	CH2_S4_OUT	Channel 2 – Synchro/Resolver outputs. Refer to Table 2 for signal connections.
18	CH2_S3_OUT	
19	CH2_S2_OUT	
20	CH2_S1_OUT	
21	AGND	Analog Ground
22	CH0_S4_OUT	Channel 0 – Synchro/Resolver outputs. Refer to Table 2 for signal connections.
23	CH0_S3_OUT	
24	CH0_S2_OUT	
25	CH0_S1_OUT	
26	OSC_RH_OUT	Internal reference oscillator output high
27	OSC_RL_OUT	Internal reference oscillator output low (respective to RH)
28	CH5_RH_IN	Channel 5 – Reference excitation input high
29	CH5_RL_IN	Channel 5 – Reference excitation input low (respective to RH)
30	CH3_RH_IN	Channel 3 – Reference excitation input high

Table 9. P3 Connector Pinouts		
Pin	**Signal Name**	**Description**
31	CH3_RL_IN	Channel 3 – Reference excitation input low (respective to RH)
32	CH1_RH_IN	Channel 1 – Reference excitation input high
33	CH1_RL_IN	Channel 1 – Reference excitation input low (respective to RH)
34	DGND	Digital Ground
35	DGND	Digital Ground
36	AGND	Analog Ground
37	CH5_S1_OUT	Channel 5 – Synchro/Resolver outputs. Refer to Table 2 for signal connections.
38	CH5_S2_OUT	
39	CH5_S3_OUT	
40	CH5_S4_OUT	
41	AGND	Analog Ground
42	CH3_S1_OUT	Channel 3 – Synchro/Resolver outputs. Refer to Table 2 for signal connections.
43	CH3_S2_OUT	
44	CH3_S3_OUT	
45	CH3_S4_OUT	
46	AGND	Analog Ground
47	CH1_S1_OUT	Channel 1 – Synchro/Resolver outputs. Refer to Table 2 for signal connections.
48	CH1_S2_OUT	
49	CH1_S3_OUT	
50	CH1_S4_OUT	

Notes:
1. All AGND and DGND pins are internally common.
2. The inputs and outputs for unpopulated channels are No Connects.

The P4 connector's pinout is listed in Table 10 with a description of the signals following the table.

Table 10. P4 Connector Pinouts

Pin	Function	Description
1	SYNC_A	Sync pulse (channel 0)
2	SYNC_E	Sync pulse (channel 4)
3	SYNC_B	Sync pulse (channel 1)
4	SYNC_F	Sync pulse (channel 5)
5	SYNC_C	Sync pulse (channel 2)
6	DGND	Digital Ground
7	SYNC_D	Sync pulse (channel 3)
8	DGND	Digital Ground
9	TP	Factory test point. Do not connect.
10	DGND	Digital Ground

Notes:
1. All DGND pins are internally common.
2. The outputs for unpopulated channels are No Connects.

5 SOFTWARE

Numerous software packages are available for the SB-3623. The DDC software packages are developed to allow shorter design cycles while allowing all SB-3623 functionality to be accessed by user level code.

The available software packages include:

- Motion Feedback C SDK (SB-36030Sx)
- Motion Feedback Application (SB-36000S0)
- Motion Feedback LabVIEW SDK (SB-36030SL)

5.1 Software Overview

5.1.1 Motion Feedback C SDK (SB-36030Sx)

The card is supplied with the SB-36030Sx Motion Feedback C SDK. This software development kit includes a runtime library that provides the user with a hardware abstraction layer for the DDC Motion Feedback hardware. This software layer includes the routines that dramatically reduce software development time by providing high-level C functions for the application programmer to interface to the card. C samples are included with the library to demonstrate how the API works with the hardware. Table 11 shows a summary of the supported operating systems.

The ***SB-36030Sx Software Manual*** can be downloaded from the DDC web site at *www.ddc-web.com*.

Table 11. Motion Feedback Library C SDK Part Number Descriptions

Part Number	Operating System
SB-36030S0	Windows
SB-36030S1	Linux

5.1.2 Motion Feedback Application (SB-36000S0)

The card is supplied with the SB-36000S0 Motion Feedback Application. This is a graphical software which runs on Windows.

The ***SB-36000S0 Manual*** can be downloaded from the DDC web site at www.ddc-web.com.

5.1.3 Motion Feedback LabVIEW SDK (SB-36030SL)

The card is supplied with the SB-36030SL Motion Feedback LabVIEW support package. This software development kit includes a runtime library that provides the user with a hardware abstraction layer for the DDC Motion Feedback hardware in a LabVIEW environment. The Package includes 3 layers of VIs which enable easy application development. Functional user samples are included for common functions.

5.1.4 Troubleshooting the Installation

Usually the installation will be successful, and the self-test within the sample programs will pass. There are, however, some situations that can cause problems during the installation. The most common are detailed below.

An error is returned when an attempt is made to run any of the samples. This fault is almost always related to an incorrectly assigned device number. Be sure that a device number was correctly assigned through the DDC Card Manager.

If an error is encountered and the device number appears to be correctly assigned, check the operating system. The BIOS setting for a PnP operating system is sometimes set to YES, which can cause a problem. This BIOS option must be set for NO. The operating system, as well as all hardware on your system, will still maintain PnP compatibility; it will not be necessary to manually configure resources for PnP cards.

6 ORDERING INFORMATION

SB-362 3 X K X - JL 3

Accuracy:
3 = 30 Arc Seconds

Environmental Temperature Options:
JL = 0°C to +55°C Operating Temperature Range

Output Channel Count:
4 = 4 Channels
6 = 6 Channels

Output Type / On-board Reference Oscillator Type:
1 = Output: 0 to 11.8 Vrms (DC to 10 kHz)
Reference Oscillator: 0 to 26 Vrms (360 Hz to 10 kHz)
Transformation Ratio: 0.4538

2 = Output: 0 to 90 Vrms (360 Hz to 1 kHz) **(Notes 1, 2, 3)**
Reference Oscillator: 0 to 115 Vrms (360 Hz to 1 kHz)
Transformation Ratio: 0.7826

Notes:
1. Output type is configured for Synchro signals only (S1, S2, S3).
2. Output type is transformer isolated and requires a dual-width slot.
3. Adds 2 arc minutes max. to specified accuracy.
4. Transformation Ratio affects the output amplitudes. E.g. SB-3623**1** input of 26Vrms gives 11.8Vrms outputs, SB-3623**2** input of 26Vrms gives 20Vrms outputs.

Included Accessories:
- 1 – Power Adapter Cable Assembly
- 1 – 50-pin Mating Connector
- 1 – 50-pin Mating Backshell
- 1 – 10-pin Receptacle (2 mm pitch)
- 10 – Crimp Terminals (2 mm pitch)
- Synchro/Resolver software CD

INCLUDED SOFTWARE (Available on *SB-3623* Product Page at www.ddc-web.com)

SB-36030SX- Motion Feedback C Software Development Kit (SDK)

Operation System:
0 = Windows
1 = Linux
L = LabVIEW (Windows)

SB-36000S0- Motion Feedback Application

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Contact Us

Inside the U.S. : Call 1-800-DDC-5757

Outside the U.S. : Call 1-631-567-5600

Operations

DDC Headquarters and Main Factory
105 Wilbur Place, Bohemia, NY 11716-2482
Tel: 1-800-DDC-5757 or (631) 567-5600
www.ddc-web.com
Data Device Corporation

DDC Space Microelectronics
13000 Gregg Street, Suite C, Poway, CA 92064
Tel:1-800-DDC-5757 or (631) 567-5600

Beta Transformer Technology Corporation
40 Orville Drive, Bohemia, NY 11716-2426
Tel: (631) 244-7393
www.BTTC-Beta.com

Beta Transformer Mexico, S. DE R L. DE C.V.
Avedina 20 De Noviembre
959 Zona Centro, Ensenada, Baja Mexico
Tel: (631) 244-7393

North Hills Signal Processing Corporation
Avedina Jose Escandon y Helquera No. 21
Km. 8.5 Carretera Lauro Villar
H. Matamoros Tamaulipas, Mexico
Tel: (631) 244-7393

DDC Electronics Ltd Headquarters
Westbridge Business Park, Cothey Way
Ryde, Isle of Wight, PO33 1QT, UK
Tel: +44 (0) 1983 817300

Sales Offices

DDC Headquarters and Main Factory
105 Wilbur Place, Bohemia, NY 11716-2426
Tel: 1-800-DDC-5757 or (631) 567-5600
www.ddc-web.com

United Kingdom: DDC U.K., Ltd Sales Office
James House, 27-35 London Road, Newbury,
Berkshire RG14 1JL, England
Tel: +44 1635 811140

France: DDC Electronique
84-88 Bld de la Mission Marchand
92411 Courbevoie Cedex, France
Tel: +33-1-41-16-3424

Germany: DDC Elektronik GmbH
Triebstrasse 3, D-80993 München, Germany
Tel: +49 (0) 89-15 00 12-11

Japan: DDC Electronics K.K.
Suidobashi Sotobori-dori Bldg, 8F, 1-5,
Koraku 1-chome,
Bunkyo-ku, Tokyo 112-0004, Japan
Tel: 81-3-3814-7688
www.ddcjapan.co.jp

Asia: DDC - RO Registered in Singapore
Blk-327 Hougang Ave 5 #05-164
Singapore 530327
Tel: +65 6489 4801

India: DDC Electronics Private Limited
C-31, C/O Quest Offices Pvt. Ltd.
10th Floor, Raheja Towers
M.G Road, Bangalore 560001, India
Tel: 91 80 46797 0368

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