

**KOLLMORGEN**

**Motion Technologies Group**

**BDS5 Manual**

**Addendum**

**VFS-5 Spindle Drive Manual**

**Old Number M-94114**

**New Number MB 5007H**



## VFS5 SPINDLE DRIVES

### 1. INTRODUCTION

The BDS5 "GOLDLINE" product has been expanded to include a line of "vector controlled" induction motor drives for spindle applications. This line of drives are also user programmable to fit many applications. The motors, that are used with these drives, are special for machine tool duty and have bearings and special balance for high speed operation. A brief description, of the spindle drives, is given below.

The VFS5 Spindle Drive is very similar in appearance to the BDS5 programmable drive. There are some mechanical differences on the VFS5-255. This model has a more efficient, bonded fin heatsink; a fan shroud, that channels all the air, from the fan, over the heatsink; and an externally mounted fan. This allows the unit to have an intermittent duty rating of 70 amps. The lower current versions are identical to the BDS5 of the same rating in physical appearance. All VFS units use a new EXIT 1 I/O card, which has filtered channels for the external inputs and a built in power meter driver circuit. This circuit drives an external analog meter that is calibrated in percentage of power at the motor shaft. Full scale is 10 vdc, which corresponds to 130% power, or maximum 30 minute duty. All VFS drives accept the standard "Motion Link" communication package, which can be accessed via an IBM type "pc" or the Industrial Drives Data Entry Panel. The firmware is special for spindle system routines and for driving an induction

motor. The variables, for system compensation, are also special due to the induction motor. This unit can also be used as a brushless motor control if the appropriate firmware is installed and the correct compensation is entered into the drive. All cards from the BDS5 are compatible with the VFS5 system except for normal "test limit" changes. The operation of this unit is identical to operation of the standard BDS5. The standard manual applies except for the changes mentioned above and those called out in **VFS-5 Spindle Firmware V1.00C**. System wiring is per the connection diagrams (A-93103 sh. 1-7) of the BDS5 manual. An externally mounted Regen Resistor is part of this system. The power meter connects to the 50 pin connector on the EXIT 1 I/O card per sheet 6 of A-93103. A calibration procedure for the load meter is available from Industrial Drives.

The VFS5 vector controlled induction motor drives firmware are designed to control induction motors such as machine tool spindle applications. VFS5 firmware is diverged from BDS5 software V3.1 beta2. Currently most functional features of BDS5 are preserved except certain functions described hereafter. In the following, features that were different from BDS5 firmware are explained. Two kinds of firmware can be distinguished easily from the power-up prompt. Power-up prompt displays either VFS5 or BDS5 along with version numbers.

## 2. VECTOR CONTROL OF INDUCTION MOTORS

Induction motors produce torque from the mutual interaction between the rotor current and the stator magnetization current. Unlike any other types of motors, the rotor current of induction motors are induced from the stator current. The objective of the vector control is to supply stator current so that its two current components - the rotor current component and the magnetizing current component are exactly supplied to the motor as commanded from a controller. The vector control condition can be met if the controller knows the exact orientation of the rotor magnetic axis, which can be estimated via the speed detector and the amount of slip frequency. Variables and Switches related to vector control are as follows.

IND	This switch has to be ON (IND=1) to configure BDS-5 for induction motor.
IMAG	Magnetization Current. Unit is in percent of IMAX. As a rule of thumb, this current should be close to the no load current of the motor at rated voltage and base frequency. The optimal IMAG value should be set at the factory. Magnetization current now is reduced automatically during field weakening operation. Magnetization current set by "IMAG" variable is maintained at speeds below base speed. At speeds higher than the base speed, magnetization current will be inversely proportional to the speed.
VBASE	Base speed RPM (Copy the name plate setting).
BSLIP	Expected Slip frequency, when IBASE current is supplied to the motor. BSLIP=524 corresponds to 1 Hz of slip frequency.
IBASE	Stator Current that produces BSLIP at VBASE. Unit is in percent of IMAX.

**SLOPE** When in field weakening region, slip per current has to be increased.

Set this value to 1000 unless you have a lab test data.

**VADVTBL** This is the maximum speed of the slip table. Set it the same as VMAX if possible. If "slip out of range error" occurs, reduce it down to "corner speed" (which is about 7000 RPM).

**SGOOSE** 0-255, 1/128xSGOOSE is added/subtracted from angle calculation to help reduce torque transients during accel/decel. Set to 0 normally.

**SLIP** Not programmable. Current Slip is displayed upon this command. In this representation, 1 Hz slip corresponds to SLIP=524.

To obtain optimal parameters for a specified motor, the following two commands help find optimal operating conditions with a dyno setup. Note that the two variables below are for factory use only.

**MADV** Manual Slip Control Switch  
MADV=1 for Manual Slip Control. Default=0, factory use only.

**MSLIP** When MADV=1, amount of slip is solely controlled by MSLIP. Factory use only. In this representation, 1 Hz slip corresponds to SLIP=524.

## 3. NEW COMMANDS ADDED OR MODIFIED

Three new variables are related to the vector control:

**SLIPLIM** User variable SLIPLIM now limits the maximum amount of slip. In any case, slip frequency cannot

exceed SLIPLIM value at all speeds. If 1 Hz slip is maximum, put SLIPLIM=4294967, which is  $65.54 \times 65536$ . Normally the maximum slip is 4 - 8 times greater than rated slip at base speed.

**TROTOR** This variable sets the rotor time constant (75 corresponds to 300 mSec).

**GIMAGF** Low pass filter gain for dynamic Imag control (7735 = 20 Hz).

PDF type velocity loop compensation that were used by BDS-5 has been completely rewritten due to the poor stability at high speed. System now uses PI velocity control regardless of "PROP" command setting. There are two parameters associated with this PI control.

**KPROP** Determines the proportional gain (Range: 1 - 32000).

**KVI** Determines integral frequency (Range: 0 - 4095).

**PROP** If integral control is undesirable in any case, you may set PROP to 1 to disable integral action (proportional gain only).

Averaging of Vext is added to the section of Vext generation. Now four sample averaging is performed at each sampling time. The averaged Vext is not saved to avoid losing accuracy for the future calculations.

**VXAVGS** A switch variable to enable (=1) or disable (=0) Vext averaging.

User's application code may be embedded in the firmware and loaded upon power-up. A switch variable LOAD enables (=1) or disables (=0) this loading upon power-up. It is remembered for the next power-up time.

**LOAD** Enable/disable loading of user application code from PROM.

Auto Baud has been disabled when power up so that the application software can be executed without waiting for the establishment of the communication,

which is expected by the CNC. The Baud rate is set to 9600.

#### 4. USAGE OF X-VARIABLES

Among 250 X-variables, only 225 X-variables (X1 - X225) are allowed for user's application. X226 - X250 are reserved for factory use. Current firmware uses the following X-variables for testing purpose. Please do NOT use these variables in the user software.

X226	average velocity display
X227	storage for dynamic Imag value
X228	storage for delta Imag
X229	storage for velocity error integrator value
X230	storage for current slip value
X231	storage for profiled Imag value x 65536

#### 5. THE DEDICATED VARIABLES

The following 16 user variables were added for the application software use only. It acts similar to X variables except that these variables have dedicated names.

1.	VZR	Zero speed in RPM
2.	VUP	Up to speed in RPM
3.	VUPH	Up to speed hysteresis in RPM
4.	GEARIC	Gear I Value for C-axis (range of -32768 to 32767)
5.	GERAOC	Gearo Value for ratio for C-axis (range of 0 to 32767)
6.	MTIMER	Delay timer for motor over temperature (long integer)
7.	DTIMER	Delay timer for drive over temperature (long integer)

8. GEARIO	Gear value for open mode (range of -32768 to 32767)	PLIM=0
9. GEAROO	Gear value for open mode (range of 0 to 32767)	RAMP=1
10. PORNT	Orient position in PRD Unit (range of 0 to 4095)	ROTARY=1
11. VORNT	Orient velocity in RPM (long integer)	PROTARY=409600000
12. MORNT	Orient mode (range of 1 - 5)	VXAVGS=1
13. VXNUMO	VXNUM value for open mode (long integer)	
14. VXDENO	VXDEN value for open mode (long integer)	
15. VXNUMC	VXNUM value for C axis- mode (long align integer)	
16. VXDENC	VXDEN value for C mode (long integer)	

## 6. VARIABLES AND COMMANDS NOT USED IN VFS-5

The following list of commands and variables which can be found in BDS-5 were removed from the firmware.

commands: TUNE, RAND, MCI, MCGO,  
MCD, TPLAY, TRECORDER

switches: CAM, HSTACH, TRIP

variables: PTRIP1, PTRIP2, KF, A1-A16

## 7. DEFAULT VALUE AT POWER-UP

GEAR=1

IND=1

PL=0

## 8. VFS-5 SPINDLE FUNCTIONS

### 8.1. PWM Output

P2.5 microprocessor port is used as PWM output. Currently this output generates 24 kHz PWM signal whose duty cycle is proportional to the torque. This pin is connected to CYCLE\_READY output, which is no longer functional. An analog filter and a driver circuit is on the I/O board to drive a panel type load meter with 10 volt output corresponding to the maximum torque.

### 8.2. General Purpose I/O Pin Assignments

VFS-5 has 16 inputs and 8 outputs of General Purpose I/O pinouts. These may be used for spindle functions such as C-axis Command, Zero speed output, etc. It is totally up to the application code.

### 8.3. Application Code

Once application code is tested and verified, the application code can be embedded into the PROM for permanent storage. One switch variable LOAD is added to enable or disable loading upon power-up. About 3.5K bytes of PROM space is reserved for the application code. Please contact the factory for more information.

**KOLLMORGEN**  
**Motion Technologies Group**

## ADDENDUM FOR BDS-5 MANUAL

**NEW COMMAND NOTICE FOR VFS5**

**Version:** VFS5 Spindle Firmware Vi.0.1C

**Date:** May 6, 1994

For calibration of the torque meter, a new command was added to VFS5 firmware.

This command can be used to calibrate the load meter instead of procedure 9.0 of Spindle Manual.

**MTEST**

Type MTEST <Enter> to start meter test routine. The VFS5 will output a 25.5% duty cycle which corresponds to 100% power. The gain PST (R25) is adjusted for 100% on the power meter (6.67 VDC).

**MTEST 0**

(Type MTEST=0) The control of the PWM is back to the servo routine.

These commands work only when VFS5 has been disabled. Make sure MTEST 0 was issued to the VFS5 after the meter test.

**Note for Hardware Adjustment**

Adjust R25 to obtain 6.67 Volt at load meter when meter test is on. Check that meter out is zero Volt when meter test is off. Zero with pot R25A

**9. TEST PROCEDURE FOR EXT 1 I/O CARD**

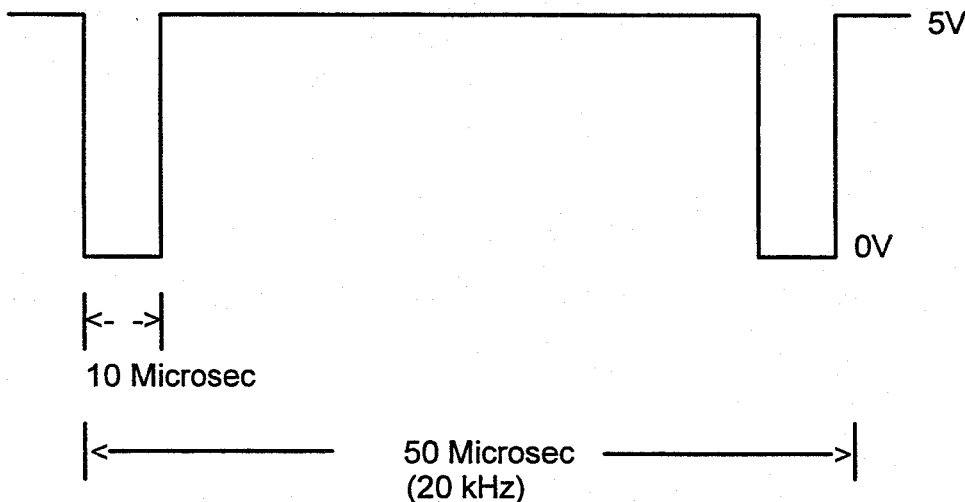
**9.1. Equipment**

1. Oscilloscope and multimeter.
2. ±12 volt power supply.
3. Signal Generator with variable pulse output.
4. Connector A-96003-050 and pins A-96004.
5. Molex connector A-79224-003 and pins A-79225.
6. Schematic for BDS5 EXT 1 I/O A-95058-1.

**9.2. Procedure**

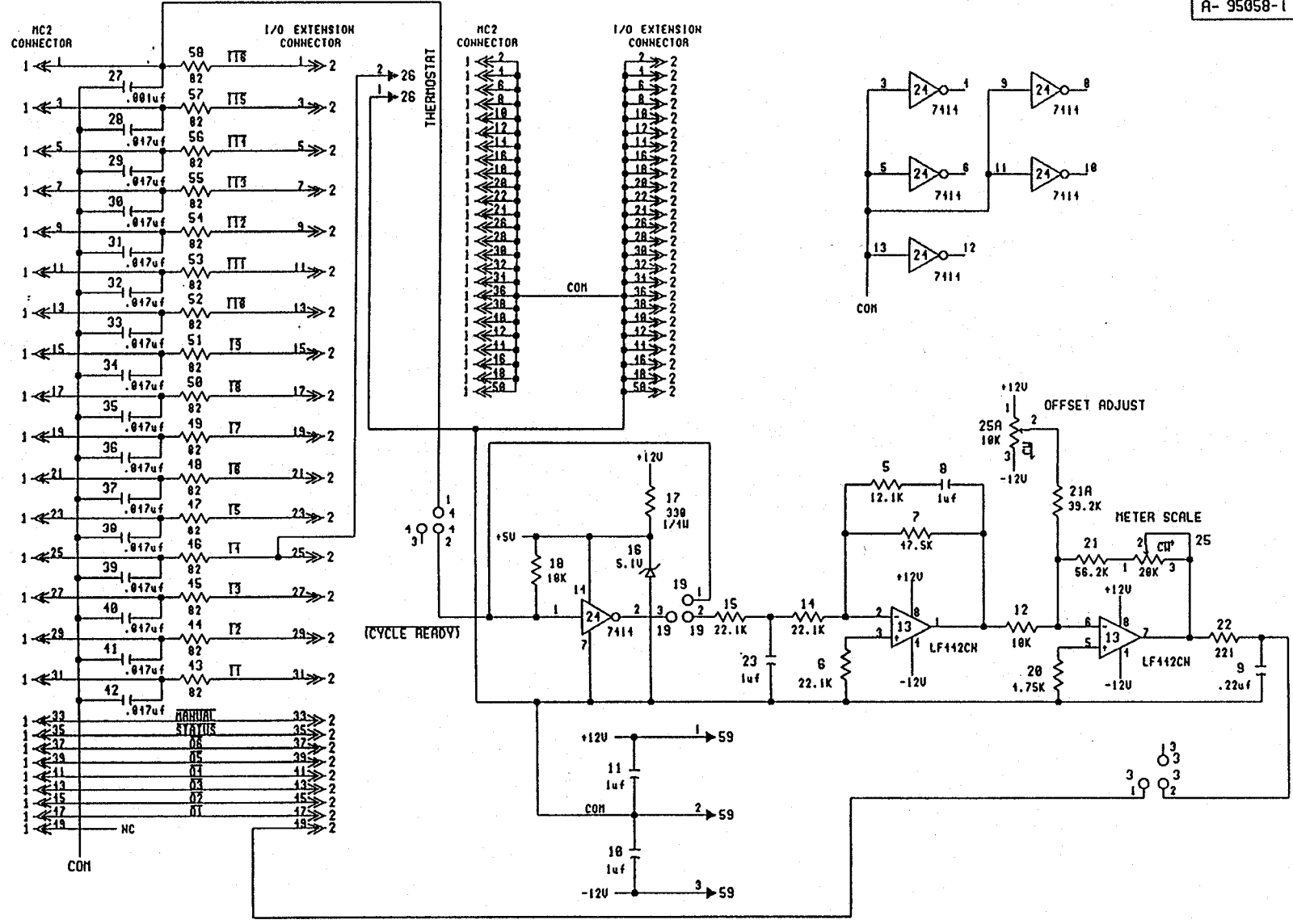
1. Visually inspect card for workmanship. Install jumper #4 from 1-2; install jumper #19 from 2-3 and jumper #3 from 1-2.

2. Connect ±12 vdc at connector #59.
3. Connect multimeter + to pin 49 of 50 pin connector #2.
4. Connect signal generator "hi" to pin #1 of connector #2 and generator "lo" to pin #2 of connector #2.
5. Apply power to card and adjust R25A (offset) for 0.0 volts at the output with signal generator connection open.
6. Adjust the signal generator for waveform in Figure 9.1 and connect to input as in step #4.
7. Adjust R25 (gain) for 5.0 vdc at meter out.
8. Seal pots. R25 and R25A.
9. Check that R43-R58 are 82 ohms and capacitors C28-C42 are .047µf and C27 is .001µf.



**Figure 9.1. Signal Generator Waveform**



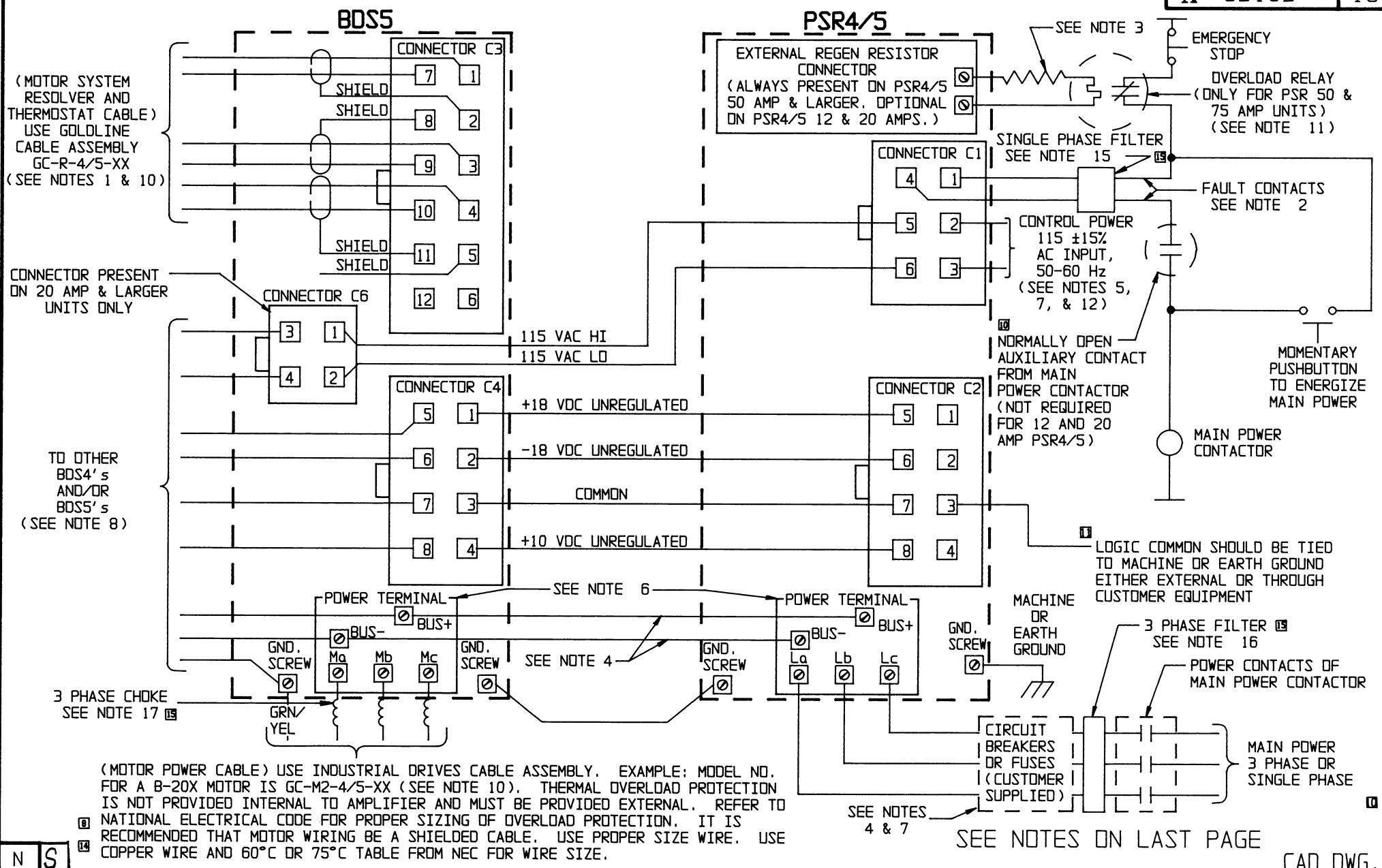


CAD DWG PROPRIETARY INFORMATION

Kollmorgen Industrial Drives  
 RADFORD, VIRGINIA

SCHEMATIC FOR BDSS-EXT1-I/O W/HP MET. DR.

COPY CODE	REV	ECH. NO.	DATE	APP'D	CHK'D BY	DATE	CHK'D BY	DATE	APP'D	DATE	REV. NO.	SHT. OF	TOTAL
	2	85828	5-12-81		LLS	11-12-93					A-95058-1	1	2



(MOTOR POWER CABLE) USE INDUSTRIAL DRIVES CABLE ASSEMBLY. EXAMPLE: MODEL NO. FOR A B-20X MOTOR IS GC-M2-4/5-XX (SEE NOTE 10). THERMAL OVERLOAD PROTECTION IS NOT PROVIDED INTERNAL TO AMPLIFIER AND MUST BE PROVIDED EXTERNAL. REFER TO NATIONAL ELECTRICAL CODE FOR PROPER SIZING OF OVERLOAD PROTECTION. IT IS RECOMMENDED THAT MOTOR WIRING BE A SHIELDED CABLE. USE PROPER SIZE WIRE. USE COPPER WIRE AND 60°C OR 75°C TABLE FROM NEC FOR WIRE SIZE.

N	S	Q	K	C	I	COPY CODE	ISS.	ECN NO.	DATE	APP'D.
		ISS.	ECN NO.	DATE	APP'D.	2	83906 V. ALLIE	3-12-91	G.H.E.	
7		84451	TDG	4-30-92	CJF	3	83964 V. ALLIE	4-17-91	C.J.F.	
8		84719	EWR	9-01-92	CJF	4	84008 V. ALLIE	5-21-91	G.H.E.	
9		84826	TDG	10-29-92	RCF	5	84051 V. ALLIE	7-01-91	C.J.F.	
10		84924	TDG	1-11-93	CJF	6	84129 EWR	8-21-91	G.H.E.	

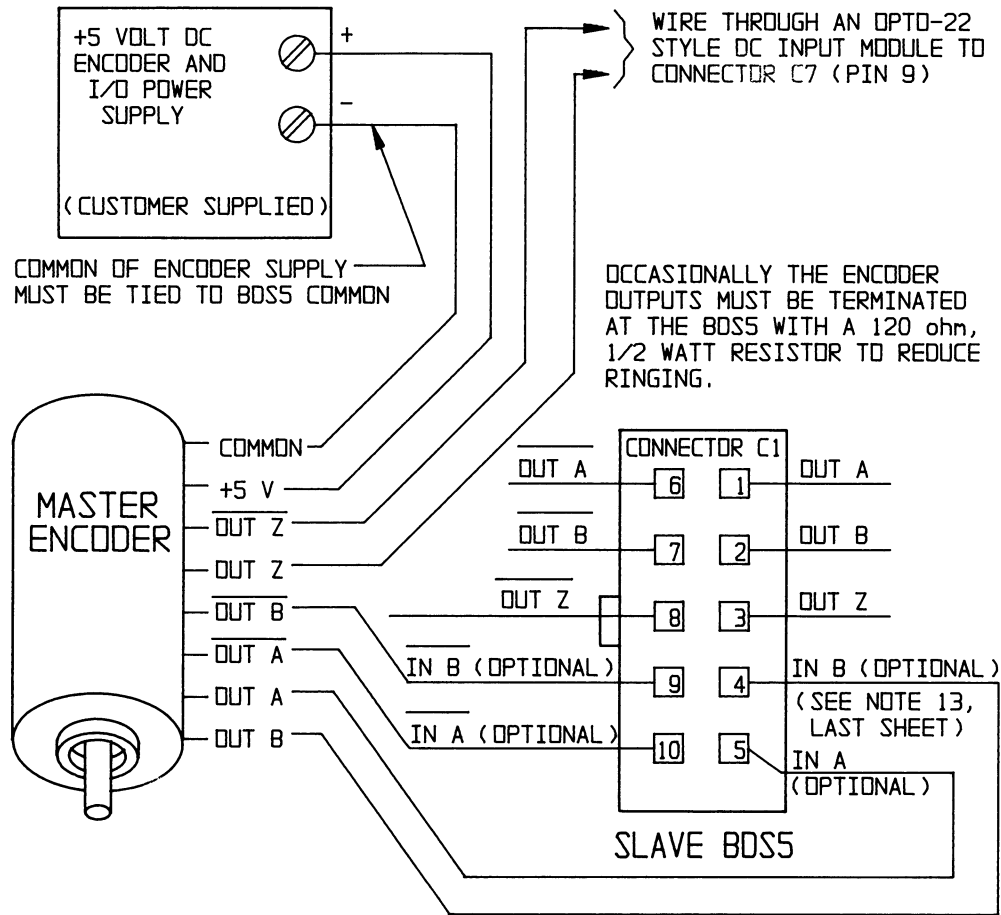
**Kollmorgen Industrial Drives**  
**RADFORD, VIRGINIA**

OWN. BY:	DATE	CHK. BY:	DATE	APP'D. BY:	DATE
VA	1-09-91	FDD	1-10-91	GHE	1-11-91

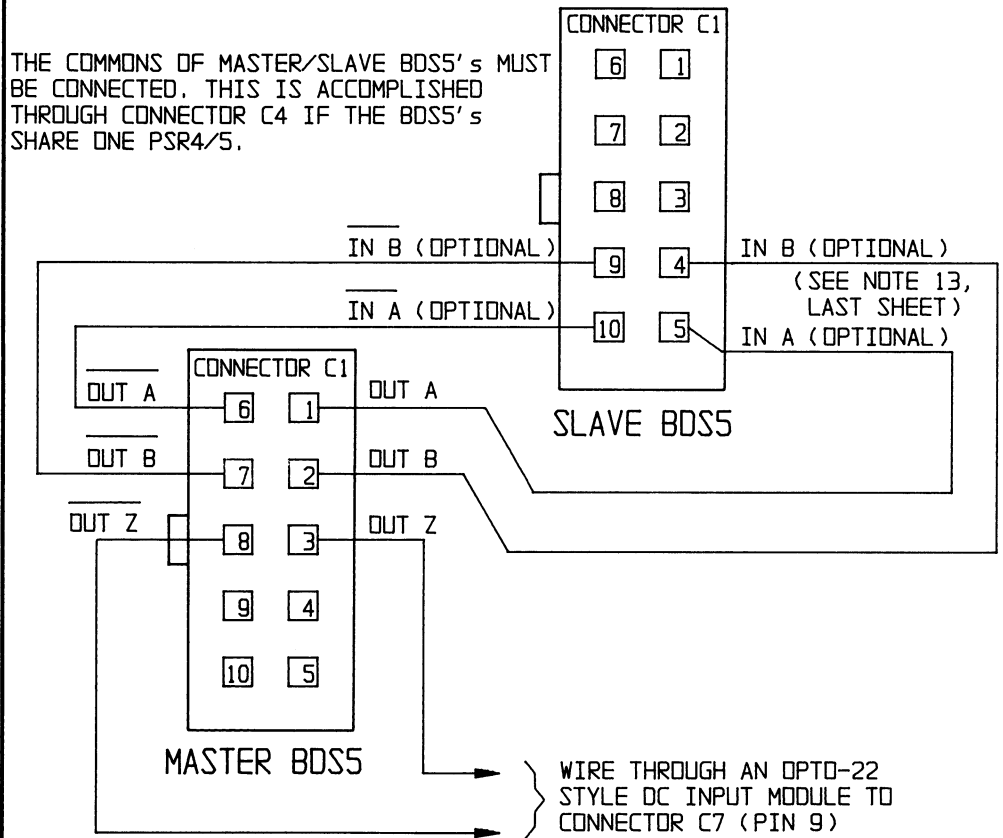
**BDS5 WIRING DIAGRAM**  
 (PSR4/5 & MOTOR CONNECTIONS)

SCALE	DWG. NO.	SHEET 1 OF 8	ISSUE
1:1	<b>A-93103</b>		15

CAD DWG.

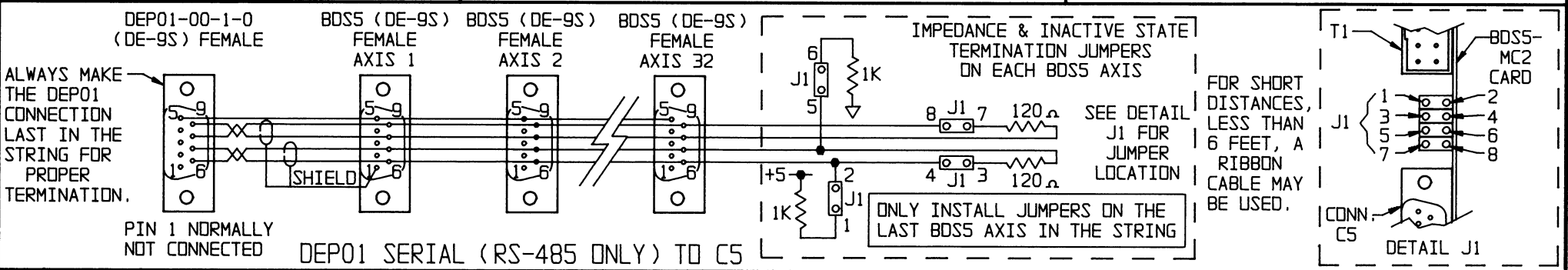
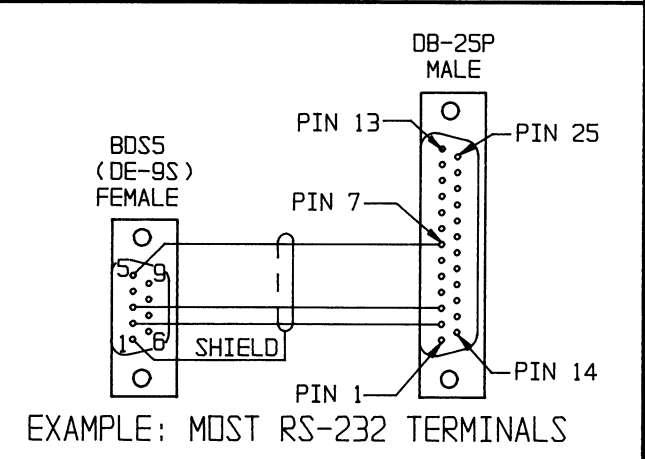
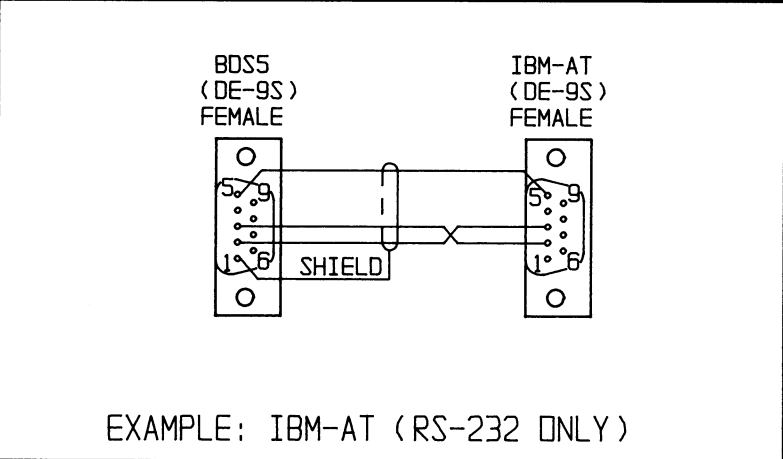
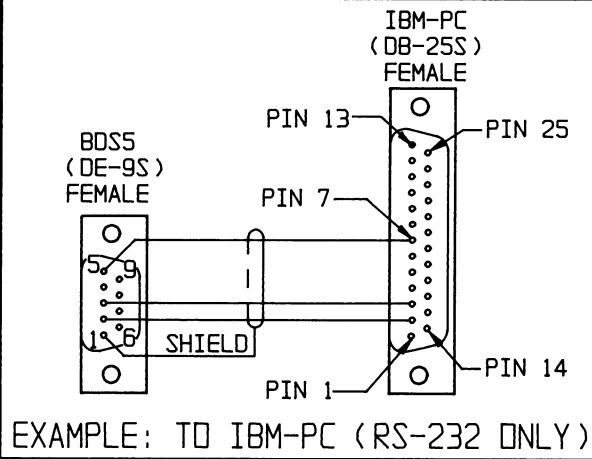
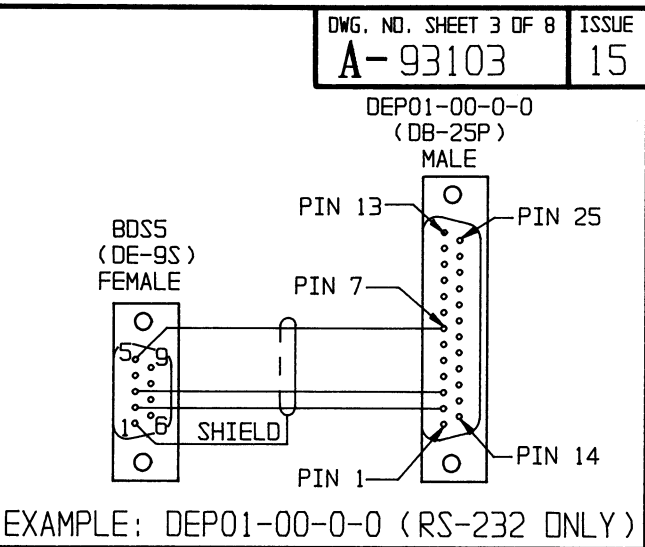
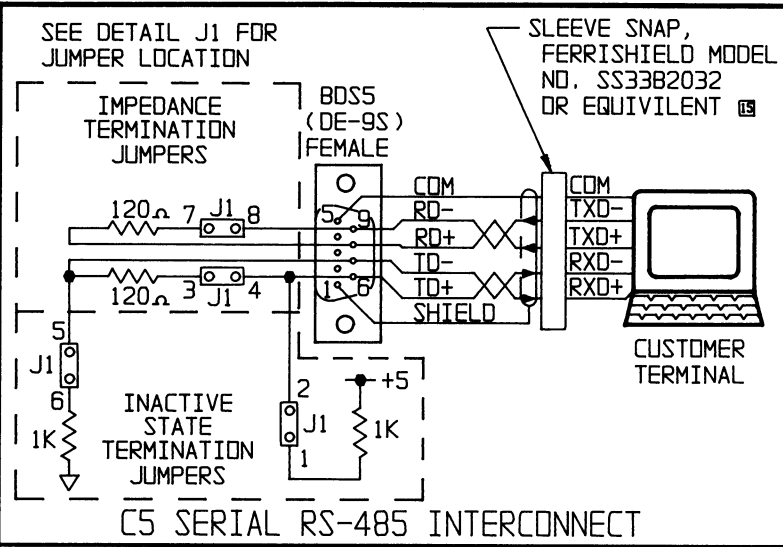
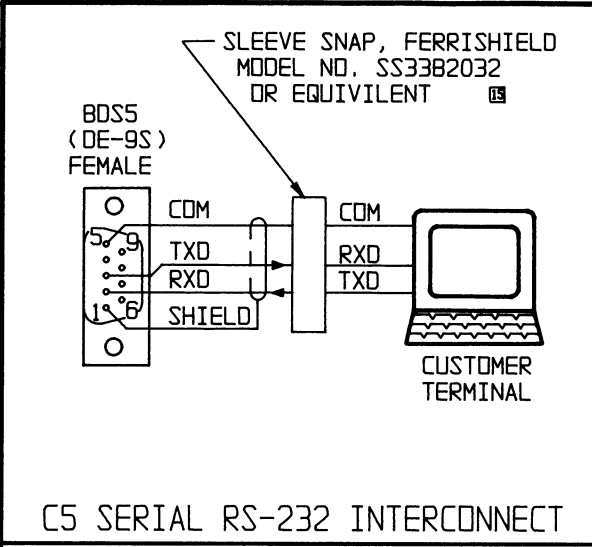


MASTER ENCODER AND SLAVE BDS5



MASTER BDS5 AND SLAVE BDS5

ISS.	ECN NO.	DATE	APP'D.	COPY CODE	ISS.	ECN NO.	DATE	APP'D.	<b>Kollmorgen Industrial Drives</b> <b>RADFORD, VIRGINIA</b>	BDS5 WIRING DIAGRAM (C1 ENCODER EQUIVALENT)					
					11	85228 TOG	5-7-93	SCM		SCALE	DWG. NO.	SHEET 2 OF 8	ISSUE		
					12	85244 LLS	5-18-93	SCM		1:1	<b>A-93103</b>		15		
					13	85698 LLS	3-16-94	SGD		OWN. BY:	DATE	CHK. BY:	DATE	APP'D. BY:	DATE
					14	85972 MAW	6-14-94	SCM		VA	1-25-91				
					15	87558 RRH	1-02-96	SCM							



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**Kollmorgen Industrial Drives**  
 RADFORD, VIRGINIA

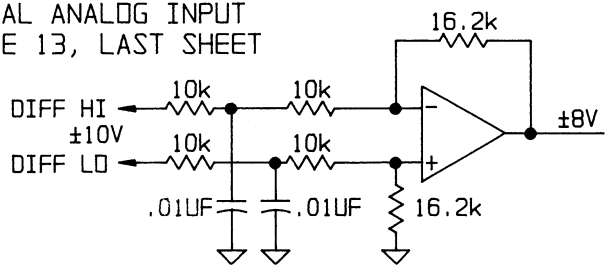
OWN. BY:	DATE	CHK. BY:	DATE	APP'D. BY:	DATE
VA	1-25-91				

**BDS5 WIRING DIAGRAM**  
 (C5 SERIAL PORT)

SCALE	DWG. NO.	SHEET 3 OF 8	ISSUE
1:1	A-93103		15

OPTIONAL ANALOG INPUT  
 SEE NOTE 13, LAST SHEET

SCHEMATIC OF OPTIONAL ANALOG INPUT CARD (BDS5-OPT1). THE ANALOG INPUT IS SCALED FOR  $\pm 10$  VOLTS = FULL SCALE. IF YOU USE THE ANALOG INPUT, SEE APPENDIX F OF THE BDS5 MANUAL FOR INSTRUCTIONS ON HOW TO CONFIGURE THE BDS5 AS A VELOCITY DRIVE.



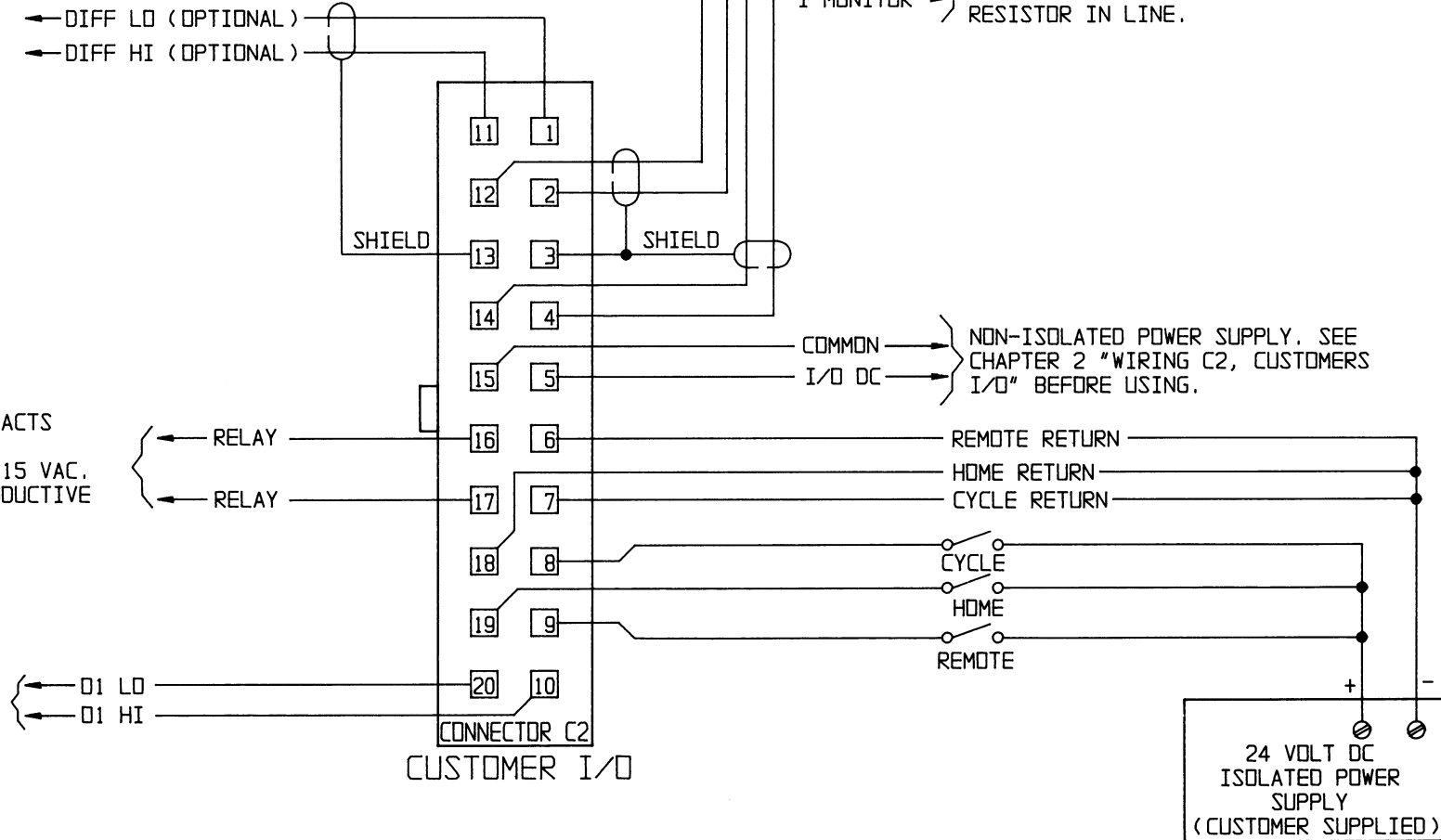
← DIFF LO (OPTIONAL)  
 ← DIFF HI (OPTIONAL)

TACH MONITOR IS A COMMON-REFERENCED SIGNAL SCALED FOR 1000 RPM CLOCKWISE = +1 VOLT. THIS SIGNAL HAS A 1k ohm RESISTOR IN LINE AND A 4700PF FILTER CAPACITOR CONNECTED TO COMMON.

I MONITOR IS A COMMON-REFERENCED SIGNAL SCALED FOR FULL CURRENT = 5 VOLTS. THIS SIGNAL HAS A 3.01k ohm RESISTOR IN LINE.

THE HARDWARE WATCHDOG RELAY CONTACTS CAN DRIVE UP TO 1 AMP RESISTIVE, AND THE CONTACTS ARE RATED FOR 115 VAC. THE RELAY MUST BE DERATED FOR INDUCTIVE LOADS.

D1 IS AN OPTICALLY ISOLATED OUTPUT. IT IS A SOLID STATE RELAY RATED FOR 0.25 AMPS AND 30 VDC. YOU MUST OBSERVE POLARITY WHEN CONNECTING D1.

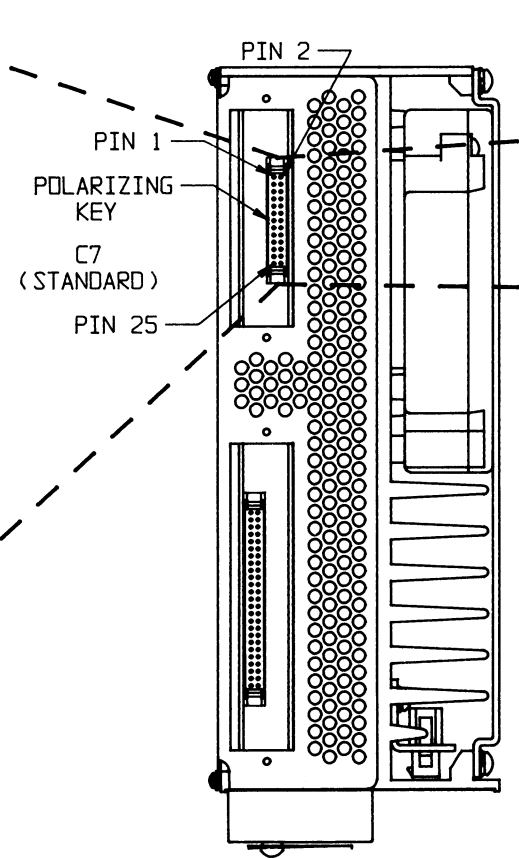


CUSTOMER I/O

24 VOLT DC  
 ISOLATED POWER  
 SUPPLY  
 (CUSTOMER SUPPLIED)

COPY CODE				ISS.	ECN NO.	DATE	APP'D.	<b>Kollmorgen Industrial Drives</b> RADFORD, VIRGINIA	BDS5 WIRING DIAGRAM (CONNECTOR C2)								
ISS.	ECN NO.	DATE	APP'D.						OWN. BY:	DATE	CHK. BY:	DATE	APP'D. BY:	DATE	SCALE	DWG. NO.	SHEET 4 OF 8
								VA	1-31-91					1:1	A-93103		15

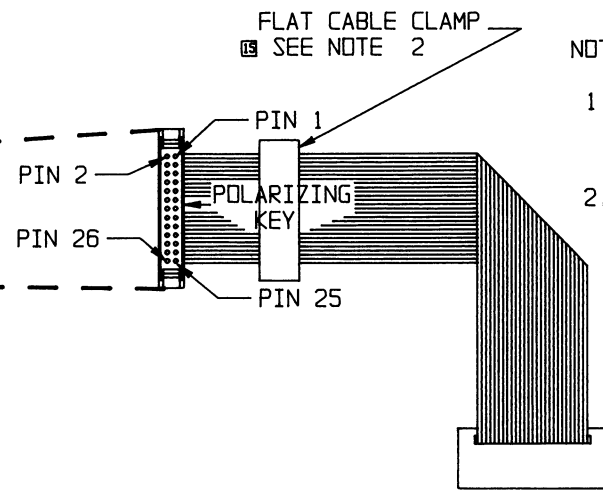
PIN	SIGNAL
1	N/C
3	N/C
5	N/C
7	N/C
9	HOME
11	LIMIT
13	CYCLE
15	MOTION
17	GATE
19	08
21	07
23	CYCLE READY
25	N/C
EVEN PINS	SIGNAL RETURN/ COMMON



TOP VIEW OF BOSS  
 (20-AMP UNIT SHOWN)

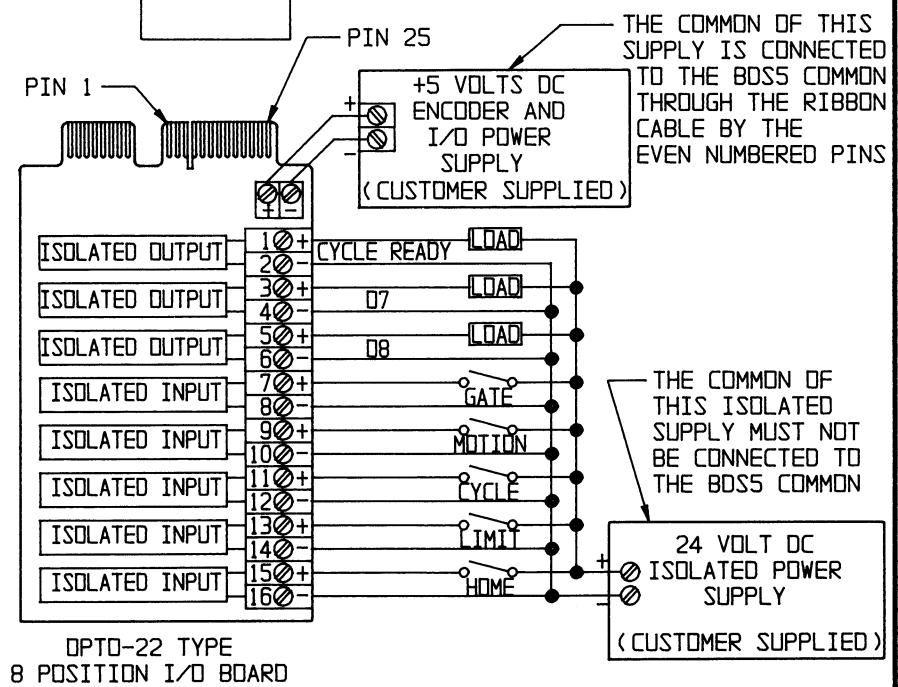
A WIDE SELECTION OF ISOLATION MODULES, BOTH INPUT AND OUTPUT, ARE AVAILABLE FROM SEVERAL SOURCES. A TYPICAL I/O CONFIGURATION, USING DC ISOLATION MODULES, IS ILLUSTRATED. HOWEVER, YOUR I/O IS NOT LIMITED TO ONLY DC MODULES AS THE FOLLOWING LIST INDICATES.

MODULE TYPE	INPUT MODULE	LOAD VOLTAGE
INPUT AC	90-280VAC	N/A
OUTPUT AC	N/A	120-240VAC
INPUT DC	3-32VDC	N/A
OUTPUT DC	N/A	10-60VDC



NOTES:

1. VFSS USES PIN 23 CYCLE READY AS METER DRIVE INPUT. (CONNECT TO PIN 1 OF C8 ON BOSS5-EXT1-I/O CARD).
2. CLAMP NEEDS TO BE AS CLOSE TO AMPLIFIER AS POSSIBLE, CLAMP NEEDS TO BE FERRISHIELD MODEL NO. FA2882480 OR EQUIVALENT



ISS.	ECN NO.	DATE	APP'D.	COPY CODE	ISS.	ECN NO.	DATE	APP'D.

**Kollmorgen Industrial Drives**  
 RADFORD, VIRGINIA

OWN. BY: DATE  
 VA 2-7-91

CHK. BY: DATE

APP'D. BY: DATE

**BOSS5 WIRING DIAGRAM**  
 (C7 STANDARD I/O)

SCALE 1:1

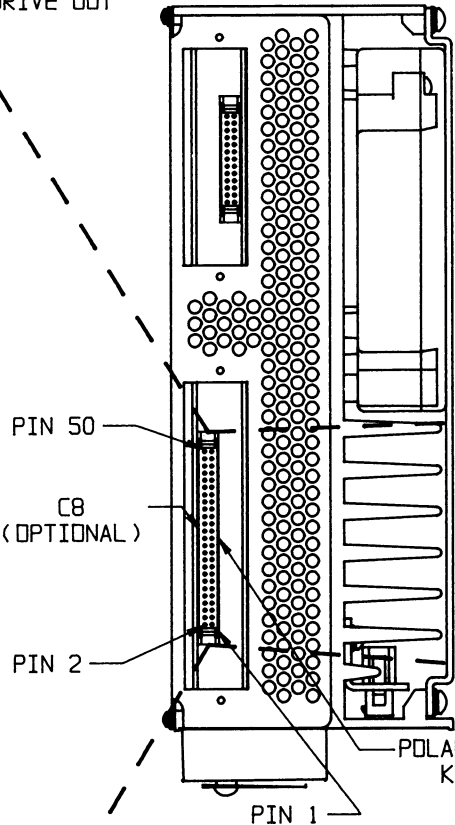
DWG. NO. SHEET 5 OF 8  
**A-93103**

ISSUE 15

NOTES:

1. VFSS USES BDSS-EXT1-I/O WITH FILTERED INPUTS AND POWER METER DRIVER.
2. INPUT #16 (PIN 1) IS POWER METER INPUT. PIN 49 IS METER DRIVE OUT

PIN	SIGNAL
49	MET. OUT
47	O1
45	O2
43	O3
41	O4
39	O5
37	O6
35	STATUS
33	MANUAL
31	I1
29	I2
27	I3
25	I4
23	I5
21	I6
19	I7
17	I8
15	I9
13	I10
11	I11
9	I12
7	I13
5	I14
3	I15
1	I16 *
EVEN PINS	SIGNAL RETURN/COMMON

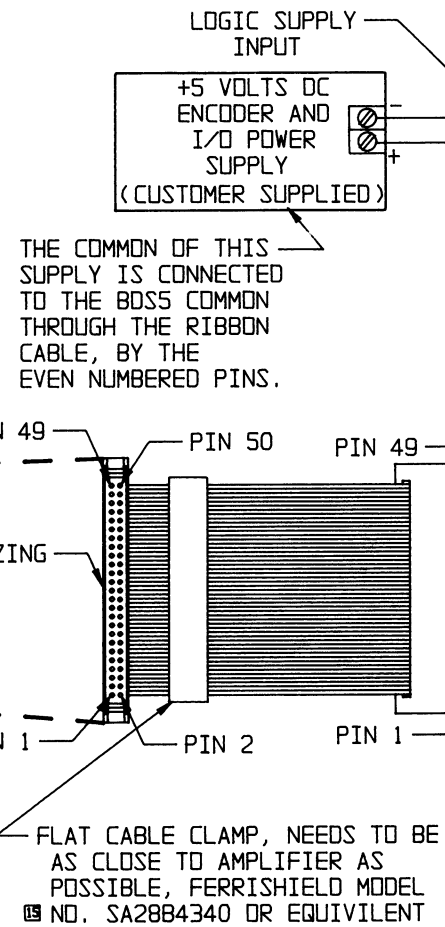


TOP VIEW OF BDSS (20-AMP UNIT SHOWN)

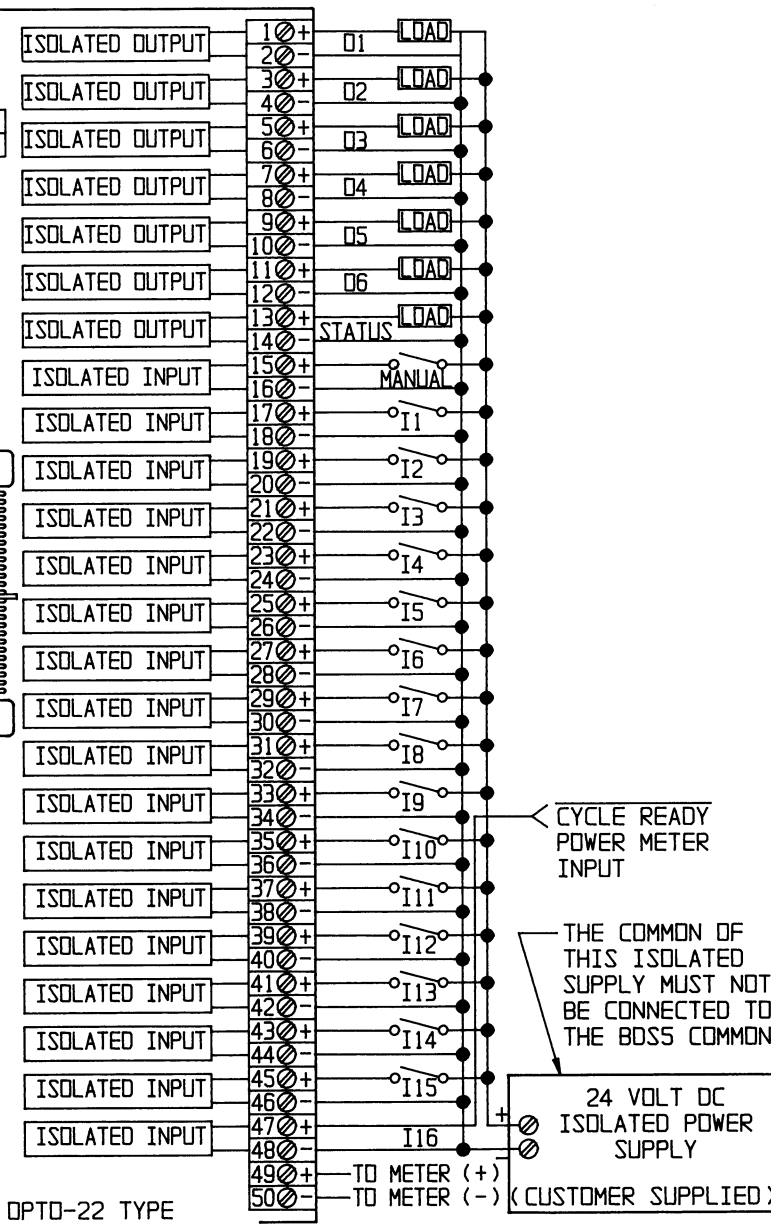
A WIDE SELECTION OF ISOLATION MODULES, BOTH INPUT AND OUTPUT, ARE AVAILABLE FROM SEVERAL SOURCES. A TYPICAL I/O CONFIGURATION, USING DC ISOLATION MODULES, IS ILLUSTRATED. HOWEVER, YOUR I/O IS NOT LIMITED TO ONLY DC MODULES AS THE FOLLOWING LIST INDICATES.

MODULE TYPE	INPUT MODULE	LOAD VOLTAGE
INPUT AC	90-280VAC	N/A
OUTPUT AC	N/A	120-240VAC
INPUT DC	3-32VDC	N/A
OUTPUT DC	N/A	10-60VDC

\* POWER METER INPUT ON VFSS ONLY



OPTO-22 TYPE 24 POSITION I/O BOARD



24 VOLT DC ISOLATED POWER SUPPLY (CUSTOMER SUPPLIED)

ISS.	ECN NO.	DATE	APP'D.

**Kollmorgen Industrial Drives**  
 RADFORD, VIRGINIA

**BDSS WIRING DIAGRAM**  
 (C8 OPTIONAL I/O)

OWN. BY:	DATE	CHK. BY:	DATE	APP'D. BY:	DATE	SCALE	DWG. NO.	SHEET 6 OF 8	ISSUE
VA	2-7-91					1:1	<b>A-93103</b>		15

NOTES:

(ALL WIRES TO BE COPPER WITH MIN. TEMP RATING OF 60°C)

DWG. NO. SHEET 7 OF 8 ISSUE  
**A-93103** 15

1. **WARNING:** THE MOTOR THERMOSTAT AUTOMATICALLY RESETS WHEN THE MOTOR COOLS. THE CUSTOMER IS RESPONSIBLE FOR LATCHING THIS SIGNAL TO INHIBIT OPERATION AFTER A MOTOR THERMOSTAT FAULT. CONNECT THERMOSTAT USING TWISTED PAIR WIRE.
  2. **CAUTION:** THE PSR4/5 FAULT CONTACTS (RATED 115 VAC 1AMP) MUST BE WIRED IN SERIES WITH THE OVERLOAD RELAY AS SHOWN ON SHEET 1. ON 12 & 20 AMP PSR4/5; THIS CONTACT IS NORMALLY OPEN AND WILL CLOSE WITHIN 250 MSEC. AFTER APPLICATION OF CONTROL AND MAIN POWER. THIS CONTACT OPENS IN FAULT CONDITIONS. ON 50 & 75 AMP PSR4/5 THIS CONTACT CLOSURES ON APPLICATION OF CONTROL POWER AND WILL OPEN IN FAULT CONDITION.
  3. **CAUTION:** RESISTOR IS CONNECTED TO HIGH VOLTAGE; ENSURE SUFFICIENT ELECTRICAL CLEARANCE WHEN MOUNTING. RESISTOR MAY BECOME VERY HOT DURING OPERATION. DO NOT MOUNT NEAR MATERIALS THAT ARE FLAMMABLE OR DAMAGED BY HEAT. VENTILATION MAY BE REQUIRED. SEE WIRING DRAWING FOR SPECIFIC REGEN RESISTOR KIT. EACH KIT HAS DIFFERENT SERIES/PARALEL RESISTOR CONNECTIONS TO OBTAIN SPECIFIC RESISTANCE AND POWER RATING.
  4. WIRE SIZES, BREAKERS AND FUSES FOR PSR4/5:  
 PSR4/5-X12 HAS A MAXIMUM MAIN POWER INPUT CURRENT OF 12 AMPS RMS,  
 PSR4/5-X20 HAS A MAXIMUM MAIN POWER INPUT CURRENT OF 20 AMPS RMS,  
 PSR4/5-X50 HAS A MAXIMUM MAIN POWER INPUT CURRENT OF 50 AMPS RMS,  
 PSR4/5-X75 HAS A MAXIMUM MAIN POWER INPUT CURRENT OF 75 AMPS RMS.  
  
 THE ACTUAL APPLICATION MAY REQUIRE LESS CURRENT. USE 600 VAC INSULATED WIRE AND REFER TO LOCAL ELECTRICAL CODES FOR PROPER WIRE SIZE FOR THE CURRENTS LISTED ABOVE. FUSES FOR MAIN POWER SHOULD BE A U.L. RATED TIME DELAY TYPE, SUCH AS, BUSS FRN-R SERIES.  
  
 THE POWER BUS BETWEEN A PSR4/5 AND BDS5 SHOULD USE THE FOLLOWING WIRE GAUGE WITH 600 VAC INSULATION:  
 PSR4/5-X12, 14 AWG (OR LARGER) WIRE,  
 PSR4/5-X20, 10 AWG WIRE,  
 PSR4/5-X50, BUS BARS SUPPLIED WITH UNIT, OR 8 AWG (OR LARGER) WIRE,  
 PSR4/5-X75, BUS BARS SUPPLIED WITH UNIT, OR 8 AWG (OR LARGER) WIRE.
  5. ALL SIGNAL AND CONTROL WIRES TO BE 22-18 AWG WIRE. THE CRIMP TERMINALS FOR 22-18 AWG WIRE ARE SUPPLIED FOR USE WITH BDS5 CONNECTORS C1, C2, C3, C4, C6 AND PSR4/5 CONNECTORS C1 AND C2. FOR 16 AWG WIRE USE MOLEX #39-00-0078 TERMINALS.
  6. IN THE BDS5 3 AMP THRU 20 AMP AND THE PSR4/5 12 AMP AND 20 AMP, THE SCREWS IN THE POWER TERMINAL BLOCKS ARE CAPTIVE. DO NOT ATTEMPT TO REMOVE THEM TO USE RING TERMINALS. USE LOCKING SPRING SPADE TERMINALS SUCH AS HOLLINGSWORTH #XSS20954S OR #SS20947SF FOR 16 AWG WIRE AND #XSS20836 OR #SS20832F FOR 12/10 AWG WIRE.
  7. ALL AC LINES SHOULD BE TWISTED CABLES.
  8. THE TOTAL NUMBER OF AXES ALLOWED, PER PSR4/5, DEPENDS ON THE PSR4/5 MODEL AND THE COMBINATION OF BDS4's AND/OR BDS5's:  
 PSR4/5-X12: A MAXIMUM OF 4 BDS4s OR 3 BDS5s,  
 PSR4/5-X20: A MAXIMUM OF 4 BDS4s OR 3 BDS5s,  
 PSR4/5-X50: A MAXIMUM OF 6 BDS4s OR 6 BDS5s,  
 PSR4/5-X75: A MAXIMUM OF 6 BDS4s OR 6 BDS5s.  
 (IF THE BDS's ARE MIXED, THEN THE TOTAL NUMBER OF AXES THAT CAN BE USED WOULD BE THE MAXIMUM GIVEN FOR THE BDS5s.)  
 AXIS EXPANSION ON THE PSR4/5 50 AND 75 AMP UNITS ARE ALSO LIMITED TO A MAXIMUM OF 4 BDS4s OR 3 BDS5s ON EITHER SIDE OF THE PSR4/5.
  9. THE BDS5 IS CONFIGURED AT THE FACTORY FOR EITHER RS-232 OR RS-485.
  10. XX IN THE CABLE NUMBER STANDS FOR CABLE LENGTH IN METERS. CABLE LENGTH IS AVAILABLE FROM 3 TO 75 METERS IN INCREMENTS OF 3 METERS.
  11. A THERMAL OVERLOAD RELAY IS SUPPLIED IN THE REGEN RESISTOR KIT FOR THE 50 AND 75 AMP PSR4/5's. THE THERMAL OVERLOAD RELAY, INCLUDED IN THE KIT, WAS SIZED FOR YOUR RESISTANCE AND POWER RATING. THE OUTPUT CONTACTS OF THE RELAY MUST BE WIRED TO DROP POWER TO THE MAIN POWER CONTACTOR IN A FAULT CONDITION, AS SHOWN ON SHEET 1.
  12. DO NOT WIRE CONTROL POWER (PSR4/5 CONNECTOR C1) THROUGH THE MAIN POWER CONTACTOR. THIS IS SO THAT CONTROL POWER WON'T BE REMOVED IF PSR4/5 FAULT CONTACTS OPEN (THIS WOULD TURN OFF ANY FAULT LED'S).
  13. IF THE BDS5 USES THE OPTIONAL ANALOG INPUT CARD (BDS5-OPT1), THE OPTIONAL ENCODER INPUTS IN CONNECTOR C1 ARE NOT USED.
  14. RECOMMENDED TORQUES FOR CONNECTION TO TERMINAL BLOCKS AND GROUND.
    - A. BDS4/5-3 TO 20 AMP AND PSR4/5-12 AND 20 AMP  
 MAX TORQUE PER UL IS 12 IN/LB, EXTERNAL REGEN, MAIN POWER AND BUS CONNECTION.  
 MAX TORQUE 12 IN/LB GROUND SCREW
    - B. BDS4/5-30 TO 55 AMP  
 MAX TORQUE 20 IN/LB MOTOR, BUS CONNECTION AND GROUND STUD
    - C. PSR4/5-50 TO 75 AMP  
 MAX TORQUE 20 IN/LB MAIN POWER, BUS CONNECTION AND GROUND STUD  
 MAX TORQUE 12 IN/LB EXTERNAL REGEN CONNECTION
- FOR GROUNDING TO MACHINE OR EARTH GROUND, A SCREW LUG SHOULD BE ATTACHED TO GROUND SCREW OR STUD. RECOMMENDED TORQUE OF 12 IN/LB FOR GROUND SCREWS AND 20 IN/LB FOR GROUND STUDS. MAY ALSO REFER TO NATIONAL ELECTRICAL CODE (NEC) OR UL STANDARD 486B FOR RECOMMENDED TORQUES
- THERMAL OVERLOAD PROTECTION DOES NOT PROVIDE INTERNAL TO AMPLIFIER AND MUST BE PROVIDED EXTERNAL. REFER TO NATIONAL ELECTRICAL CODE FOR PROPER SIZING OF OVERLOAD PROTECTION.

COPY CODE				ISS.	ECN NO.	DATE	APP'D.	Kollmorgen Industrial Drives RADFORD, VIRGINIA	BDS5 WIRING DIAGRAM (NOTES PG. 1)								
ISS.	ECN NO.	DATE	APP'D.						OWN. BY:	DATE	CHK. BY:	DATE	APP'D. BY:	DATE	SCALE	DWG. NO.	SHEET 7 OF 8
								VA	2-13-91					1:1	A-93103		15



NOTES:

( ALL WIRES TO BE COPPER WITH MIN. TEMP RATING OF 60°C )

DWG. NO.	SHEET 8 OF 8	ISSUE
A-93103		15

15. USE A CORCOM SR1 SINGLE PHASE FILTER OR EQUIVILENT  
(FOR CE REQUIREMENTS)

16. USE A SHAFFNER THREE PHASE FILTER OR EQUIVILENT  
 MODEL NO. 258-16/07 FOR PSR4/5A-112 & 212,  
 MODEL NO. 258-30/77 FOR PSR4/5A-120 & 220,  
 MODEL NO. 258-55/07 FOR PSR4/5A-250,  
 MODEL NO. 258-75/34 FOR PSR4/5A-275  
 (FOR CE REQUIREMENTS)

17. USE A SCHAFFNER THREE PHASE CHOKE OR EQUIVILENT  
 MODEL NO. RD 7137-6-12n0 OR RD 7137-36-0n5 FOR BDS5A-103, 203, 106, & 206,  
 MODEL NO. RD 7137-10-6n6 OR RD 7137-36-0n5 FOR BDS5A-110 & 210,  
 MODEL NO. RD 7137-25-1n3 OR 7137-36-0n5 FOR BDS5A-120 & 220,  
 MODEL NO. RD 7137-36-0n5 FOR BDS5A-230,  
 MODEL NO. RD 8137-64-0n5 FOR BDS5A-240 & 255,  
 (FOR CE REQUIREMENTS)

		COPY CODE		ISS.	ECN NO.	DATE	APP'D.	<b>Kollmorgen Industrial Drives</b> RADFORD, VIRGINIA				BDS5 WIRING DIAGRAM (NOTES PG. 2)					
ISS.	ECN NO.	DATE	APP'D.									OWN. BY:	DATE	CHK. BY:	DATE	APP'D. BY:	DATE
								RRH	1-02-96					1:1	A-93103		15



TEST LIMITS AND MODIFICATION DATA  
FOR VF55 INDUCTION MOTOR CONTROLLER

TL VF55-255-90120-2604A\*

ISSUE 2 SH 1 OF 5

WRITTEN BY S. Dalton

APPROVED BY [Signature]

\*Firmware version shown in this area of Model Number.

MOTOR DATA :

MODEL	<u>V-2604A</u>	
MAXIMUM SPEED	<u>10000</u>	RPM
CONTINUOUS TORQUE	<u>95</u>	LB.FT.
ROTOR INERTIA	<u>0.119</u>	LB.FT.SEC. <sup>2</sup>
LOAD INERTIA RANGE	<u>0.014</u>	LB.FT.SEC. <sup>2</sup>

AMPLIFIER DATA :

MODEL	<u>255</u>		
TACH MONITOR	<u>2000</u>	RPM/VOLT	C2-PIN 2
CURRENT MONITOR	<u>22</u>	AMPS RMS/VOLT	C2-PIN 4
CONTINUOUS CURRENT	<u>55</u>	AMPS RMS/PHASE OR	<u>50%</u>
PEAK CURRENT	<u>110</u>	AMPS RMS/PHASE OR	<u>100%</u>
NOM. SYSTEM VOLTS	<u>230</u>	VOLTS RMS	
MAX. SYSTEM SPEED	<u>10000</u>	RPM AT NOM. SYSTEM VOLTS	

AMPLIFIER COMPENSATION :

CURRENT LOOP

A-PHASE	R7	<u>536K</u>	C8	<u>0.0033</u>	C9	<u>OPEN</u>
B-PHASE	R4	<u>536K</u>	C5	<u>0.0033</u>	C6	<u>OPEN</u>
C-PHASE	R1	<u>536K</u>	C2	<u>0.0033</u>	C3	<u>OPEN</u>

The following variables are listed in the UNPROTECTED VARIABLES section.

POSITION LOOP

PL = SOFTWARE SWITCH (Default Value = 0)  
KP = GAIN FOR POSITION LOOP

VELOCITY LOOP

KProp - DETERMINES PROPORTIONAL GAIN RANGE (1-32,000)  
Prop - SET TO 1 TO DISABLE INTEGRAL ACTION

LOW-PASS FILTERS INTEGRAL FREQUENCY (0-4095)

LPF = SOFTWARE SWITCH  
LPFHZ = HERTZ

SYSTEM SPEED

VOSPD = OVERSPEED is a user changeable variable up to 120% of VMAX.  
VMAX = MAXIMUM SYSTEM SPEED. This is a PROTECTED VARIABLE.

ECN : (2) 85733 3/31/94 SD:

TL VFS5-255-90120-2804A\*  
 ISSUE 2 SH 2 OF 5  
 TEST LIMITS AND MODIFICATION DATA

JUMPERS: RESOLVER CODING - RESOLVER RESOLUTION 12 BIT

EXAMPLE :  
 BDS5-203-00000-204A-J-LL  
 J IS THE RESOLVER RESOLUTION

	J	J38	J39	J69	J98	J9B
12 BIT	2	IN	OUT	OUT	IN	OUT
14 BIT	4	OUT	OUT	IN	OUT	IN

RS-485 JUMPERS J1 (3-4) OUT J1 (7-8) OUT

RELAY CODING  
 RELAY MODE JUMPER J1 (1-2) OUT

SPECIAL INSTRUCTIONS : MC2 R37 Change to 274K - 1% 1/8W  
 C59 Change to 560pf - 50V Ceramic  
 C19 Change to .022ufd - (SMD)  
 R3 Change to 56K - (SMD)

PERFORMANCE CURVES :

NOTE : The following parameters effect these performance curves.

PL ACC. DEC. AND ILIM

DISPLAYED PROFILE SCALING :

ACCEL/DECEL  
N/A RPM

LOAD INERTIA

N/A  
N/A ms/DIV  
N/A AMPS/DIV

TL VFS5-255-90120-2604A\*  
ISSUE 2 SH 3 OF 5

TEST LIMITS AND MODIFICATION DATA

Label VFS5-COMP 1, in the box provided, with amplifier current rating and motor compensation.

EXAMPLE :

MODEL :
255/2604A
REV. NO.

ADDENDUM :

Attached to this TL SHEET , please find a listing of VFS5 variables.

## VSF5 VARIABLES

```

;VSF5 V1.0.2C
;
;MOTOR      =      V-2604A
;
;AMPS       =      55
;VOLTS      =      230
;
;UNITS:
;
PNUM        =      1
PDEN        =      1
VNUM        =      44739
VDEN        =      10
ANUM        =      4474
ADEN        =      1000
INUM        =      4095
IDEN        =      100
PXNUM       =      1
PXDEN       =      1
VXNUM       =      131070
VXDEN       =      10
;
;UNPROTECTED VARIABLES:
;
ABAUD       =      0
ACC         =      100000
ADDR        =      0
AMAX        =      100000
BAUD        =      9600
CAP         =      0
CAPDIR      =      1
CLAMP       =      0
DEC         =      4500
DEP         =      0
DIR         =      1
DTIMER      =      15000
ECHO        =      1
EXTDX       =      0
EXTLOOP     =      0
FAULT       =      0
GATEMODE    =      0
GEAR        =      0
GEARI       =      4096
GEARIC      =      2048
GEARIO      =      4096
GEARO       =      12000
GEAROC      =      30000
GEAROO      =      12000
GIMAGF      =      7735
ILIM        =      100
IMAG        =      18
KC          =      200
KP          =      2000
KPROP       =      5000
KV          =      7705
KVI         =      2500
LOAD        =      1
LPF         =      1
LPFHZ       =      100
MONITOR     =      0
MORNT       =      4
MSG         =      1
MTIMER      =      120000
MULTI       =      1
PECLAMP     =      100
PEMAX       =      32767
PEXT        =      0
PFB         =      0
PL          =      0
PLIM        =      0
PMAX        =      2000000000
PMIN        =      2000000000
PORNT       =      0
PROMPT      =      1
PROP        =      0
PROTARY     =      409600000
RAMP        =      1
REG         =      0
REGKHZ      =      1000
ROTARY      =      1
SCKSUM      =      0
SCRV        =      1
SLIPLIM     =      55555555
SS          =      0
STATMODE    =      0
TQ          =      0
TRC         =      0
TROTOR      =      75
VDEFAULT    =      200
VOFF        =      0
VORNT       =      500
VOSPD       =      11000
VUP         =      15

```

```
VUPH      =      15
VXAVGS    =      1
VXDENC    =      2
VXDENO    =     10
VXNUMC    =    131070
VXNUMO    =    131070
VZR       =      5
WATCH     =      0
WTIME     =     1000
ZERO      =      0
;
```

V-SERIES  
MOTOR CONECTOR (RESOLVER SIDE)

VFSS CONECTOR (C3)

