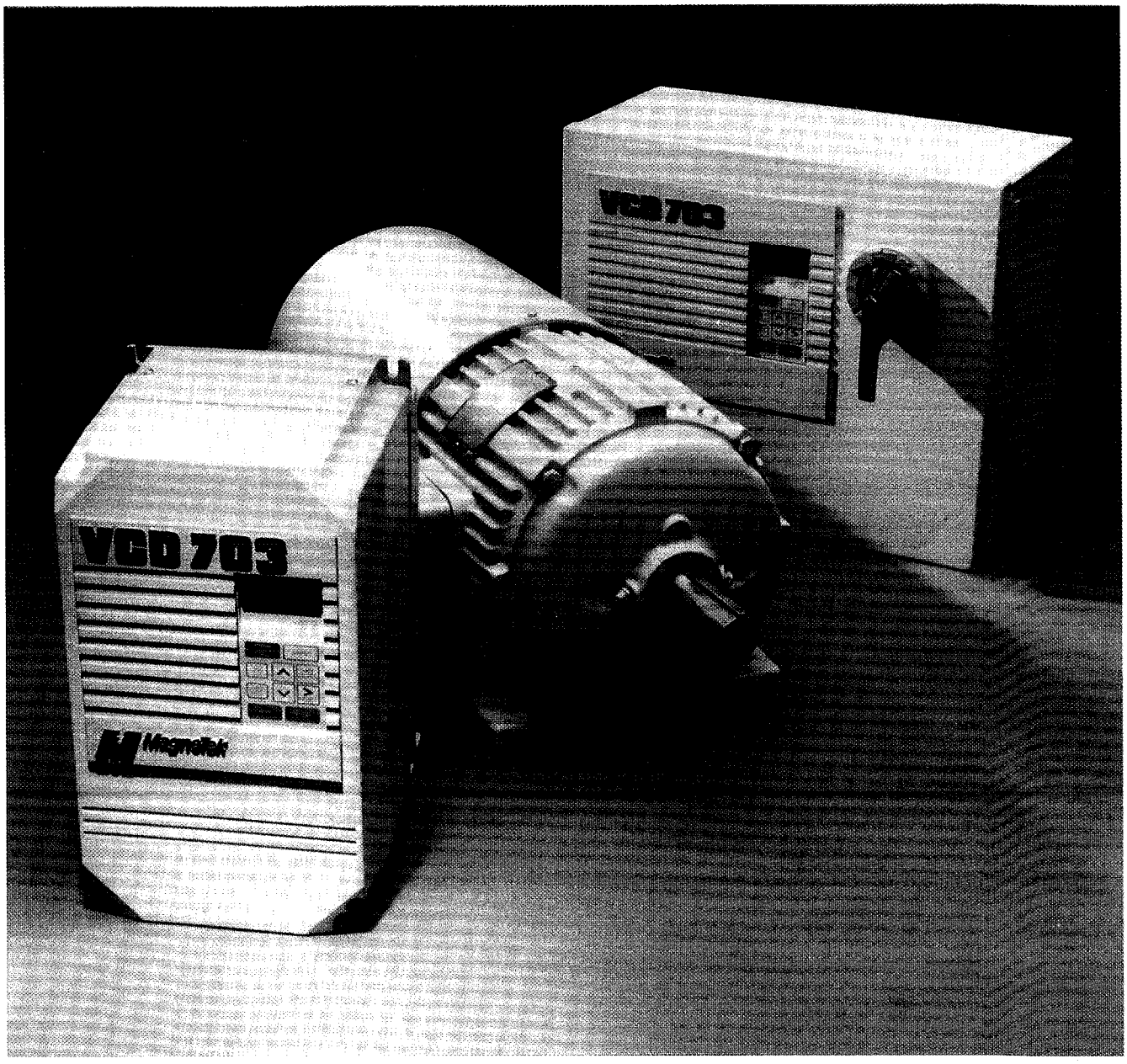
MagneTek

VCD 703
Technical Manual



QUICK REFERENCE FOR VCD 703 CONSTANTS

CONSTANT NUMBER	FACTORY SETTING	USER SETTING
An-01	0 00	
An-02	0.00	
An-03	0 00	
An-04	0 00	
An-05	0 00	
An-06	0 00	
An-07	0 00	
An-08	0 00	
An-09	10 00	
bn-01	10 0	
bn-02	10 0	
bn-03	10 0	
bn-04	10 0	
bn-05	20 with PG 10 w/o PG	
bn-06	1000	
bn-07	150 00	
bn-08	150 00	
bn-09	150 00	
bn-10	1 0000	
bn-11	Not Used	—
bn-12	10 0	
bn-13	1	
bn-14	Not Used	—
bn-15	0 00	
bn-16	1 000	
bn-17	23	
bn-18	1 000	
bn-19	0 0	
bn-20	1 1	
bn-21	Not Used	—
bn-22	22	
bn-23	1 000	
bn-24	23	
bn-25	1 000	
bn-26	2	
bn-27	1 000	
Sn-01	*(1)*	
Sn-02	FFF *(2)*	
Sn-03	0000	
Sn-04	0011	
Sn-05	0000	
Sn-06	0000 w PG 1000 w/o PG	
Sn-07	0000	
Sn-08	0010	
Sn-09	0000	
Sn-10	0111	
Sn-11	0000	
Sn-12	0100	

CONSTANT NUMBER	FACTORY SETTING	USER SETTING
Sn-13	0101	
Sn-14	1101	
Sn-15	03	
Sn-16	04	
Sn-17	06	
Sn-18	08	
Sn-19	00	
Sn-20	00	
Sn-21	01	
Sn-22	02	
Sn-23	06	
Sn-24	0d	
Sn-25	0000	
Sn-26	0001	
Sn-27	0000	
Sn-28	0000	
Sn-29 – Sn-32	Not Used	—
Sn-33	0000	
Sn-34	0001	
Sn-35 – Sn-36	Not Used	—
Sn-37	00	
Sn-38	0000	
Sn-39 – Sn-41	Not Used	—
Sn-42	0000	
Sn-43 – Sn-49	Not Used	—
Sn-50	1000	
Cn-01	2 00	
Cn-02	100 00	
Cn-03	2 00	
Cn-04	10 00	
Cn-05	109 00	
Cn-06	2 00	
Cn-07	4	
Cn-08	00	
Cn-09	1024	
Cn-10	0 00	
Cn-11	0 0	—
Cn-12	0	
Cn-13	0 0	
Cn-14	110	
Cn-15	60	
Cn-16	120	
Cn-17	210 (230V) 420 (460V)	

CONSTANT NUMBER	FACTORY SETTING	USER SETTING
Cn-18	1 00	
Cn-19	2 0 *(3)*	
Cn-20	0	
Cn-21	1 0	
Cn-22	20 with PG 10 w/o PG	
Cn-23	0	
Cn-24	5	
Cn-25	10	
Cn-26	0 0	
Cn-27	0	
Cn-28	80	
Cn-29	Not Used	—
Cn-30	100 0	
Cn-31	100 0	
Cn-32	100 0	
Cn-33	100 0	
Cn-34	100 0	
Cn-35 – Cn-44	Not Used	—
Cn-45	0 00	
Cn-46	0 00	
Cn-47	20	
Cn-48	0	
Cn-49	0	
Cn-50 – Cn-51	Not Used	—
Cn-52	*(5)*	
Cn-53	100 0	
Cn-54	100 0	
Cn-55	Not Used	—
Cn-56	0	
Cn-57	0	
dn-01 – dn-18	*(2)*	
dn-21 – dn-38	—	
dn-39 – dn-45	—	
dn-51 – dn-58	—	
On-01	0000	
On-02	0000 w PG 0001 w/o PG	
On-03	0010	
On-04	0000	
On-05	*(8)*	—

CONSTANT NUMBER	FACTORY SETTING	USER SETTING
On-06	*(8)*	—
On-07	50 00	
On-08	020	
On-09	0	—
On-10	1 00	
On-11	*(6)*	—
On-12	1 00	
On-13	120	
On-14	1 000	
On-15	1 000	
On-16	*(7)*	—
On-17	*(9)*	
On-18	*(9)*	
On-19	*(9)*	
On-20	*(9)*	
On-21	1 00	
On-22	*(9)*	
On-23 – On-25	Not Used	—
On-26	2 20	
On-27	1 0	
On-28 – On-29	Not Used	—
On-30	0010	
On-31 – On-33	Not Used	—
On-34 – On-40	*(9)*	—
On-41	Not Used	—
On-42	—	—
On-43	Not Used	—
On-44	—	—
On-45	Not Used	—
On-46	—	—
On-47	—	—
On-58	0FFF	
On-59	FFFF	
On-60	0000	
Un-01 – Un-41, Un-44, Un-49	*(4)*	—

(1) Setting depends on VCD 703 rating See Table A2-1 in Technical Manual

(2) Setting depends on vector control motor (VCM) selected All dn-XX (Motor Constants) settings are factory set See Appendix 2 in Technical Manual

(3) Factory setting for Momentary Power Loss Ride-thru Time (Cn-19) depends on VCD 703 rating (Sn-01 setting) See Appendix 2 in Technical Manual

(4) Monitor Displays (Un-XX) are display or output selections, rather than parameter setup, therefore, user setting is not possible

(5) Effective only when Sn-09 = 1 X X X

(6) Setting value determined by Sn-02 setting DO NOT CHANGE

(7) Setting is lower 4 digits of NV-RAM software program number

(8) Setting value determined by Sn-01 setting DO NOT CHANGE

(9) Value determined by particular control card

CONTENTS

CONTENTS - Continued

Never touch circuit components unless main input power has been turned off and "CHARGE" lamp is extinguished. The capacitors are still charged and can be dangerous. Do not connect or disconnect wires and connectors while power is applied to the circuit.

Know your application before using the reset function of constant Sn-03. (See paragraph 5.21 for additional information on reset codes.)

1110 = Factory 2-wire Control Reset (Maintained RUN Contact)

1111 = Factory 3-wire Control Reset (Momentary START/STOP Contact)

When either of these reset codes is entered, all constants are returned to factory settings (EXCEPT Sn-01, Sn-02 and all dn-XX constants); Sn-03 automatically returns to 0000.

If the VCD 703 is connected for 3-wire control and constant Sn-03 is set to 1110 (2-wire control reset), the motor may run in reverse direction without a RUN command applied. Equipment damage or personnel injury may result.

IMPORTANT

The VCD 703 must be grounded using ground terminal G(E). See paragraph 1.4.3.

Never connect AC main power to output terminals T1(U), T2(V), T3(W).

All constants have been factory set. Do not change their settings without understanding the effect.

Do not perform a withstand voltage test on any part of the VCD 703. Equipment uses semi-conductors and is vulnerable to withstand voltage test voltage levels.

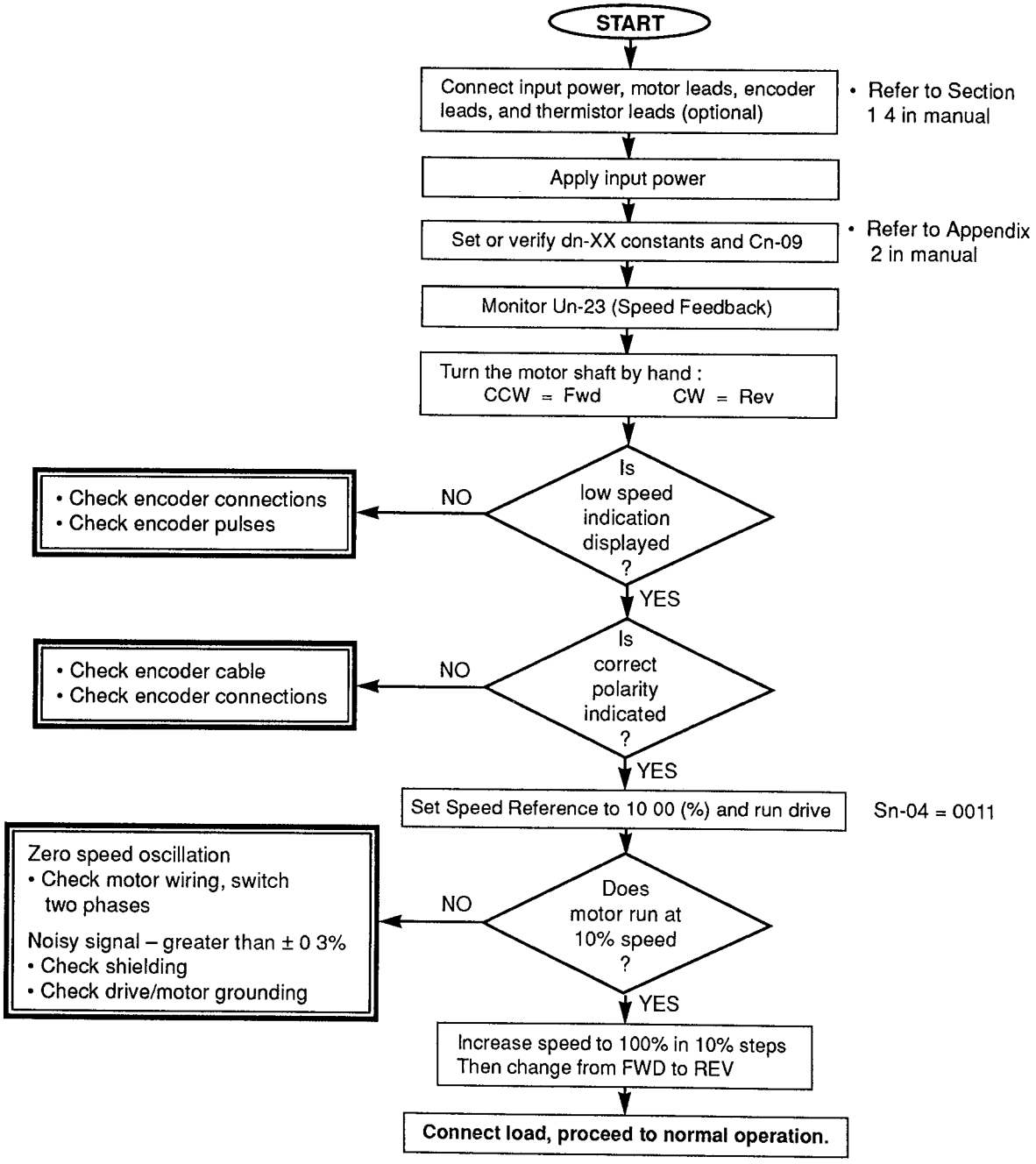
The Control PC board employs CMOS ICs which may be damaged by static electricity. Use proper electrostatic discharge (ESD) procedures when handling all PC boards.

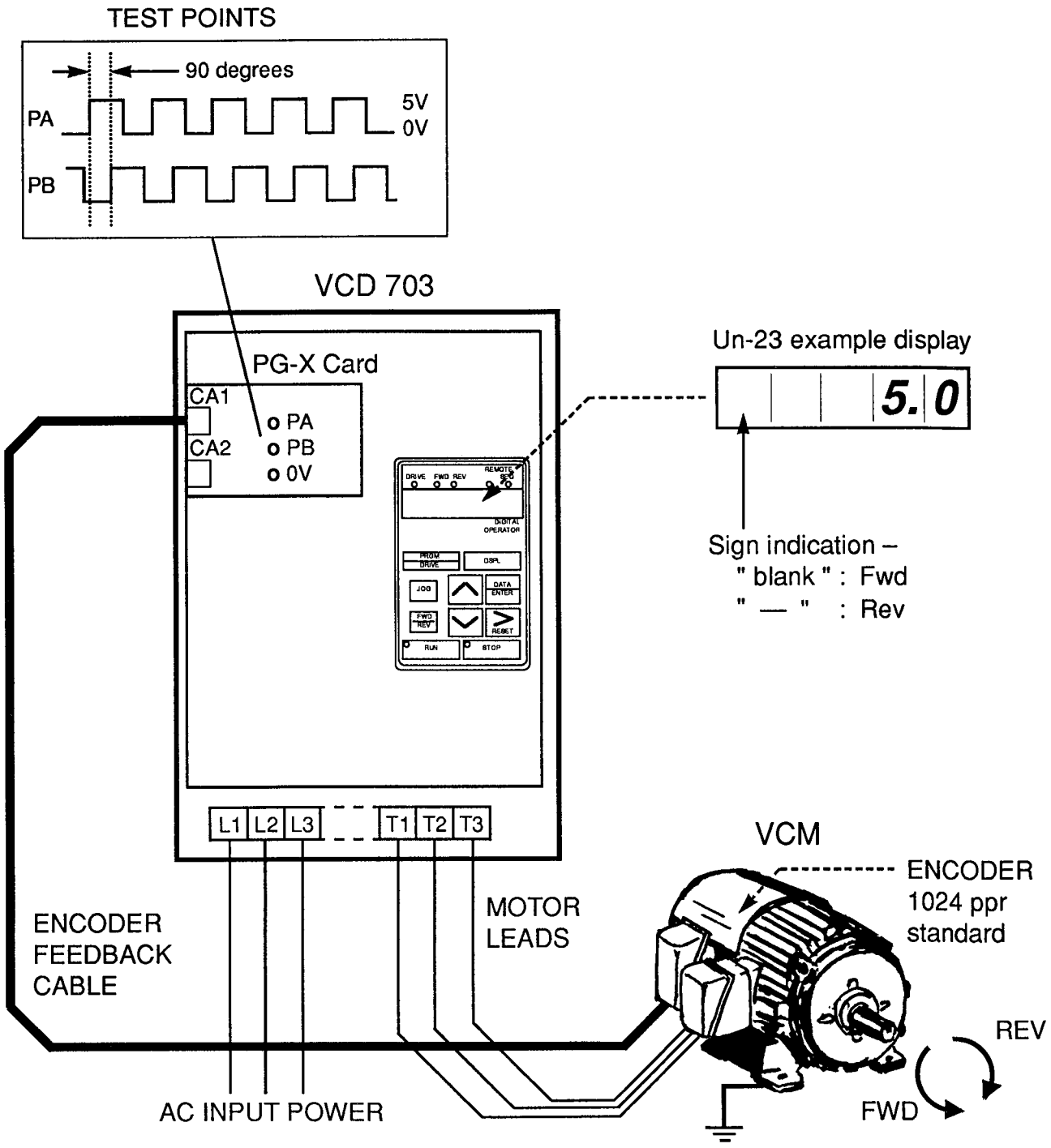
VCD 703 SIMPLIFIED START-UP PROCEDURE

The information on the following pages is provided for use by individuals who are already familiar with the programming and operation of MagneTek Adjustable Frequency drives. It provides quick reference for understanding and troubleshooting common issues that may occur during start-up of a VCD 703 drive.

The flow chart below shows the steps required to start up a VCD 703. A second part identifies the monitoring points that are available to analyze a problem with respect to feedback related issues. These monitoring functions usually provide answers to 90% of the start-up problems, or at least indicate where to begin looking in the Technical Manual for further help.

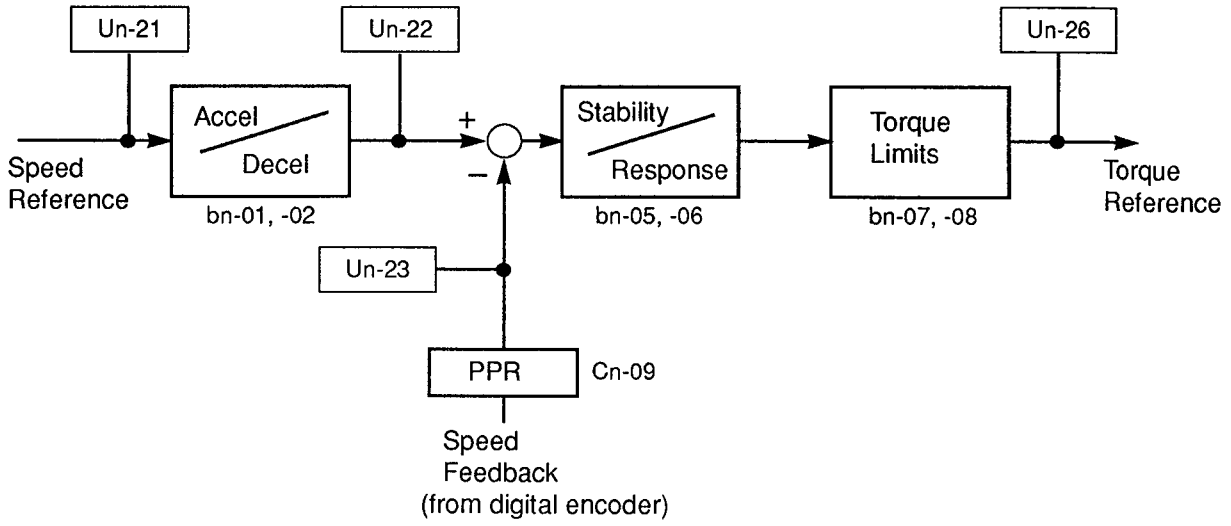
SIMPLIFIED START-UP FLOW CHART





NOTE: Motor phasing should match encoder feedback phasing. If the phasing is not correct, the motor will not accelerate up to speed. It will typically oscillate back and forth at zero speed, and current will be at the current limit (torque limit) point. Switching two phases should correct this situation.

MONITORING POINTS (Un-XX's)



Normal conditions (Steady State) :

1. Speed feedback (Un-23) should equal speed reference (Un-22). Un-23 should be within ± 0.2 %.
2. Torque reference (Un-26) should be less than 150% of torque limit value set in bn-07 or bn-08.

Common problem:

1. Speed feedback – If speed feedback does not equal speed reference, torque limit will occur and the motor will not run.
   Monitoring Un-23 will identify if there is a problem with the encoder feedback. Also, the VCD 703 can be operated open loop (i.e. without speed feedback) to troubleshoot encoder feedback problems.

Possible Feedback Issues:

- Incorrect wiring.
- Incorrect tach counts – Cn-09 should match encoder PPR spec.
- Improper phasing with respect to motor direction – Review start-up procedure in Section 2 of Technical Manual.

NOTE: The following issues may require an oscilloscope to measure pulses. Pulses can be measured using test points PA & PB on the PG-X card.

- Encoder failure.
- Noise on feedback.
- PG-X card failure.

One of the following three procedures may be used to run open loop.

V/Hz Test Mode 2 This mode is selected by setting On-01 to ***0101***. If On-01 does not accept this value, then this mode is not available and you must use one of the other two modes. The speed reference is then set at An-01. If there does not appear to be suitable torque generated, increase bn-20 (setting range 1.0 - 1.5).

Vector Control w/o PG This method can only be used with a TRQ-A card installed. This mode is selected by setting On-02 to ***0001***. The speed reference is set at An-01. If there does not appear to be suitable torque generated, adjust dn-07 up to approximately 70 - 80 %. The current drawn will follow whatever you set into dn-07, so this mode should only be used to check for encoder feedback problems or motor rotation, not for current readings of the motor.

V/Hz Test Mode 1 This mode is selected by setting On-01 to ***0100***. The speed reference is set at An-01 and the magnetizing current reference is set at An-02. If there does not appear to be suitable torque generated, increase An-02 (start at 30 %).

Section 1. INSTALLATION

1.1 GENERAL

The VCD 703 is a high performance sine-coded pulsewidth modulated AC motor drive which generates an adjustable three phase output for complete speed or torque control of a VCM AC induction motor. The VCD 703 can maintain a 150% current overload for 60 seconds with automatic stall prevention and voltage boost to prevent nuisance tripping during load or line side transient conditions. The VCD 703 will not induce any voltage line notching distortion to the utility line and maintains a displacement power factor of approximately 0.98 throughout its speed range.

The VCD 703 is available as a basic protected chassis drive unit, or mounted in a NEMA 1 or NEMA 12 wall mount enclosure with other factory-wired power/control components required for VCD/VCM interconnection.

When properly installed, operated, and maintained, the VCD 703 will provide a lifetime of service. It is important that the person who operates, inspects, or maintains this equipment thoroughly read and understand this manual before proceeding.

This manual primarily describes the VCD 703, but contains basic information for external operator controls as well. Details of any VCD 703 options mentioned in this manual are covered in separate instruction sheets.

1.2 RECEIVING

The VCD 703 has been thoroughly tested at the factory. After unpacking, verify the part numbers with the purchase order (invoice). Any damages or shortages evident when the equipment is received must be reported immediately to the commercial carrier who transported the equipment. Assistance, if required, is available from your sales representative.

1.3 PHYSICAL INSTALLATION

Location of the VCD 703 is important to achieve proper performance and normal operating life. The unit should be installed in an area where it will be protected from:

- Direct sunlight, rain or extreme (condensing) moisture.
- Corrosive gases or liquids.
- Vibration, airborne dust or metallic particles.

See Appendix 3 for VCD 703 and VCM motor dimensions.

For effective cooling and maintenance, the VCD 703 must be installed vertically. There MUST be a MINIMUM 6 in. clearance above and below the enclosure. A MINIMUM 1 in. clearance is required on the left side of the enclosure.

1.4 ELECTRICAL INSTALLATION

All basic interconnections (using the Digital Operator) are shown in Figure 1-3 (for 2-wire control) and Figure 1-4 (for 3-wire control).

1.4.1 Main Circuit Input/Output

Complete wiring interconnections for the main circuit according to Tables 1-1 and 1-2, while observing the following:

CAUTION

- **Use only factory supplied instructions to install dynamic braking resistors. Failure to do so may cause equipment damage or personnel injury.**
- **Use 600 volt vinly-sheathed wire or equivalent. Wire size should be determined considering ampacity and codes.**
- **Never connect AC main power to output terminals T1(U), T2(V), and T3(W).**
- **NEVER allow wire leads to contact the VCD 703 enclosure. Short-circuit may result.**
- **NEVER connect power factor correction capacitors or noise filter to VCD 703 output.**
- **Size of control wire must be suitable for Class I circuits.**
- **Use only closed loop (ring lug) connectors sized for the selected wire guage. The connectors are to be installed using the correct crimp tool recommended by the connector manufacturer.**

WIRE SIZE AWG	WIRE SIZE mm^2	TERMINAL SCREW	CLOSED-LOOP CONNECTOR
20	0.5	M3.5	1 25 - 3.5
18	0.75	M3.5	1 25 - 3.5
16	1.25	M4	1 25 - 4
14	2	M4	2 - 4
		M5	2 - 5
12	3 5	M4	3.5 - 4
		M5	3.5 - 5
10	5 5	M4	5.5 - 4
		M5	5.5 - 5
8	8	M5	8 - 5
		M6	8 - 6
6	14	M6	14 - 6
4	22	M8	22 - 8
1	38	M8	38 - 8
1	38	M10	38 - 10
2/0	60		60 - 10
3/0	80		80 - 10
4/0	100		100 - 10
4/0	100	M12	100 - 10
MCM300	150		150 - 12
MCM400	200		200 - 12

NOTE: See paragraph 1.4.4 for details of vector control motor (VCM) connections.

Table 1-1. Wire Sizing For Main Circuit

SECTION A. 208/230V				
DRIVE MODEL VCD703-	TERMINAL SYMBOL	TERMINAL SCREW	WIRE SIZE AWG	WIRE SIZE mm^2
A001	L1(R), L2(S), L3(T), –, B1/+, B2, T1(U), T2(V), T3(W), G(E)	M4	14 - 10	2 - 5.5
A003	L1(R), L2(S), L3(T), –, B1/+, B2, T1(U), T2(V), T3(W)	M4	14 - 10	2 - 5.5
	G(E)	M4	12 - 10	3 5 - 5 5
A005	L1(R), L2(S), L3(T), –, B1/+, B2, T1(U), T2(V), T3(W), G(E)	M4	10	5.5
A7P5, A010	L1(R), L2(S), L3(T), –, B1/+, B2, T1(U), T2(V), T3(W)	M5	8	8
	G(E)	M5	10	5.5
A015	L1(R), L2(S), L3(T), B0/–, B1/+, T1(U), T2(V), T3(W)	M6	4	22
	G(E)	♦	8 - 2	8 - 38
	ℓ_1(r), ℓ_2(s)	M4	14 - 10	2 - 5.5
A020	L1(R), L2(S), L3(T), B0/–, B1/+, T1(U), T2(V), T3(W)	M8	3 - 1/0	30 - 60
	G(E)	♦	8 - 2	8 - 38
	ℓ_1(r), ℓ_2(s)	M4	14 - 10	2 - 5 5
A025	L1(R), L2(S), L3(T), B0/–, B1/+, T1(U), T2(V), T3(W)	M8	2 - 1/0	38 - 60
	G(E)	♦	6 - 2	14 - 38
	ℓ_1(r), ℓ_2(s)	M4	14 - 10	2 - 5 5
A030	L1(R), L2(S), L3(T), B0/–, B1/+, T1(U), T2(V), T3(W)	M8	1/0	60
	G(E)	♦	6 - 2	14 - 38
	ℓ_1(r), ℓ_2(s)	M4	14 - 10	2 - 5 5
AL40	L1(R), L2(S), L3(T), –(N), +3(P3), T1(U), T2(V), T3(W)	M10	2 - 4/0	38 - 100
	G(E)	♦	4 - 2	22 - 38
	ℓ_1(r), ℓ_2(s)	M4	20 - 14	0.5 - 2
AL50	L1(R), L2(S), L3(T), –(N), +3(P3), T1(U), T2(V), T3(W)	M10	2 - 4/0	38 - 100
	G(E)	♦	4 - 2	22 - 38
	ℓ_1(r), ℓ_2(s)	M4	20 - 14	0 5 - 2

♦ indicates terminal uses a pressure lug

Table 1-1. Wire Sizing For Main Circuit – Continued

SECTION B. 380/415/460V				
DRIVE MODEL VCD703-	TERMINAL SYMBOL	TERMINAL SCREW	WIRE SIZE AWG	WIRE SIZE mm^2
B001, B003	L1(R), L2(S), L3(T), –, B1/+, B2, T1(U), T2(V), T3(W), G(E)	M4	14 - 10	2 - 5.5
B005	L1(R), L2(S), L3(T), –, B1/+, B2, T1(U), T2(V), T3(W)	M4	14 - 10	2 - 5.5
	G(E)	M5	12 - 10	3 5 - 5 5
B7P5	L1(R), L2(S), L3(T), –, B1/+, B2, T1(U), T2(V), T3(W)	M4	12 - 10	3 5 - 5.5
	G(E)	M5	12 - 10	3 5 - 5.5
B010	L1(R), L2(S), L3(T), –, B1/+, B2, T1(U), T2(V), T3(W)	M4	10	5 5
	G(E)	M5	10	5.5
B015, B020	L1(R), L2(S), L3(T), –, B1/+, B2, T1(U), T2(V), T3(W), P3	M5	8	8
	G(E)	♦	10 - 2	5.5 - 38
	ℓ_1(r), ℓ_2($_3$)	M4	14 - 10	2 - 5 5
B025	L1(R), L2(S), L3(T), B0/–, B1/+, T1(U), T2(V), T3(W)	M6	4	22
	G(E)	♦	8 - 2	8 - 38
	ℓ_1(r), ℓ_2($_3$)	M4	14 - 10	2 - 5 5
B030	L1(R), L2(S), L3(T), B0/–, B1/+, T1(U), T2(V), T3(W)	M6	6 - 4	14 - 22
	G(E)	♦	8 - 2	8 - 38
	ℓ_1(r), ℓ_2($_3$)	M4	14 - 10	2 - 5.5
B040	L1(R), L2(S), L3(T), B0/–, B1/+, T1(U), T2(V), T3(W)	M8	3 - 1/0	30 - 60
	G(E)	♦	8 - 2	8 - 38
	ℓ_1(r), ℓ_2($_3$)	M4	14 - 10	2 - 5 5
B050	L1(R), L2(S), L3(T), B0/–, B1/+, T1(U), T2(V), T3(W)	M8	2 - 1/0	38 - 60
	G(E)	♦	6 - 2	14 - 38
	ℓ_1(r), ℓ_2($_3$)	M4	14 - 10	2 - 5 5
BL60	L1(R), L2(S), L3(T), –(N), +(P1), +3(P3), T1(U), T2(V), T3(W)	M8	1/0	60
	G(E)	♦	6 - 2	14 - 38
	ℓ_1(r), ℓ_2($_3$)	M4	14 - 10	2 - 5 5
BL75, BL100	L1(R), L2(S), L3(T), –(N), +3(P3), T1(U), T2(V), T3(W)	M10	2 - 4/0	38 - 100
	G(E)	♦	4 - 2	22 - 38
	ℓ_1(r), $\ell_2$200($_3$200), $\ell_2$400($_3$400), x, y	M4	20 - 14	0 5 - 2
BL150	L1(R), L2(S), L3(T), –(N), +3(P3), T1(U), T2(V), T3(W)	M10	2 - 4/0	38 - 100
	G(E)	♦	3 - 2	30 - 38
	ℓ_1(r), $\ell_2$200($_3$200), $\ell_2$400($_3$400), x, y	M4	20 - 14	0 5 - 2
BL200	L1(R), L2(S), L3(T), –(N), +3(P3), T1(U), T2(V), T3(W)	M12	4/0 - MCM400	100 - 200
	G(E)	♦	1 - 2/0	50 - 67
	ℓ_1(r), $\ell_2$200($_3$200), $\ell_2$400($_3$400), x, y	M4	20 - 14	0 5 - 2
B250, B300	L1(R), L2(S), L3(T), –, +1, +3, T1(U), T2(V), T3(W)	M12	MCM650 x 2P	325 x 2P
	G(E)	♦	1/0 - 2/0	54 - 67
	ℓ_1(r), ℓ_2($_3$), x, y	M4	20 - 14	0 5 - 2
B400	L1(R), L2(S), L3(T), –, +1, +3, T1(U), T2(V), T3(W)	M12	MCM650 x 2P	325 x 2P
	G(E)	♦	2/0	67
	ℓ_1(r), $\ell_2$200($_3$200), $\ell_2$400($_3$400), x, y	M4	20 - 14	0 5 - 2

♦ indicates terminal uses a pressure lug

Table 1-2. Terminal Functions and Voltages of Main Circuit

SECTION A. 208/230V

TERMINAL (Note 1)	FUNCTION IN MODEL VCD703-	
	A001 TO A030	AL40 TO AL50
L1 (R) L2 (S) L3 (T)	Main circuit input power supply 3 phase, 208V at 50Hz, 208 / 230V at 60Hz	
ℓ1 (r) ℓ2 (s)	— —	Power supply input for cooling fan (one phase from main circuit input power)
T1 (U) T2 (V) T3 (W)	VCD 703 output to motor	
B1/+ (B1/P)	Optional DB resistor (B1/+ - B2)	— —
B2		
– (B0/–) (N)	DC power supply (B1/+ - –)	Optional DB unit (+3 - –) DC power supply (+3 - –) Ride-thru capacitor (+3 - –)
+3 (P3)	— —	
+1 (P1)		
G (E)	Ground terminal (100 Ω or less)	

SECTION B. 380/415/460V

TERMINAL (Note 1)	FUNCTION IN MODEL VCD703-		
	B001 TO B050	BL60 TO BL200	B250 TO B400
L1 (R) L2 (S) L3 (T)	Main circuit input power supply 3 phase, 380 / 415 /460V at 50 / 60 Hz		
ℓ1 (r)	Power supply input for cooling fan (one phase from main circuit input power)		
ℓ2 (s) (ℓ2400)			
ℓ2200 (s200)	Not Used		
T1 (U) T2 (V) T3 (W)	VCD 703 output to motor		
B1/+ (B1/P)	Optional DB resistor (B1/+ - B2) Optional DB unit (B1/+ - B0/–) DC power supply (B1/+ - B0/–)	— —	Optional DB unit (B1/+ - –) DC power supply (+3 - –) Momentary power loss ride-thru capacitor (+3 - –)
B2			
– (B0/–) (B0/N)		Optional DB unit (+3 - –) DC power supply (+3 - –) Momentary power loss ride-thru capacitor (+3 - –)	
+3 (P3)	— —		
+1 (P1)			— —
x y	— —	Power supply for external option modules (230V, 10VA)	
G (E)	Ground terminal (100 Ω or less)		

NOTES:
1 (x) indicates alternate terminal marking
2 — — indicates terminal(s) not present.
3 See Appendix 5 for dynamic braking (DB) connections

1.4.2 Control Circuit

All basic control circuit (signal) interconnections are shown in the appropriate diagram:

- Figure 1-3 shows interconnections for external two-wire control in combination with the Digital Operator.
- Figure 1-4 shows interconnections for external three-wire control in combination with the Digital Operator.

Make wiring connections according to the diagram and Table 1-3, observing the following precautions:

- Use twisted shielded or twisted-pair shielded wire (20-14 AWG (0.5-2mm^2)) for control circuit leads. Wire size should be determined considering voltage drop in leads.
  See Figure 1-1: connect shield sheath AT THE VCD 703 END ONLY; the far end should be dressed neatly and left unconnected.
- Signal leads (1 thru 32) and feedback leads (PG) must be separated from main circuit leads L1(R), L2(S), L3(T), T1(U), T2(V), T3(W) and any other power cables, to prevent erroneous operation caused by noise interference.
- Control circuit leads 9, 10, 18, 19, and 20 (contact output) must be separated from leads 1-8, 11-17 and 21-32.
- Lead length should NOT EXCEED 164 feet (50 meters).

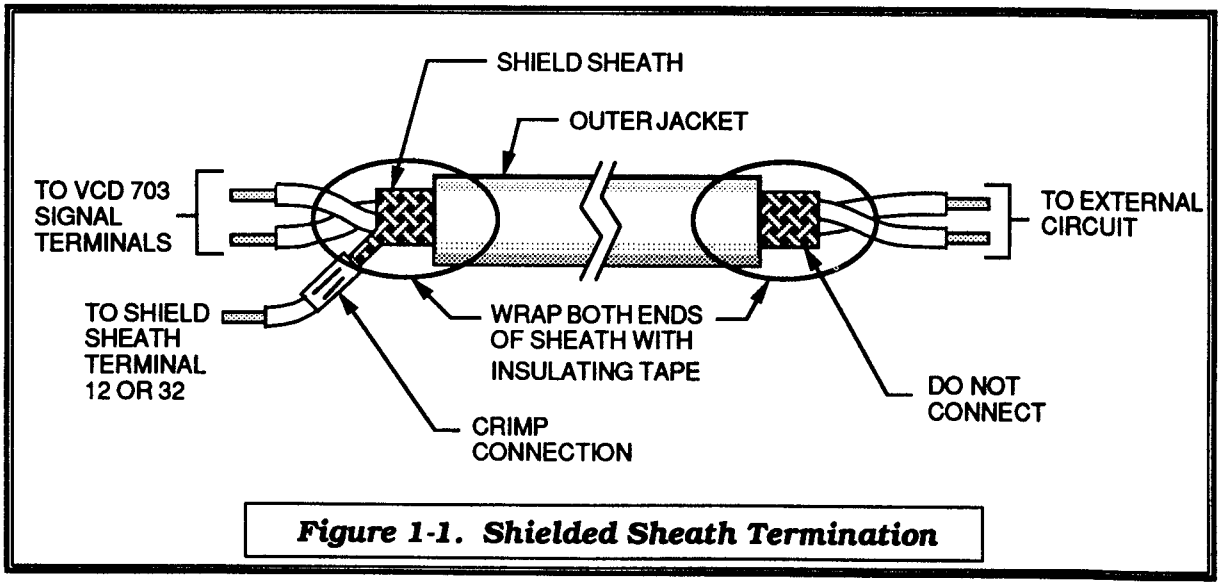


Figure 1-1. Shielded Sheath Termination

Table 1-3. Terminal Functions and Signals of Control Circuit

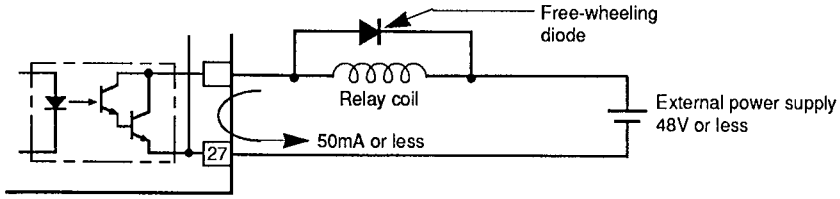
TERMINAL	FUNCTIONS	LEVELS	
1	2-WIRE CONTROL: Forward Run/Stop signal (See NOTE 1) 3-WIRE CONTROL: Run signal	Run at closed, stop at open (See NOTE 2) Run at closed (See NOTE 2)	Rated at +24Vdc, 8mA
2	2-WIRE CONTROL: Reverse Run/Stop signal (See NOTE 1) 3-WIRE CONTROL: Stop signal	Run at closed, stop at open (See NOTE 2) Stop at open (See NOTE 2)	Rated at +24Vdc, 8mA
3	External fault input	Fault at closed (see NOTE 2). When the External Fault input is applied, the VCD 703's Fault relay trips (shutdown) and the motor coasts to a stop The Digital Operator displays "***EF3***" failure Rated at +24Vdc, 8mA	
4	Fault reset input (external)	Fault reset at closed (see NOTE 2 and NOTE 3) The Fault Reset input will reset the Fault relay, if the VCD 703 is in "stopped" condition. Forward Run/Stop signal, Reverse Run/Stop signal, and excitation command must all be OPEN Rated at +24Vdc, 8mA	
5 - 8	External signal inputs (see NOTE 2 and NOTE 3); functions as defined by settings of system constants Sn-15 thru Sn-18. See **MULTI-FUNCTION INPUT TERMINALS** in Section 5 of this manual Rated at +24Vdc, 8ma		
9, 10	Multi-function contact output. One of 30 functions are available, by setting of system constant Sn-20. (N.O.)	Contact capacity: 250 VAC at 1A or below 30 VDC at 1A or below	
11	Input common for terminals 1 - 8, sequence control.	Sequence control input 0 V	
12	Connection for shield sheath of signal leads	– – – –	
13	Auto speed reference input (ref term 7)	±10V (20K ohms)	
14		4-20 mA (250 ohms)	
15	Analog input power supply	+15V (Control power supply for analog input max 20 mA)	
16	Multi-function analog input, function of input signal is selected by setting of system constant Sn-19	±10V (20K ohms)	
17	Control common	0 V	
18	Fault contact output (N O /N.C) — Closed at fault	Contact capacity. 250 VAC at 1A or below 30 VDC at 1A or below	
19	Open at fault		
20	Common		
21	Multi-function analog monitor output 1 (+)	Type of analog signal (operating parameter) to be output is selected by setting of constant bn-17 Monitor output. 0 to ±10V, 2 mA maximum	
22	Multi-function analog monitor output 1 (–)		

Table 1-3. Terminal Functions and Signals of Control Circuit - Continued

TERMINAL	FUNCTIONS		LEVELS
23	Multi-function analog monitor output 2 (+)		Type of analog signal (operating parameter) to be output is selected by setting of constant bn-26 Monitor output 0 to ±10V; 2 mA maximum
24	Multi-function analog monitor output 2 (–)		
25	Multi-function open collector output	One of 22 functions are available, by setting of system constants Sn-21 and Sn-22	Photocoupler isolated output +48Vdc, 50mA or less (See NOTE 4)
26	Multi-function open collector output		
27	Multi-function open collector output common		0V
28	Multi-function open collector output	One of 22 functions are available, by setting of system constants Sn-23 and Sn-24	Photocoupler isolated output +48Vdc, 50mA or less (See NOTE 4)
29	Multi-function open collector output		
30	Motor thermistor input		Motor temperature feedback
31	Common		
32	Connection for shield sheath of signal leads		Internally connected to terminal 12
33	Analog input power supply		–15V (Control power supply for analog input max 20 mA)
Connector CA1	Isolated 12V power supply to encoder; encoder input (motor speed feedback)		See Table 1-5
Connector CA2	Output to pulse monitor		See Figure 1-7, RS 422 compatible, 40mA max , 300kHz output max

NOTES:

1. When Forward Run and Reverse Run inputs are both closed for more than 500 ms, "***EF***" blinks on the Digital Operator and the motor (if rotating) is decelerated by the VCD 703 to a stop. This stop condition is not stored by the VCD 703 (red STOP indicator lamp on Digital Operator does not light); **IF ONE OF THE INPUTS IS OPENED, THE MOTOR WILL IMMEDIATELY START UP AGAIN.**
2. When using relays for input to terminals 1-8, use relays with highly reliable contacts (for very small current) with a capacity of 30Vdc or more and rated current of 100mA or higher When using transistor (open collector) input, use transistors with rated voltage of 35Vdc or more and rated current of 100mA or more.
3. With a multi-function input terminal programmed as Excitation Command input (see paragraph 5.7), when the Excitation Command input is applied and no RUN/STOP input is applied, the RUN and STOP indicator lamps on the Digital Operator will both blink. A fault condition cannot be cleared by a RESET command until the Excitation Command input is removed.
4. When an inductive load, such as relay coils, is used, connect a free-wheeling diode as shown below.

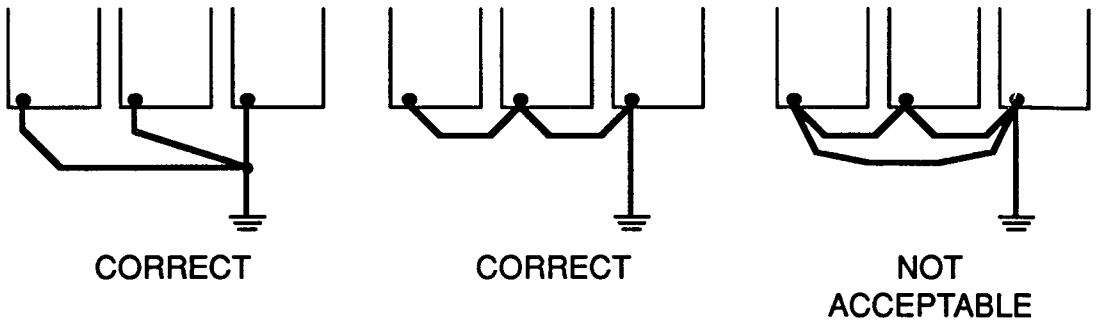


1.4.3 Grounding

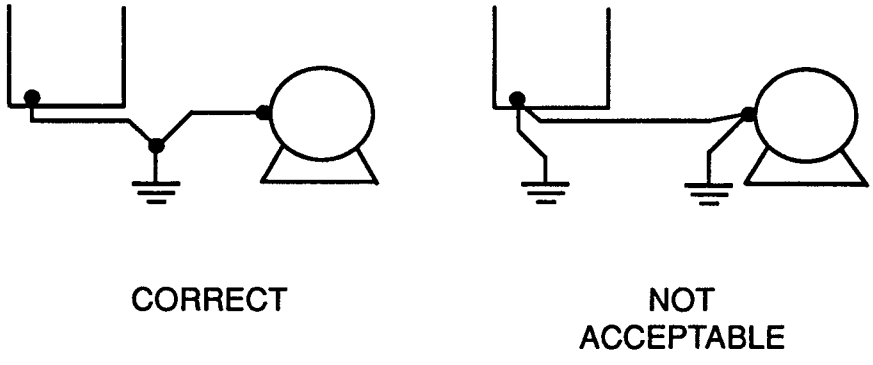
The VCD 703 must be solidly grounded using main circuit ground terminal G(E).

- Ground resistance should be 100 ohms or less.
- NEVER ground the VCD 703 in common with welding machines, motors, or other large-current electrical equipment. Run the ground lead in a separate conduit from leads for large-current electrical equipment.
- Use ground lead size listed in Table 1-1, and make the length as short as possible.
- Where several VCD 703s are used side by side, all should be grounded directly or daisy-chain to the ground pole(s) (see Figure 1-2). DO NOT FORM A LOOP WITH THE GROUND LEADS.

Figure 1-2 illustrates correct methods of grounding.



A. Grounding of Three VCD 703s



B. Grounding of VCD 703 & Motor

Figure 1-2. Grounding

NOTES

Indicates twisted pair shielded leads

* Indicates components not supplied.

** If the VCD 703 being wired is a basic protected chassis drive, these components are not included, and must be supplied by the customer if not ordered from MagneTek as loose items

□ Indicates customer connection terminal Wire only to terminals shown

( ) Indicates alternate terminal marking, e g. (R) and L1

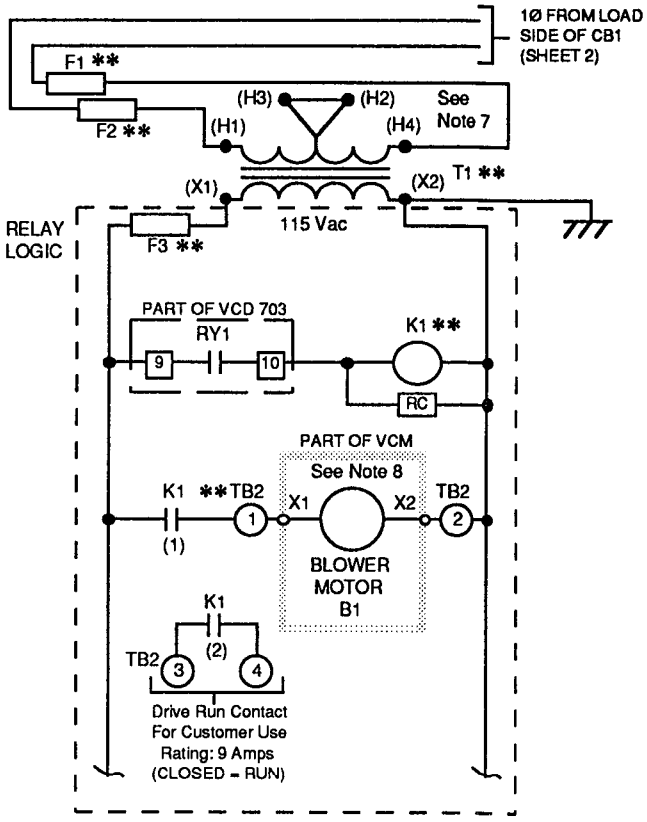
○ Indicates customer connection point on panel mounted terminal blocks TB1 and TB2

▲ Function labels shown for these terminals are determined by factory settings of system constants Sn-15 through Sn-18

● Function labels shown for these terminals are determined by factory settings of system constants Sn-20 through Sn-24 DO NOT CHANGE Sn-20 if blower kit is provided with drive package

■ Function labels shown for these terminals are determined by factory settings of application constants:
bn-17 & bn-18 – for Multi-function Analog Monitor 1;
bn-26 & bn-27 – for Multi-function Analog Montitor 2

♦ Function label shown for this terminal is determined by factory setting of system constant Sn-19



1 If only a remote Manual Speed pot (R2) is used, S4 is not needed Jumper must be added between terminals 5 and 11 This will override both the Auto and Digital Operator speed references, regardless of the programming of Sn-04 X X X X

2 The VCD 703 Electronic Thermal Overload function (Cn-14, Cn-15 & dn-18) meets the standards set by UL for motor thermal overload protection If local codes require separate mechanical overload protection, an overload relay should be installed, interlocked with the VCD 703 as shown It should be the manual reset type to prevent automatic restart following a motor fault and subsequent contact reclosure after cool down

3 Insulated twisted shielded wire is required
2-conductor #18 GA (Beldon #8760 or equivalent)
3-conductor #18 GA (Beldon #8770 or equivalent)
Connect shield only at VCD 703 end Stub and isolate other end

4 Digital Operator is standard on every VCD 703 Remote operators, as shown, may not be required

5 Customer to connect terminal G (E) to earth ground

6 Wire only one Auto speed reference input

7 Connection shown for 460V power supply For 230V power supply, jumper H2-H3 will be removed and jumpers H1-H3 and H2-H4 are added

8 Blower motor connection must be made in accordance with this figure Failure to follow instructions may result in equipment damage

9 The VCM contains 2 thermistors Connect only 1 thermistor (M1 - M11) to the VCD 703 The other thermistor (M2 - M22) is a spare

10 Color coding of factory wiring from TB1 to CA1 may not match color coding of encoder (PG) leads of the VCM See Table 1-5

11 Wire the Dynamic Braking (DB) option per Appendix 5 instructions

Figure 1-3. Interconnections - 2-Wire Control (with constant Sn-04 set to 0000) Sheet 1 of 2

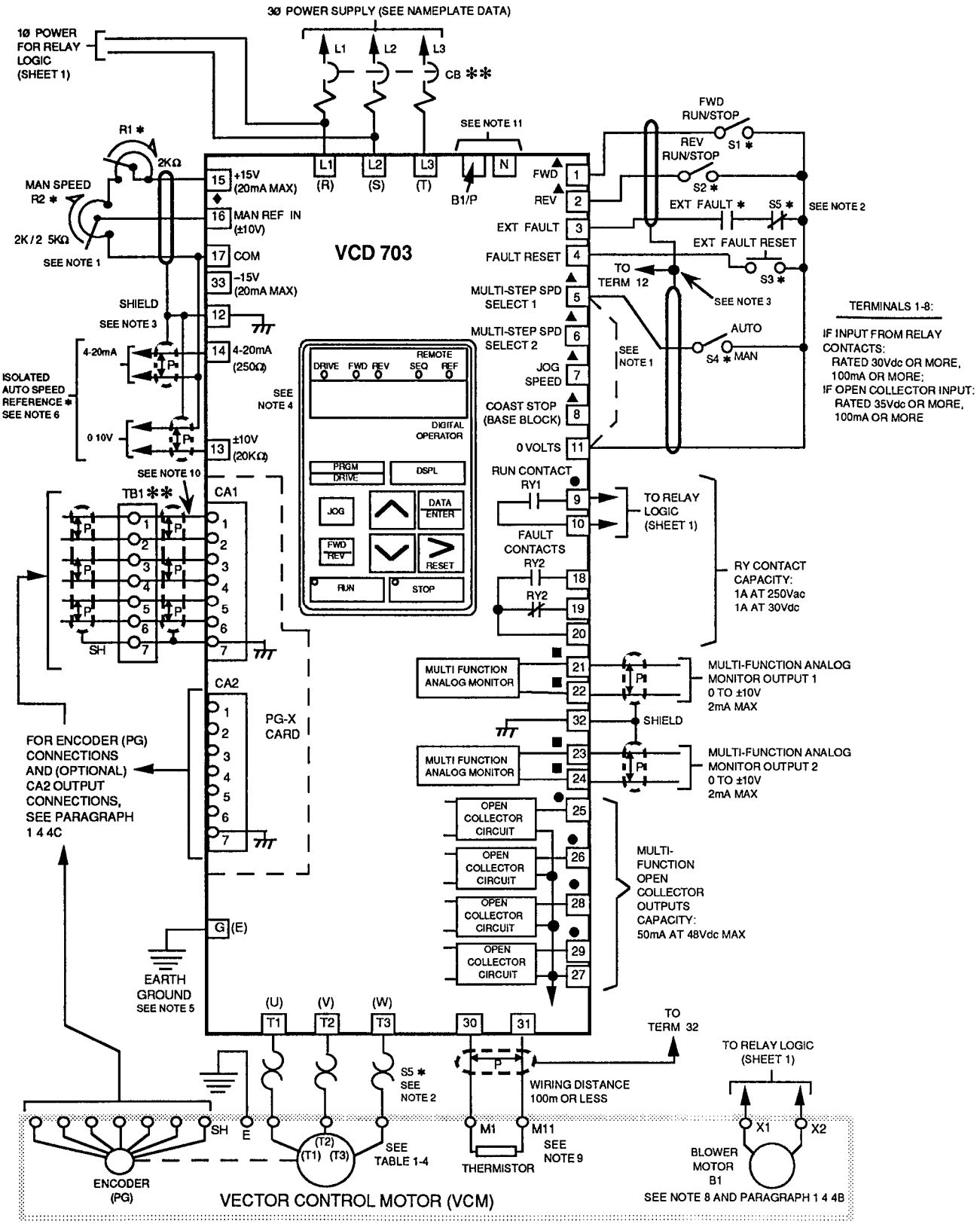


Figure 1-3. Interconnections - 2-Wire Control (with constant Sn-04 set to 0000) Sheet 2 of 2

NOTES

Indicates twisted pair shielded leads

* Indicates components not supplied

** If the VCD 703 being wired is a basic protected chassis drive, these components are not included, and must be supplied by the customer if not ordered from MagneTek as loose items

□ Indicates customer connection terminal Wire only to terminals shown

( ) Indicates alternate terminal marking, i e (R) and L1

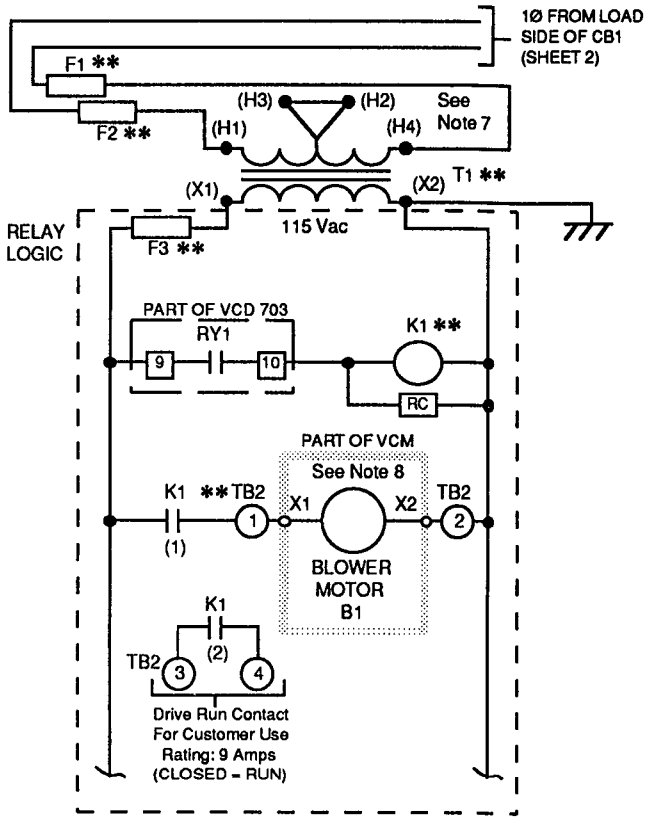
○ Indicates customer connection point on panel mounted terminal blocks TB1 and TB2

▲ Function labels shown for these terminals are determined by factory settings of system constants Sn-16 through Sn-18: Sn-16 = ***03***, Sn-17 = ***04***, Sn-18 = ***06***

● Function labels shown for these terminals are determined by factory settings of system constants Sn-20 through Sn-24 DO NOT CHANGE Sn-20 if blower kit is provided with drive package

■ Function labels shown for these terminals are determined by factory settings of application constants:
bn-17 & bn-18 – for Multi-function Analog Monitor 1;
bn-26 & bn-27 – for Multi-function Analog Montitor 2

◆ Function label shown for this terminal is determined by factory setting of system constant Sn-19



1 If only a remote Manual Speed pot (R2) is used, S4 is not needed Jumper must be added between terminals 6 and 11 This will override both the Auto and Digital Operator speed references, regardless of the programming of Sn-04 X X X X

2 The VCD 703 Electronic Thermal Overload function (Cn-14, Cn-15 & dn-18) meets the standards set by UL for motor thermal overload protection If local codes require separate mechanical overload protection, an overload relay should be installed, interlocked with the VCD 703 as shown It should be the manual reset type to prevent automatic restart following a motor fault and subsequent contact reclosure after cool down

3 Insulated twisted shielded wire is required
2-conductor #18 GA (Beldon #8760 or equivalent)
3-conductor #18 GA (Beldon #8770 or equivalent)
Connect shield only at VCD 703 end Stub and isolate other end

4 Digital Operator is standard on every VCD 703 Remote operators, as shown, may not be required

5 Customer to connect terminal G (E) to earth ground

6 Wire only one Auto speed reference input

7 Connection shown for 460V power supply For 230V power supply, jumper H2-H3 will be removed and jumpers H1-H3 and H2-H4 are added

8 Blower motor connection must be made in accordance with this figure Failure to follow instructions may result in equipment damage

9 The VCM contains 2 thermistors Connect only 1 thermistor (M1 - M11) to the VCD 703 The other thermistor (M2 - M22) is a spare

10 Color coding of factory wiring from TB1 to CA1 may not match color coding of encoder (PG) leads of the VCM See Table 1-5

11 Wire the Dynamic Braking (DB) option per Appendix 5 instructions

CAUTION

Before running, system constant Sn-03 must be set to "0000". Setting Sn-03 to "1110" (2-wire reset) may cause the motor to run in the reverse direction without a Run command, and possibly result in damage to the equipment of personal injury.

Figure 1-4. Interconnections - 3-Wire Control (with constant Sn-04 set to 0000, Sn-15 set to 00, Sn-16 set to 03, Sn-17 set to 04, and Sn-18 set to 06) Sheet 1 of 2

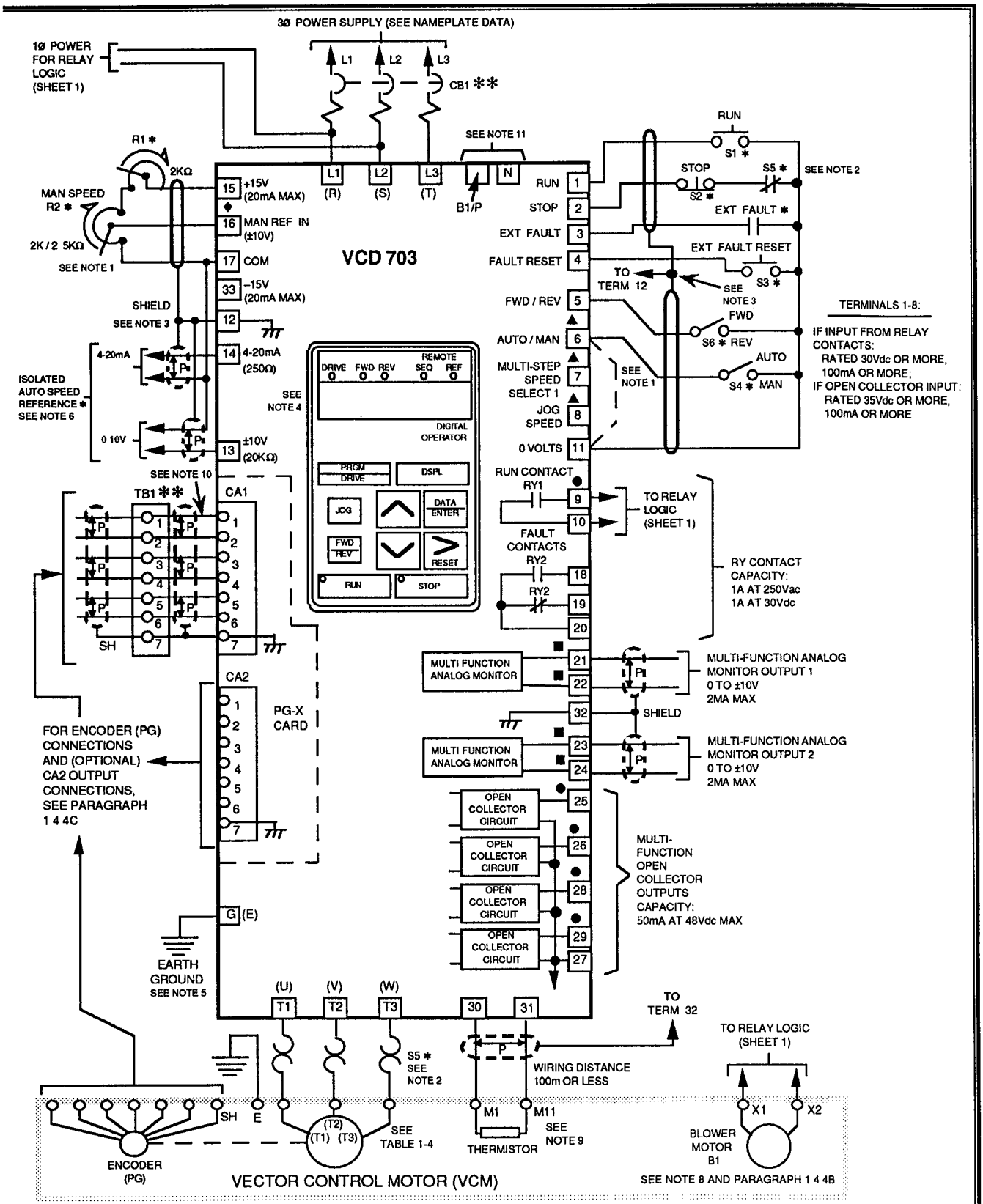


Figure 1-4. Interconnections - 3-Wire Control (with constant Sn-04 set to 0000, Sn-15 set to 00, Sn-16 set to 03, Sn-17 set to 04, and Sn-18 set to 06) Sheet 2 of 2

1.4.4 MagneTek Vector Control Motor (VCM) Connections

A. Motor Windings

WARNING

If the F2 conduit modification has been applied to the motor, the normal direction of motor rotation will be reversed from that described in this manual. Be sure to check for correct rotation wherever so stated in Section 2, DRIVE START-UP.

MagneTek VCM motors have dual winding configurations of either 380V/460V or 190V/230V, except for the 1HP, which is 190V/380V. The selection of which winding configuration should be connected depends on the application for which the vector drive system is used. Here are some guidelines to help in making the selection.

Low voltage winding – 190V or 380V:

Torque Control or Speed Control mode

- Peak torque of 150% required at base speed of 90-100%
- 100% torque at 0 RPM

High voltage winding – 230V or 460V:

SPEED CONTROL MODE ONLY

- Speed control with torque limit adjustment capability
- High starting torque
- Replacing an existing 460V/230V NEMA design B motor with encoder feedback

NOTE

VCD 703 factory settings for Sn-02 are based on the 190V or 380V sections of Table A2-2.

1HP (380V) :

Table 1-4a. 1HP VCM Motor Winding Connection

T1	T2	T3	CONNECT TOGETHER		
T1	T2	T3	T4 & T7	T5 & T8	T6 & T9

Consult MagneTek for proper settings of Sn-02 and dn-XX constants.

1.4.4 MagneTek Vector Control Motor (VCM) Connections – Continued

A. Motor Windings – Continued

1HP (190V) :

Table 1-4b. 1HP VCM Motor Winding Connection

T1	T2	T3	CONNECT TOGETHER
T1 & T7	T2 & T8	T3 & T9	T4 - T5 - T6

Consult MagneTek for proper settings of Sn-02 and dn-XX constants.

3HP and above (190V or 380V) :

Table 1-4c. VCM Motor Winding Connection

CONNECTION	T1	T2	T3	CONNECT ALL TOGETHER
Parallel Star	T1 & T7	T2 & T8	T3 & T9	T4 - T5 - T6 - T10 - T11 - T12

Refer to Appendix 2, Motor Constants, for proper setting of constant Sn-02 Setting should be based on 190V or 380V sections of Table A2-2.

3HP and above (230V or 460V) :

Table 1-4d. VCM Motor Winding Connection

CONNECTION	T1	T2	T3	CONNECT TOGETHER		
Delta	T1 & T12	T2 & T10	T3 & T11	T4 & T7	T5 & T8	T6 & T9

Refer to Appendix 2, Motor Constants, for proper setting of constant Sn-02. Setting should be based on 230V or 460V sections of Table A2-2.

The VCM contains two thermistors. Connect only one thermistor (VCM M1 & M11 leads) to the VCD 703. The other thermistor (leads M2 & M22) is a spare.

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1.4.4 MagneTek Vector Control Motor (VCM) Connections – Continued

B. Blower Motor

For VCM frame sizes 180 & 210, the blower motor leads should be connected as shown in Figure 1-6 before making blower motor power connections.

Blower Motor Specifications

MOTOR FRAME SIZE	HP	VOLTS	AMPS
180 - 210	1/15	115/230	2.0/1.0
250 - 320	1/15	115	1.9
360 - 440	1/3	115	4.2

Use power cable (600V vinyl sheathed lead, etc.) of 20-14 AWG (0.5 to 2mm^2) for motor cooling fan wiring.

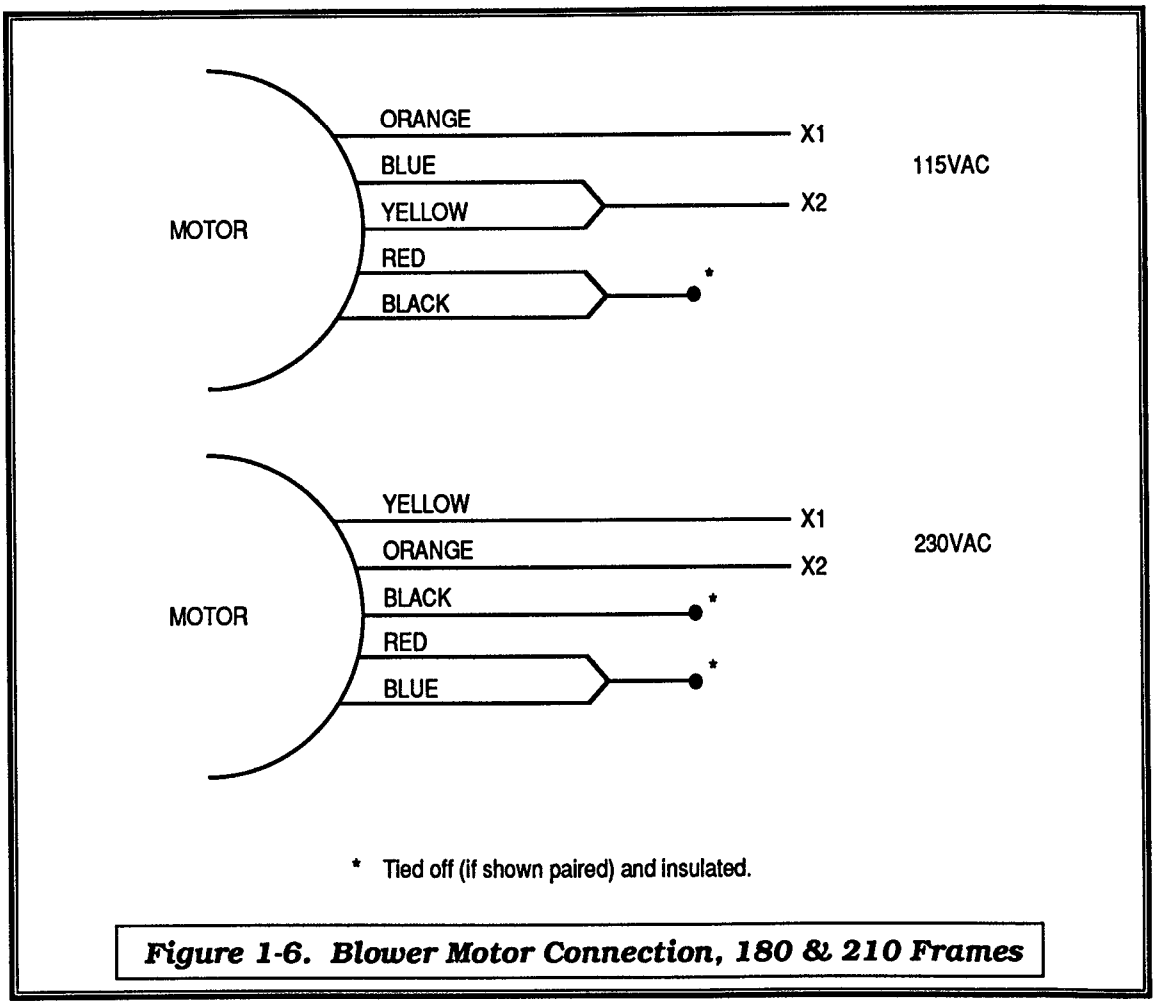


Figure 1-6. Blower Motor Connection, 180 & 210 Frames

1.4.4 MagneTek Vector Control Motor (VCM) Connections – Continued

C. Encoder Feedback (PG)

If the VCD 703 was ordered as a panel mounted or in a NEMA 1 or NEMA 12 enclosure, terminal board TB1 is provided and encoder input connector CA1 of the PG-X card is factory wired to TB1 to simplify PG connection. Make connections from TB1 or CA1 to the PG according to Tables 1-5 and Figures 1-6a & 1-7.

Table 1-5. Encoder (PG) Connection

FUNCTION	TB1 TERMINAL OR CA1 PIN	EPC (1) MODEL 755A	DYNAPAR H-20 (Pin #)	BEI MODEL E25
+12V (200mA)	1	White	D	Red
0V	2	Black	F	Black
A+	3	Red	A	Yellow
A–	4	Green	H	Wht/Yel
B+	5	Brown	B	Blue
B–	6	Yellow	I	Wht/Blue
SHIELD	7	Shield	E	Green

(1) For PG, EPC Model 755A, Orange and Blue wires are not used.

The PG-X card also has a connector CA2 which provides processed PG signal output for use by an external pulse monitor. This connection can be made with the connector supplied loose with the VCD 703 drive according to Figures 1-6a & 1-7.

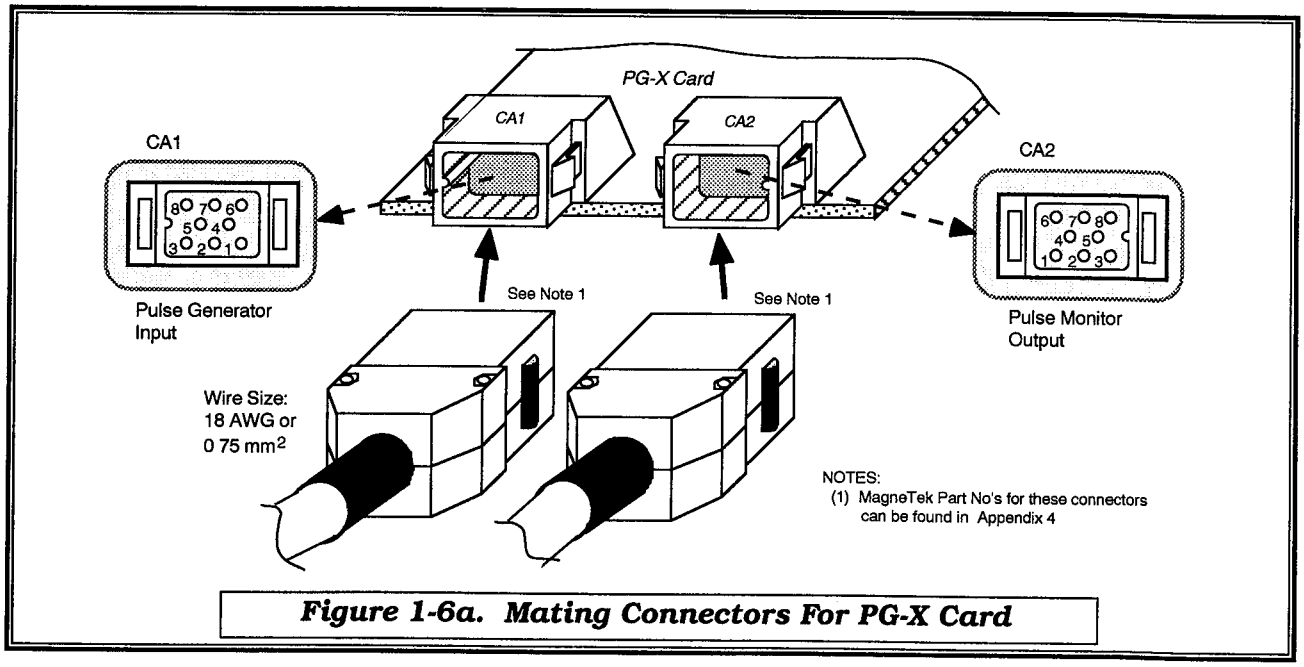


Figure 1-6a. Mating Connectors For PG-X Card

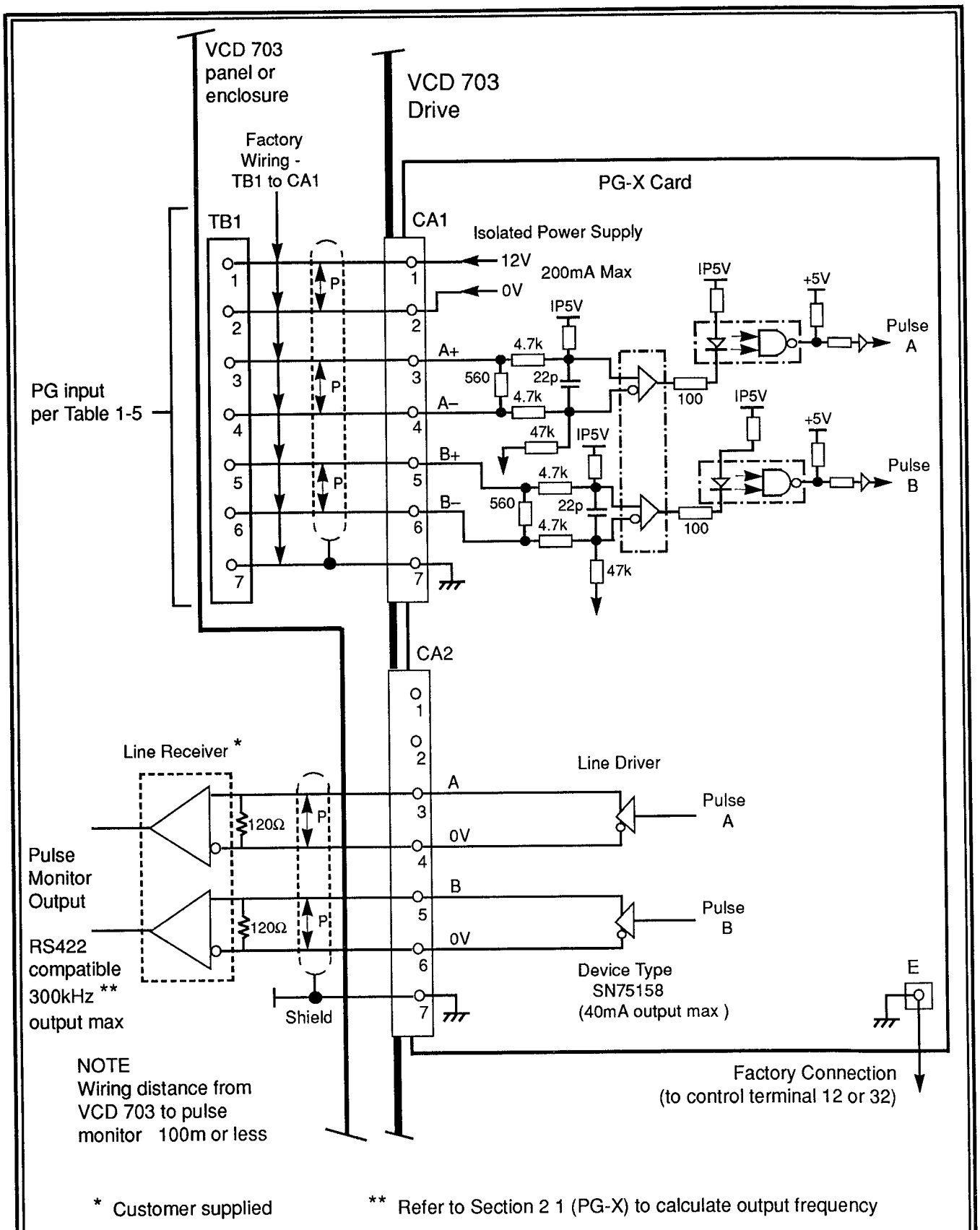


Figure 1-7. PG-X Card Input/Output Connections

Section 2. DRIVE START-UP ("LOCAL" CONTROL)

2.1 PREPARATION

WARNING

This procedure is written for F1 conduit position. If F2 conduit modification has been applied to the motor, motor rotation will be the opposite of what is presented here.

CAUTION

Verify that incoming power IS NOT connected to VCD 703 output terminals T1, T2 & T3. This will cause severe damage to the drive when energized.

☐ Ensure motor is disconnected from load. To assure safety, prior to test operation, disconnect the coupling or belt which connects the motor with the machine so that motor operation is isolated. If an operation must be performed while the motor is directly connected to the machine, use great care to avoid any possible hazardous condition.

☐ Verify VCD 703 Drive configuration:
- ☐ EPROM on Control PC board: Part No. NSW670003 or greater.
- ☐ PG-X Encoder Feedback card.

a. Rev.1 or Part No. 73600-A0101. For use with line driver type encoders (8830, 88C30), ouput pulse levels of 5-12V. Quadrature (A+, A–, B+, B–). 12V @ 200mA power supply available for encoder.

b. PG Output Frequency Calculation [PG-X frequency response (fPG-X) = 300 kHz]

$fPG = 1.2 \bullet k \bullet (\text{Base Speed RPM} / 60) \bullet PPR \leq fPG\text{-}X$

Where k = Top Speed or Speed Adjustment setting (bn-10)

EXAMPLE: k = 1, top speed = base speed; k = 2, top speed = 2 x base speed

☐ **For 460V, 15HP and above only:** Verify that the VCD 703 power voltage select connector (see Figure 2-1) is positioned correctly for the input power line voltage. Voltage is preset to 460V at the factory. Reposition if required.

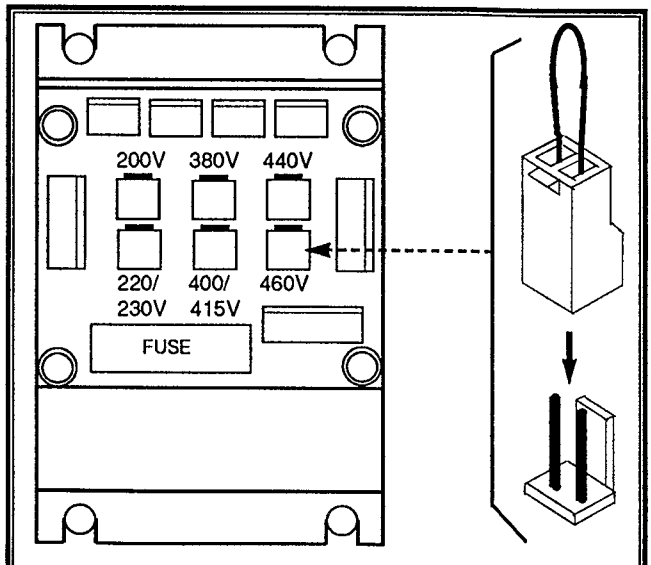


Figure 2-1. Power Voltage Selection in 460V VCD 703, 15HP and Above

☐ Verify interconnections against Section 1 figures or installer's "as wired" schematic. NOTE: If a MagneTek VCM vector motor is not used, verify motor, blower and encoder (PG) wiring against manufacturer supplied drawings.

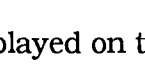
☐ Remove all debris from VCD 703 enclosure, especially loose wire clippings.

☐ Verify all VCD 703 mechanical connections are tight.

☐ Verify proper grounding of VCD 703 and motor.

2.2 POWER ON AND PRELIMINARY CHECKS

☐ Apply three phase input power to the drive and then verify that the "CHARGE" lamp inside the drive is lit.

☐ Verify no fault codes are displayed on the Digital Operator. If  (i.e. " THM ") is displayed, it is an indication that the VCD 703 is not receiving the expected "normal" reading from the motor's thermistor.

- **If the motor is not equipped with a thermistor**, ignore this display for now; it will be eliminated when constant On-02 is reprogrammed.
- **If the motor thermistor is connected**, turn off input power, switch the thermistor connections to the motor's spare thermistor per paragraph 1.4.4 and re-apply power.

☐ Press the PRGM / DRIVE key. Verify that the red "DRIVE" status lamp has gone out; the drive is now in the Program mode. Verify the following constant settings:

- ☐ " An-01 " is displayed. Press and release the DSPL key until " Sn-01 " is displayed.
- ☐ Press the "up arrow" key to display " Sn-02 ".
- ☐ Press the DATA / ENTER key. Verify that the display is " FFF ", or the factory setting of Sn-02 as listed in Appendix 2 (Table A2-2).

☐ Press the DSPL key; the display returns to " Sn-02 ".

CAUTION

If a reset code is entered into Sn-03, verify that Cn-09 is set to the correct Pulses Per Revolution (PPR) for your encoder, BEFORE attempting to run the motor.

☐ Press the "up arrow" key to display " Sn-03 ".

- ☐ Press the DATA / ENTER key. Verify that the factory setting of Sn-03 is " 0000 " and far right "0" is blinking.
- ☐ Press the "up arrow" key to change the "0" to a "1". Press and release the "right arrow" key until the left-most "0" is blinking. Press the "up arrow" key to change the "0" to a "1". Verify that " 1001 " is now displayed.
- ☐ Press the DATA / ENTER key. The blinking "1" briefly lights steady, then " End " is displayed for approx. 1 second. Then " 1001 " is again displayed, with the far right "1" blinking. This new setting for Sn-03 provides access to On-XX and dn-XX constants.

☐ Press the DSPL key; the display returns to " Sn-03 ".

- ☐ Press and release the DSPL key until " On-01 " is displayed.
- ☐ Press the "up arrow" key to display " On-02 ".
- ☐ Press the DATA / ENTER key. Verify that the factory setting of On-02 is" 0000 " .

- **If the motor is not equipped with a thermistor:**
  - ☐ Press and release the "right arrow" key until the second "0" from the right is blinking. Press the "up arrow" key to change the "0" to a "1". Verify that " 0010 " is now displayed.
  - ☐ Press the DATA / ENTER key. The blinking "1" briefly lights steady, then " End " is displayed for approximately 1 second. Then " 0010 " is again displayed, with the far right "0" blinking. This new On-02 settings disables the motor thermistor feedback.

☐ Press the DSPL key; the display returns to " On-02 ".

☐ Press and release the DSPL key until " dn–01 " is displayed.

IMPORTANT: If the motor being used is *not* a MagneTek VCM vector motor, refer to paragraph 2.3 at this time and calculate the required setting values of the Motor Constants (dn–XX). Table 5-7 lists all Motor Constants, with the setting range for each. Change and enter values for each Motor Constant that must be altered from the factory setting to suit your motor. After the last of the new Motor Constant settings has been entered, proceed with the following step.

☐ Press the PRGM / DRIVE key; the drive is now in the Drive mode. Verify the following indications on the Digital Operator:

- ☐ " THM " is no longer displayed. Press the RESET key; this will reset the thermistor " THM " fault.
- ☐ "DRIVE" and "FWD" status lamps are lit, and the red indicator lamp in the corner of the STOP key is lit.
- ☐ " n000.0 " is displayed, with the left-most "0" blinking.

☐ Check encoder (PG) feedback:

- ☐ Press and release the DSPL key until " Un–01 " is displayed. Press and release the "up arrow" key until " Un–23 " is displayed. Press the DATA / ENTER key; the display changes to " 0.0 ", indicating that the present Motor Speed (i.e. PG feedback) is 0% motor base speed.

☐ Manually rotate the motor shaft CCW, as viewed from the load end. Verify that the displayed value of PG feedback is positive (i.e. " – " sign does not appear).

- **If the display does not change from** " 0.0 ", check the PG cable connections. If the problem persists, use an oscilloscope to check for pulses at test points PA and PB on the right-hand side of the PG-X card. Lack of pulses, with good PG connections, indicates a defective PG-X card.
- **If the feedback display shows a negative sign (–)**, reverse PG signal polarity by switching the wiring between the A and B channels. For example, first switch the wire connection for A+ with the wire for B+, then switch the wire connection for A– with the wire for B–.

☐ Manually rotate the motor shaft CW, as viewed from the load end. Verify that the displayed value of PG feedback is negative (" – " sign appears).

☐ Check motor rotation:
- ☐ Verify that drive is in the FWD rotation mode. The "FWD" status lamp is lit. If not, press and release the FWD / REV key.
- ☐ Press and hold the JOG key. Check that motor accelerates smoothly. When motor is running at steady speed, verify that the PG feedback display reads " 10.0 ".
- ☐ Release the JOG key. Verify that motor comes to a stop.

• **If the motor does not accelerate smoothly or oscillates**, reverse any two of the motor leads. Then repeat the motor rotation check.
IMPORTANT: Properly re-identify the motor leads that were reversed.

• **If the PG feedback display does not read** " 10.0 " :
- ☐ Press the DSPL key; the display returns to " Un–23 ". Press and release the DSPL key until " An–01 " is displayed. Press and release the "up arrow" key until " An–09 " is displayed. Press the DATA/ENTER key. Display now reflects factory setting of " 10.0 ".

• **If the displayed value is the same as the PG feedback** indicated during the motor rotation check, then An-09 was inadvertently changed when previously in the Program mode. If the displayed value is acceptable for Jog Speed in your application, no further action is required. If not, An-09 must be reprogrammed to the desired value. This will be accomplished during procedures listed in paragraph 2.5.

☐ Press the DSPL key; the display returns to " An–09 ".
- ☐ Press and release the DSPL key until " Cn–01 " is displayed. Press and release the "up arrow" key until " Cn–09 " is displayed. Press the DATA / ENTER key. Verify that the displayed value matches the PPR rating for encoder. If not, Cn-09 must be reprogrammed to the proper value. This will be accomplished during procedures listed in paragraph 2.5.
- ☐ Press and hold the JOG key. Check for instability of motor operation. Release the JOG key. If instability is noticed, check for a noise related problem (see bottom of next page).
- ☐ Press the PRGM / DRIVE key. Verify that the red "DRIVE" status lamp has gone out; the drive is now in the Program mode.

- **"Open Loop" test (Run the motor w/o PG feedback)**
  - ☐ Press and release the DSPL key until " On-01 " is displayed. Press the DATA / ENTER key. The present four digit setting of On-01 will be displayed (this is normally all zeroes). If the far digit is a "0", press the "up arrow" key to change it to a "1". Press the "right arrow" key twice, and press the "up arrow" to change the blinking "0" to a "1" (display now shows " 0101 "). Press the DATA / ENTER key. The blinking digit briefly lights steady, then " End " is displayed for approximately 1 second. Then the four-digit setting is again displayed. In this mode. the drive will run open loop; that is, it will not use PG feedback for speed control.
  CAUTION: Only a Test mode; Do not use under load!

☐ Press the PRGM / DRIVE key to return to Drive mode.
- ☐ Press and hold the JOG key. If motor instability disappears, the problem is noise or feedback related (see bottom of this page). Release the JOG key.
- ☐ Press the PRGM / DRIVE key to return to Program mode.
- ☐ Change the far right digit of On-02 to setting to a "0", or change On-01 setting to " 0000 ". Press the DATA / ENTER key to save the new constant setting.

☐ Press and release the DSPL key until " Sn–01 " is displayed. Press and release the "up arrow" key until " Sn–09 " is displayed.
- ☐ Press the DATA / ENTER key. Verify that the display is " 0000 " (factory setting of Sn-09). Press and release the "right arrow" key until the left-most "0" is blinking. Press the "up arrow" key to change the "0" to a "1".
- ☐ Press the DATA / ENTER key. The "1" briefly lights steady, then " End " is displayed for approximately 1 second. Then the four-digit setting is again displayed. With left-most digit set to "1", the carrier frequency is increased to the value in constant Cn-52.

☐ Press the PRGM / DRIVE key to return to Drive mode.
- ☐ Press and hold the JOG key.
  - If motor instability is now decreased or eliminated, the high carrier frequency can be used for operation (with restrictions – see Section 5.9a, "Low Noise Operation"), and you can proceed to the Test Run.
  - If motor instability is the same as before or has increased, the problem is definitely noise related (see bottom of this page).
- ☐ Release the JOG key.
- ☐ Press the PRGM / DRIVE key to return to Program mode.
- ☐ Change the left-most digit of Sn-09 to a "0". Press the DATA / ENTER key to save the new setting.
- ☐ Press the PRGM / DRIVE key to return to Drive mode.

☐ To determine the noise source, check for **grounding problems** in the following areas:
- Motor grounding.
- Drive grounding.
- Shield connections.
- External power supply connections for encoder common should be isolated from earth ground.
- External signals, if used, should be isolated from earth ground.

Proceed to paragraph 2.4 for Test Run.

2.3 CALCULATING MOTOR PARAMETERS

If the motor being used with the VCD 703 drive is NOT a MagneTek VCM induction AC motor, the factory default values of Motor Constants (dn-XX) cannot be assumed to be suitable for the motor. Therefore, the following procedure must be used for calculating the required constant values, and the new values must be entered into the dn-XX constants using the Program mode of the drive.

The following information used in the calculation formulas is usually listed on the motor nameplate. If no-load current is not marked on the nameplate, and the motor manufacturer is not able to supply it, use the default value of **30** (%) for the setting of dn-07.

Motor Output (HP) :	HP	No. of Poles :	pp
Motor Voltage (V) :	V_m	Full Load Amps (FLA) :	I_{FLA}
Motor Rated Speed (RPM) :	N_R	No-Load Amps (NLA) :	I_{NLA}
Motor Synchronous Speed (RPM) :	N_S		

2.3.1 Calculation Formulas

(1) **dn-01 : Base Speed**

See Table 2.3.1a (no formula needed)

Table 2 3 1a Base Speed

f (Hz)	Poles (dn-03)	RPM (dn-01)
60	4	1750
50	4	1450
60	6	1150
60	8	850

(2) **dn-02 : Top Speed**

(a) For constant torque applications,
dn-02 = dn-01

(b) For constant HP applications,
dn-02 = Top Speed (dn-02 ≤ 2 • dn-01)

(3) **dn-03 : No. of Poles (pp)**

dn-03 = pp (See Table 2.3.1a)

(4) **dn-04 : No-Load Voltage (V_{NL})**

dn-04 = V_{NL} (See Table 2.3.1b)

Table 2 3 1b No-Load Voltage

Vm	V_{NL}
230 V	210 V
460V	420 V

(5) **dn-05 : Torque Producing Current (IT)**

$$dn\text{-}05 = \sqrt{(I_{FLA})^2 - (I_{NLA})^2}$$

(6) **dn-06 : Slip Frequency (SF)**

$$dn\text{-}06 = \frac{N_S - N_R}{N_S} \times 60 \times .7$$

(7) **dn-07 : Magnetizing Current (IM)**

$$dn\text{-}07 = \frac{I_{NLA}}{dn\text{-}05} \times 100\%$$

(IM = 30% if no-load current not available)

(8) **dn-08 thru dn-18** : Factory default values acceptable.

(9) **Cn-09 : Encoder (PG) Constant**

Cn-09 = PPR of Encoder (Pulses Per Revolution)

(10) **Optional Adjustments:**

On-02 = 0110 (To disable thermistor and rotor heat model)

On-03 = 0010 (To disable overvoltage protection when Dynamic Braking is installed)

2.3.2 Sample Calculation

Motor Data: Motor Output : HP = 15 — No. of Poles : pp = 4
Motor Voltage : V_m = 230V — Full Load Amps (FLA) : I_{FLA} = 39.4 A
Motor Rated Speed : N_R = 1763 RPM — No-Load Amps (NLA) : I_{NLA} = 12.0 A
Motor Synchronous Speed : N_S = 1800 RPM

Calculation of dn-XX settings:

(Sn-02: FFF)

dn-01 = **1750** dn-02 = **1750**

dn-03 (pp) = **4** dn-04 (V_{NL}) = **210**

$$dn\text{-}05 = \sqrt{(I_{FLA})^2 - (I_{NLA})^2}$$

$$= \sqrt{(39.4)^2 - (12)^2} = 37.5 \approx \mathbf{38}$$

$$dn\text{-}06 = \frac{N_S - N_R}{N_S} \times 60 \times .7$$

$$= \frac{1800 - 1763}{1800} \times 60 \times .7 = 0.863 \approx \mathbf{0.9}$$

$$dn\text{-}07 = \frac{I_{NLA}}{dn\text{-}05} \times 100\%$$

$$= \frac{12}{38} \times 100\% = \mathbf{31.6}\ (\%)$$

2.3a AUTOMATIC MOTOR TUNING

NOTE: A TRQ-A option card is required for automatic motor tuning.

Automatic motor tuning "fine tunes" some of the dn-XX settings. It is not necessary to run automatic motor tuning for every appliction; however, it can improve torque linearity and drive response. This feature can be especially useful when the VCD 703 is used with a motor that is NOT a MagneTek VCM induction AC motor.

Before using any of the auto-tuning functions, the motor must be separated (de-coupled) from the load and the brake released (if the motor has a brake). The auto-tuning function will accelerate the motor to a high speed. Personnel in the area need to be advised of the motor operation. If the key on the motor shaft is not secured, it needs to be removed because it can be thrown from the motor shaft and cause personal injury.

2.3a.1 Automatic Motor Tuning Using dn-XX Parameters Already in the Drive

Sn-37: Automatic Motor Tuning | Data : 04

When using this mode, the automatic motor tuning function takes the values already in dn-01 thru dn-18, performs motor tuning, then places the new values back into dn-01 thru dn-18. (If motor 2 is selected from the multi-function inputs, the values from dn-21 thru dn-38 are used/modified during auto motor tuning.)

1. Put the drive into program mode by pressing the PRGM/DRIVE key on the Digital Operator. The drive is in program mode when the "DRIVE" lamp is off.

2. If using a MagneTek VCM induction AC motor, make sure the value of Sn-02 is set correctly (see Table A2-2 in Appendix 2). If using a motor that is NOT a MagneTek VCM induction AC motor, use the automatic motor tuning using motor nameplate data (section 2.3a.2).

3. If speed feedback is used (PG encoder), make sure Cn-09 (dn-39 for motor 2) is set for the correct pulses per revolution prior to executing automatic motor tuning.

4. Set Sn-37 to " 04 " and press the DATA/ENTER key. The display will momentarily show " End ", and the "SEQ" and "REF" lamps will flash.

5. Press the PRGM/DRIVE key to return to the drive mode. The display will then show " CAL14 " (" CAL24 " for motor 2), and the "SEQ" and "REF" lamps will still be flashing.

2.3a.1 Automatic Motor Tuning Using dn-XX Parameters Already in the Drive (Continued)

This next step will cause the motor to run automatically! Make sure that the motor is mechanically disconnected from the load and that personnel in the area are informed that the motor is going to run.

6. Press the RUN key. The display will then flash " CAL14 " (" CAL24 " for motor 2), the drive will then run the motor several times.

7. When the automatic motor tuning is completed, the display will momentarily show " End ", and the drive will return to its normal mode. NOTE: Sn-37 is automatically set back to " 00 " when auto-tuning is initiated.

8. Automatic tuning is now complete.

2.3a.2 Automatic Motor Tuning Using Motor Nameplate Data

Sn-37: Automatic Motor Tuning | Data : 0F

When using this mode, the automatic motor tuning function takes motor nameplate data entered into dn-51 thru dn-58, performs motor tuning, and puts the calculated and measured values into dn-01 thru dn-18. (If motor 2 is selected from the multi-function inputs, the calculated and measured values are placed into dn-21 thru dn-38.)

1. Put the drive into program mode by pressing the PRGM/DRIVE key on the Digital Operator. The drive is in program mode when the "DRIVE" lamp is off.

2. If speed feedback is used (PG encoder), make sure Cn-09 (dn-39 for motor 2) is set for the correct pulses per revolution prior to executing automatic motor tuning.

3. Enter the motor nameplate data into the VCD 703:

dn-51	Motor rated horsepower
dn-52	Motor rated speed in RPM
dn-53	Motor maximum speed in RPM
dn-54	Number of motor poles
dn-55	Motor rated voltage
dn-56	Motor rated current in Amps
dn-57	Motor insulation class (see chart at right)
dn-58	VCD 703 input power supply voltage

Insluation Class	dn-57 Setting Value
A (105°C)	0
E (120°C)	1
B (130°C)	2
F (155°C)	3
H (180°C)	4

NOTE: If input power is removed from the VCD 703, the values contained in dn-51 thru dn-58 will be lost.

2.3a.2 Automatic Motor Tuning Using Motor Nameplate Data (Conitnued)

4. Set Sn-37 to " 0F " and press the DATA/ENTER key. The display will momentarily show " End ", and the "SEQ" and "REF" lamps will flash.

5. Press the PRGM/DRIVE key to return to drive mode. The display will then show " CAL1F " (" CAL2F " for motor 2), and the "SEQ" and "REF" lamps will still be flashing.

This next step will cause the motor to run automatically! Make sure that the motor is mechanically disconnected from the load and that personnel in the area are informed that the motor is going to run.

6. Press the RUN key. The display will then flash " CAL1F " (" CAL2F " for motor 2), the drive will then run the motor several times.

7. When the automatic motor tuning is completed, the display will momentarily show " End " and the drive will return to its normal mode. NOTE: Sn-37 is automatically set back to " 00 " when auto-tuning is initiated. The value of Sn-02 will automatically be set to " 0FFF ".

8. Automatic motor tuning is complete.

2.4 TEST RUN USING DIGITAL OPERATOR ("LOCAL" CONTROL)

The operation described in Table 2-1 and shown in Figure 2-2 is for a standard vector control motor.

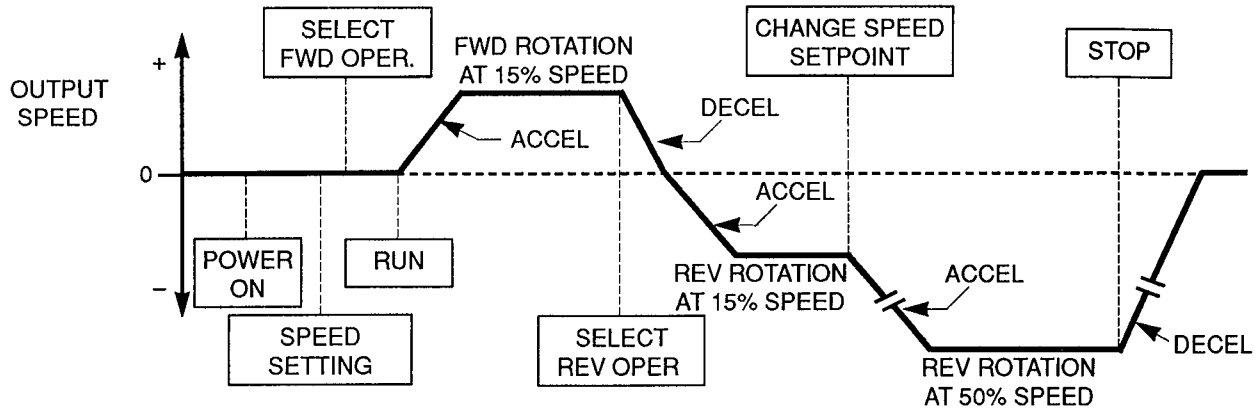


Figure 2-2. Example of Simple Operation

Table 2-1. Test Run With Digital Operator

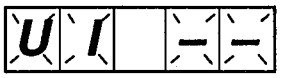
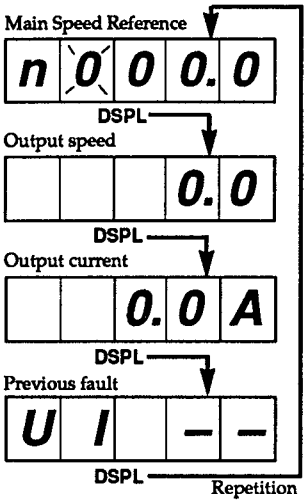
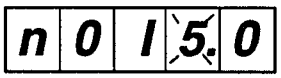
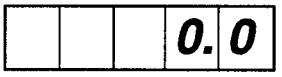
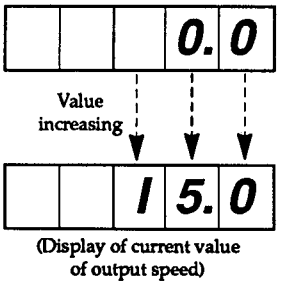
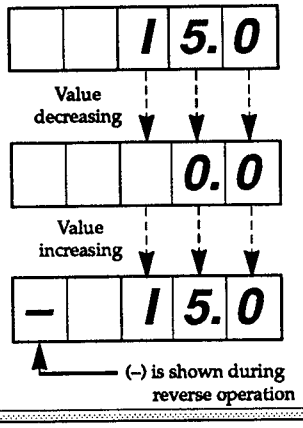
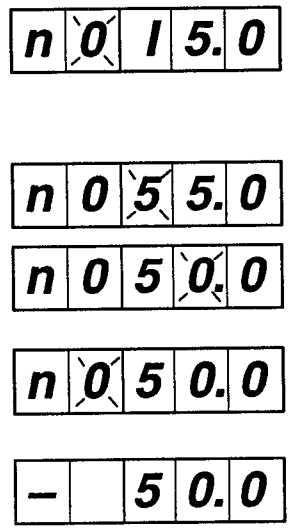
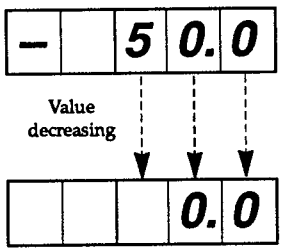
OPERATING PROCEDURE	OPERATION AT DIGITAL OPERATOR	DIGITAL DISPLAY	DESCRIPTION
Power On	Red lamp at **STOP** key lights. (**REMOTE** lamp remains off).	 blinking for 5 seconds, then last selected monitor display (see below).	When power is applied, the last display before power off is indicated.
Frequency Setting	Select Drive mode by using **PRGM/DRIVE** key. Red **DRIVE** lamp lights.		VCD 703 is ready for controlling motor operation.
	Press **DSPL** key, as necessary, until Main Speed Reference is displayed.		Monitor function display selection.
			*See "DISPLAYING FAULT SEQUENCE" in Section 6.
	EXAMPLE: Set Main Speed Reference to 15 %:		
	Move to the setting digit by using > and make the setting with ∧ and ∨.		
	Store the Main Speed Reference value with **DATA/ENTR** key. (This data is stored even when the power is off).		Initial setting becomes Main Speed Reference.
	Press **DSPL** key once to change display to monitor output speed.		
Select Forward Operation	Select the rotation of motor with **FWD/REV** key. (Red FWD lamp lights).		VCD 703 is set for forward motor operation, but is still in "stopped" condition.
Run	Press **RUN** key. (Red lamp lights. Red lamp at **STOP** key goes off).		VCD 703 output and motor speed increase smoothly at preset acceleration rate, then hold steady at 15 % speed.

Table 2-1. Test Run With Digital Operator - Continued

OPERATING PROCEDURE	OPERATION AT DIGITAL OPERATOR	DIGITAL DISPLAY	DESCRIPTION
Select Reverse Operation	Press **FWD/REV** key. (Red **FWD** lamp goes off, and red **REV** lamp lights).		VCD 703 output (and motor speed) decreases smoothly, at preset deceleration rate, to zero. Then motor begins rotation in reverse direction, accelerating smoothly, then holds steady at 15 % speed.
Change Speed Setpoint	Press **DSPL** key repeatedly until Main Speed Reference is again displayed. Example: Set 50 % as new value of Main Speed Reference. Change the speed set point by using >, ∧ and ∨. Store Main Speed Reference value by **DATA/ENTR** key. Press **DSPL** key once to change display to monitor output speed.		Motor continues running at 15 % speed. Motor continues running at 15 % speed. Motor immediately begins accelerating, then holds steady at 50 % speed.
Stop	Press **STOP** key. (Red lamp at **STOP** key lights. Red lamp at **RUN** key blinks while VCD 703 is decelerating motor, then goes off). **REV** lamp stays lit. **DRIVE** lamp stays lit.		Motor speed decreases under VCD 703 control, at preset deceleration rate, to zero. (See NOTE 1) Motor remains stopped. Lamps and display remain on as long as power is applied.

NOTES:

1. The decel time is set too short relative to the load if the RPM of the decelerating motor does not decrease smoothly (stall prevention during deceleration is functioning) or if a fault is displayed on the Digital Operator. To select coast stop operation rather than ramp to stop, refer to Sn-04 entry in Table 5-9.

2.5 PRE-OPERATION CONSIDERATIONS

- After completing the Test Run, connect the motor to the load.

- Additional control circuit wiring can be added, and constants in the VCD 703 can be programmed to configure the drive system to your specific application, including "Remote" (2-wire or 3-wire) Control. See Section 5 for description of programmable features, and also see instruction sheets for any options included with the drive.

- Record all constant values (see Quick Reference card at the front of this manual).

2.6 MEMORY STORAGE FUNCTION

The VCD 703 uses internal NV-RAM to store information when power is removed or in the event of a power failure. Therefore, when power is reapplied, operation will begin at the same state as when power was removed.

The following information is stored:

1. Last monitor display selection (in Drive mode).

2. Last Main Speed Reference setting and forward/reverse selection from Digital Operator.

3. The sequence of failure conditions that occurred before power was removed (including content of CPF failure).

Section 3. OPERATION AT LOAD

After completing the test run, and programming of constants, turn off the AC main circuit power. Make additional wiring connections required for the external control functions selected by the constant programming. Connect the driven machine to the motor. Verify that the driven machine is in running condition, and that no dangerous conditions exist around the drive system.

OPERATING PRECAUTIONS

- When starting and stopping the motor, use the operation signals (RUN/STOP, FWD/REV), NOT the magnetic contactor on the power supply side.

Run the motor under load with control by the Digital Operator using the same procedure as for the Test Run (Table 2-1). If Digital Operator is used in combination with external commands or external commands only are used, the procedure must be altered accordingly.

For preset starting (one-touch operation after setting the speed), perform the following:

1. Set the speed and press **RUN**. Motor accelerates, at the rate corresponding to the preset accel time, to the preset speed. The accel time is set too short relative to the load if the RPM of the accelerating motor does not increase smoothly, or if a fault is displayed on the Digital Operator.

2. Press **STOP**. Unless coast stop operation has been selected (by programming of Sn-04), the motor decelerates, at the rate corresponding to the preset decel time, to a stop.

Section 4. DIGITAL OPERATOR

4.1 GENERAL

The Digital Operator enables the VCD 703 to be operated in either the Drive (DRIVE) mode or the Program (PRGM) mode. The Program mode enables the user to enter information into the VCD 703's memory to configure the VCD 703 to the application. In the Drive mode, the VCD 703 controls motor operation. Switching between the two modes can only be done when the VCD 703 is in a stopped condition.

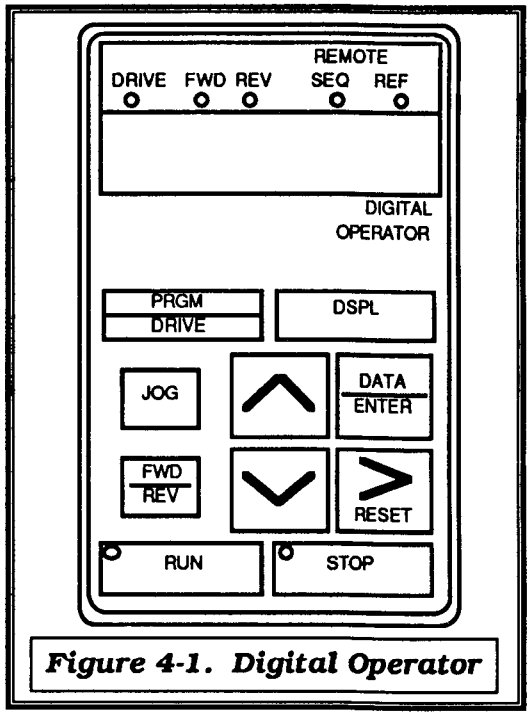


Figure 4-1. Digital Operator

4.2 DISPLAY AND KEYPAD

The Digital Operator has a 5 digit LED display. Both numeric and alphanumeric data can appear on the display.

Indicator lamps and keys on the Digital Operator are described in Table 4-1.

Table 4-1. Digital Operator Controls

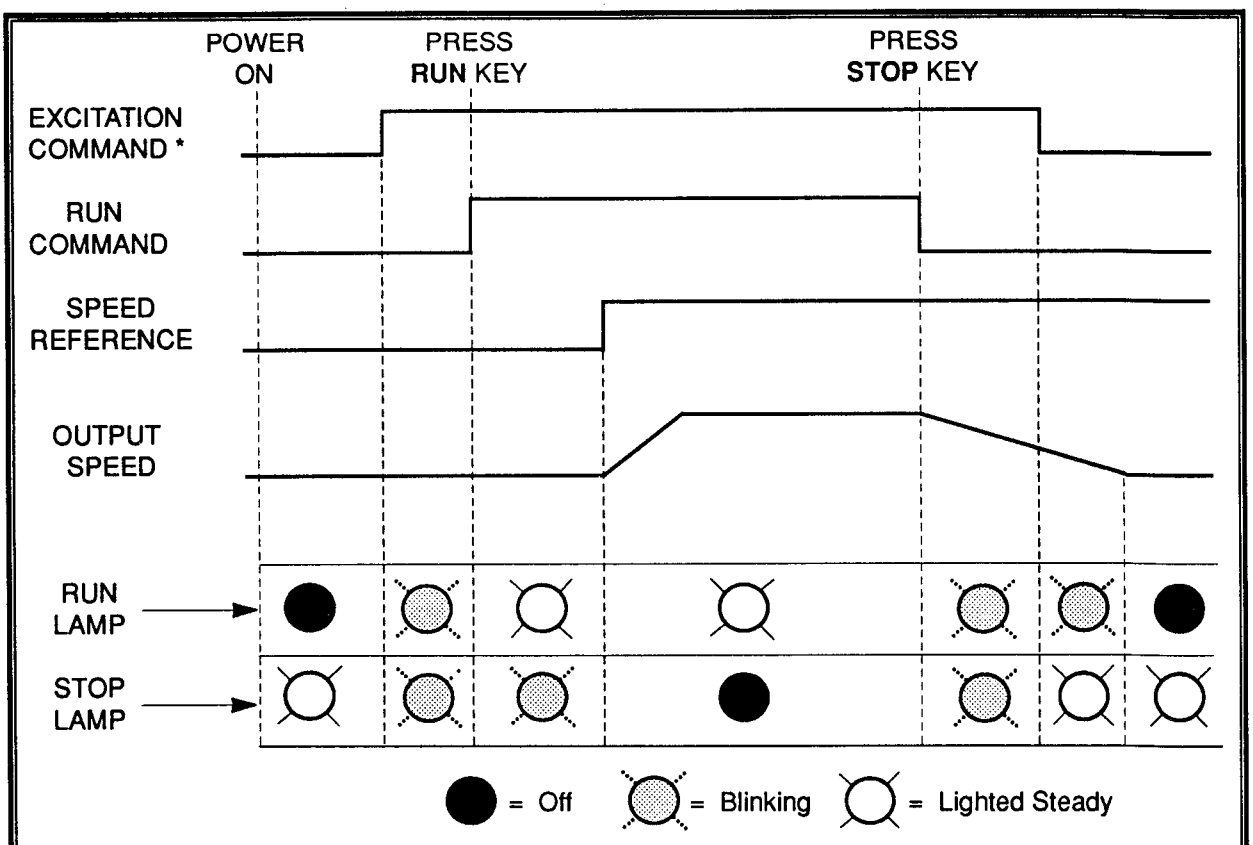
A. INDICATOR LAMPS	
NAME	**FUNCTION**
DRIVE	Lights when the VCD 703 is in the Drive mode of operation.
FWD	Lights when Forward motor run has been selected.
REV	Lights when Reverse motor run has been selected.
REMOTE SEQ	Lights when the VCD 703 is programmed to operate from external RUN and STOP signals.
REMOTE REF	Lights when the VCD 703 is programmed to operate by an external speed reference signal.
RUN	Off when VCD 703 is in stopped condition; lights steadily when Run signal is active; blinks after Stop signal has been received and VCD 703 output is ramping down. (See Figure 4-2.)
STOP	Lights steadily at initial power-up; blinks after Run signal becomes active but speed reference is zero; off when VCD 703 output is controlling motor speed. (See Figure 4-2.)

Table 4-1. Digital Operator Controls - Continued

B. KEYPAD KEYS	
LABEL	**FUNCTION**
PRGM / DRIVE	Pressing this key toggles between the Drive and Program modes of operation. Active only when the VCD 703 is in stopped condition.
JOG	IN DRIVE MODE: Pressing and holding this key will initiate Jog function: VCD 703 output goes to programmed Jog Speed to check motor operation, or to position machine. When key is released, output returns to zero and motor stops. If the motor is already running, pressing this key will have no effect. NOTE: This key will be ineffective if the VCD 703 is programmed for an external JOG input.
FWD / REV	IN DRIVE MODE: Each press of this key will toggle between Forward and Reverse motor run direction. The selected direction is indicated by the **FWD** or **REV** lamp being lit. If the selection is made while the VCD 703 is stopped, it determines the direction the motor will run when started. If the selection is changed during running, the VCD 703 will ramp the motor to zero speed and then ramp it up to set speed in the opposite (i.e. newly selected) direction.
RUN	IN DRIVE MODE: If the VCD 703 is not programmed to operate by external RUN and STOP signals (as indicated by **REMOTE SEQ** lamp being lighted), pressing this key will produce a Run command to initiate VCD 703 output to the motor. However, output speed will be zero if the speed reference is zero at the time this key is pressed.
STOP	IN DRIVE MODE: Pressing this key will produce a Stop command. The VCD 703 will decelerate the motor in the programmed stopping manner, then VCD 703 output will be disconnected from the motor.
DSPL	IN DRIVE MODE: Each press of this key will change the display to the next displayable parameter type available for the Drive mode. (Also see description of **>** key.) IN PROGRAM MODE: Each press of this key will change the display to the first available constant number in the next list of constants (An-, bn-, Sn-, Cn-, etc.).
DATA / ENTER	IN DRIVE MODE **OR** PROGRAM MODE: When a constant number is being displayed, pressing this key will display the constant's set value presently in the VCD 703 memory. IN PROGRAM MODE ONLY: After the displayed set value has been changed as desired, pressing this key will write the new set value into VCD 703 memory to replace the old value.
> / RESET	IN DRIVE MODE **OR** PROGRAM MODE: When a changeable constant setting value is being displayed, pressing this key moves the blinking (i.e. "changeable") position to the next digit to the right. If at the right-most position, this will wrap-around to the left-most "changeable" position.

Table 4-1. Digital Operator Controls - Continued

B. KEYPAD KEYS - Continued	
LABEL	**FUNCTION**
> **RESET** (continued)	IN DRIVE MODE ONLY: When a VCD 703 fault has occurred, pressing this key will reset the fault circuit in the VCD 703. Pressing this key along with the **DSPL** key will allow access to the constants available in the Program mode (for *read only* of constant settings).
^	IN DRIVE MODE **OR** PROGRAM MODE: Pressing this key will increase the value of the blinking digit in the display by 1. Increasing stops at the value of ***9*** (or ***F***, if the constant's setting range allows ***A - F*** characters). Pressing this key will scroll up by 1 within a list of constants. For fault display, see paragraph 6.2.
v	IN DRIVE MODE **OR** PROGRAM MODE: Pressing this key will decrease the value of the blinking digit in the display by 1. Decreasing stops at the value of ***0***. Pressing this key will scroll down by 1 within a list of constants.



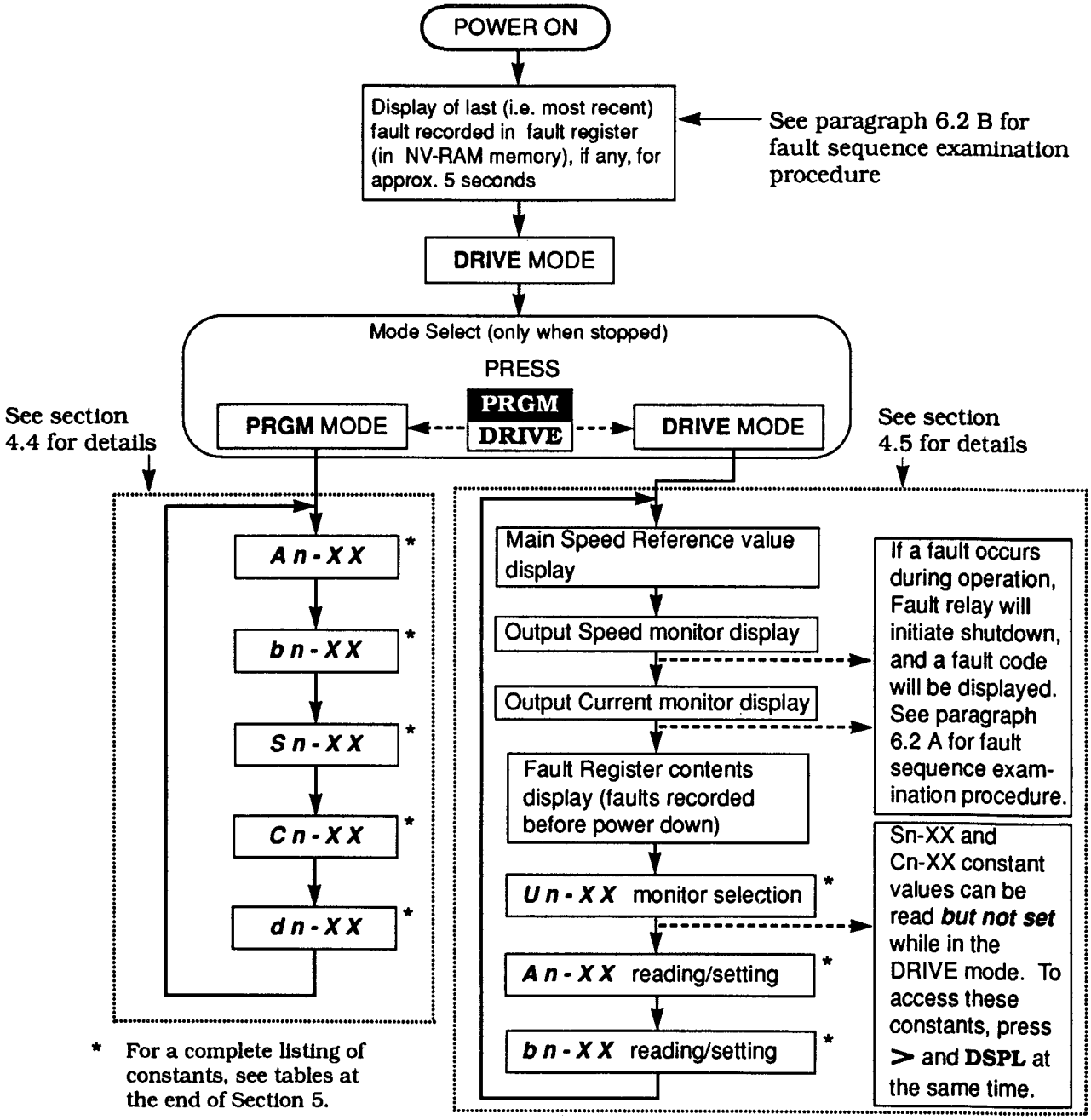
* See paragraph 5.7.

Figure 4-2. Functioning of RUN and STOP Lamps

4.3 COMPARISON OF PROGRAM MODE AND DRIVE MODE

Displays that appear on the Digital Operator differ according to the selected mode of operation. The **PRGM** (Program) mode is used to change constant settings in the Drive's memory to configure it to the requirements of the application. The **DRIVE** mode is used primarily to control (i.e. start and stop) Drive output for motor/machine operation. The only constants that can be changed while in the **DRIVE** mode are An- or bn- settings, or Un- display selection.

The constant group to be displayed, in either mode, is selected by pressing the **DSPL** key.



4.4 PROGRAM MODE OPERATION

A. Changing Display With DSPL Key:

ACTION	DESCRIPTION	DISPLAY
Apply Power	**DRIVE** lamp is on. — If the VCD 703 fault circuit detects a fault, a blinking Fault code will be displayed for 5 seconds. — Then the Speed Reference 1 (An-01) setting display appears.	n000.0
Press **PRGM / DRIVE** Key to Select Program Mode	**DRIVE** lamp turns off. Display changes to first Speed Reference Memory Settings constant number. (See next page for changing settings.)	An-01
Press **DSPL** Key	Display changes to first Run Operative Settings constant number. (See next page for changing settings.)	bn-01
Press **DSPL** Key	Display changes to first System Constants number. (See next page for changing settings.)	Sn-01
Press **DSPL** Key	Display changes to first Control Constants number. (See next page for changing settings.)	Cn-01
Press **DSPL** Key	Cycle begins again with first Speed Reference Memory Settings constant number.	
After All Programming is Completed, Press **PRGM / DRIVE** Key to Return to Drive Mode	**DRIVE** lamp lights. Display shows the Speed Reference 1 (An-01) setting.	n000.0

B. Procedure For Changing a Setting:

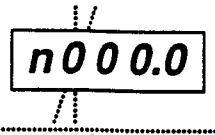
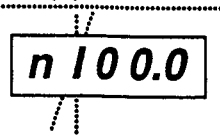
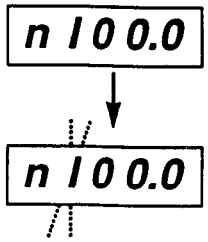
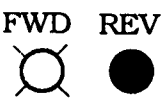
ACTION	DESCRIPTION	DISPLAY
Press ^ and v Keys as Necessary Until Display Shows Desired Constant No.	Value of ***bn-XX*** digits scrolls up or down by 1 each time one of these keys is pressed. **EXAMPLE:** Select bn-03, Accel Time 2.	**bn-03**
Press **DATA ENTER** Key to Display Current Setting	Display shows the value currently stored in memory for the constant. NOTE: Factory setting for bn-03 is ***10.0*** sec.	**10.0**
Press >, ^ and v Keys as Necessary Until Display Shows Desired Setting	Blinking position of display shifts to the left. Value of blinking digit increases or decreases when keys are pressed. **EXAMPLE:** Set bn-03 to ***16.0*** sec.	**16.0**
Press **DATA ENTER** to Store New Setting	Display lights steady for a short time, then ***End*** is displayed for approx. 1 sec. Then setting is displayed again, with one digit blinking. NOTE: If the setting being entered is not within acceptable range for the selected constant, all digits will blink for approximately 5 seconds (the new setting was not written into EPROM memory); then the display again shows the value currently stored in memory.	**16.0** ↓ **End** ↓ **16.0**
Press **DSPL** Key to Return to Setting Number Selection	Display returns to beginning of cycle for selection of setting number to be programmed (see preceding page).	**bn-03**

A. Changing Display With DSPL Key:

ACTION	DESCRIPTION	DISPLAY
Apply Power	**DRIVE** lamp is on. — If the VCD 703 fault circuit detects a fault, a blinking Fault code will be displayed for 5 seconds. — Then the Speed Reference 1 (An-01) value appears.	n000.0
Press **DSPL** Key	Display changes to present Output Speed value.	0.0
Press **DSPL** Key	Display changes to present Output Current value.	0.0 A
Press **DSPL** Key	Display changes to last Fault code. (If no fault has occurred, cycle skips to next display).	U1Uu1 **EXAMPLE:** Main Circuit UV Trip
Press **DSPL** Key	Display changes to first Monitor Displays number.	Un-01 *
Press **DSPL** Key	Display changes to first Speed Reference Memory Settings constant number.	An-01 *
Press **DSPL** Key	Display changes to first Run Operative Settings constant number.	bn-01 *
Press **DSPL** Key	Cycle begins again with Speed Reference display.	

* Use ^ key to step through the list of constants, and **DATA** key to display An- or bn- set value, or information called for by Un- constant.

B. Drive Operation From Digital Operator (Using Factory Settings):

ACTION	DESCRIPTION	DISPLAY
Apply Power	**DRIVE** lamp is on. The Speed Reference 1 (An-01) set value appears.	
Use ➤, ^, and ˅ Keys as Necessary Until Display Shows Desired Run Speed	Blinking position of display shifts to the left. Value of blinking digit increases or decreases when keys are pressed.	
Press **DATA / ENTER** Key To Write New Value Into Memory	Displayed value stops blinking for approximately 2 seconds, then digit resumes blinking.	
Press **FWD / REV** Key To Select Desired Direction of Motor Rotation	Observe **FWD** and **REV** indicate lamps on Digital Operator to see which direction motor will rotate when VCD 703 is started.	 **EXAMPLE:** FWD Run selected
Press **DSPL** Key	Present Output Speed is displayed.	
Press and Hold **JOG** Key	Check motor operation at programmed Jog Frequency operating speed.	
Release **JOG** Key; Press **RUN** Key	VCD 703 output increases to Speed Reference level, at programmed Accel Rate. Motor speed increases accordingly.	
Press **STOP** Key	Motor speed decreases under VCD 703 control, at preset deceleration rate, to zero. Motor remains stopped.	

C. Drive Operation (2-Wire Control) By External Input Signals:

ACTION	DESCRIPTION	DISPLAY
Apply Power	**DRIVE** lamp is on. The Speed Reference 1 (An-01) set value appears. NOTE: If the VCD 703 has already been programmed for operation by external signal input, frequency display will be as shown at "...Return to Drive Mode" action on next page; then continue at "Set Auto/Manual..." action.	n000.0
Press **PRGM / DRIVE** Key to Select Program Mode	**DRIVE** lamp turns off. First Speed Reference Memory Settings constant number is displayed.	An-01
Press **DSPL** Key Twice	First System Constants number is displayed.	Sn-01
Use ^ and v Keys as Necessary Until Display Shows *Sn-04*	Value of Sn-XX digits scrolls up or down by 1 each time one of thses keys is pressed.	Sn-04
Press **DATA / ENTER** Key to Display Current Setting	The value currently stored in memory for the constant is displayed. NOTE: Factory setting for Sn-04 is *0011* (An-01 as speed reference, and Jog, Run and Stop by Digital Operator).	0011
Press >, ^ and v Keys as Necessary Until Display Shows *0000*	Blinking position of display shifts to the left. Value of blinking digit increases or decreases when keys are pressed.	0000
Press **DATA / ENTER** Key To Write New Setting of Sn-04 Into Memory	Display lights steady for a short time, then ***End*** is displayed for approx. 1 sec. Then setting is displayed again, with one digit blinking. NOTE: With Sn-04 set to 0000, speed reference is by external signal input, and Jog, Run and Stop are by external command inputs.	0000 → End → 0000

(Sequence continues on next page)

C. Drive Operation (2-Wire Control) By External Input Signals - Continued:

ACTION	DESCRIPTION	DISPLAY
Press **PRGM / DRIVE** Key to Return to Drive Mode	**DRIVE** lamp lights. Display shows the Speed Reference value as set by input at terminal 13, 14, or 16, ref. terminal 17.	n 0.0 (no digit blinking)
Set Auto/Manual Switch, If Used, To Select Desired External Reference Signal	Display shows speed reference commanded by the present level of the input signal.	n 0.0 (no digit blinking)
Adjust External Speed Reference To Desired Level	Observe display as speed reference is adjusted. Stop when display shows desired output speed. **EXAMPLE:** Adjust for 60Hz output.	n 100.0 (no digit blinking)
Press **DSPL** Key to Show Present Output Speed	Present Output Speed is displayed.	0.0
* Close Contact at Terminals 7 & 11 To Jog Motor [Term. 8 & 11]	Check motor operation at programmed Jog speed.	10.0
* Close Contact at Terminals 1 & 11 To Perform Forward Run [Momentary Run]	VCD 703 output increases to Speed Reference level, at programmed Accel Rate. Motor speed increases accordingly.	100.0
* Open Contact at Terminals 1 & 11 To Stop Drive [Term. 2 & 11; Momentary Stop]	Motor speed decreases under VCD 703 control, at preset Decel Rate, to zero.	0.0

* These procedure steps describe opeartion when the VCD 703 is programmed and wired for 2-wire control. The wording in brackets [ ] indicates the difference when programmed for 3-wire control.

Section 5. PROGRAMMABLE FEATURES

5.1 GENERAL

Each paragraph in this section provides a description of one of the features of the VCD 703 which is defined by programmed settings in the various constants in memory. Since most features use more than one constant, the descriptions appear in alphabetical order by the function name, as listed in Table 5-1.

To cross reference a particular constant to the features to which it applies, see the listings in Tables 5-4 thru 5-10 at the end of this section.

NOTE

Some of the constants have clearly defined functions, and therefore do not appear in any of the descriptions of features in this section.

5.1.1 OVERVIEW OF VCD 703 OPERATION

The Control Circuit Block Diagram on the next two pages represents an overview of the VCD 703's control circuit operation.

The VCD 703 has two basic modes of operation:

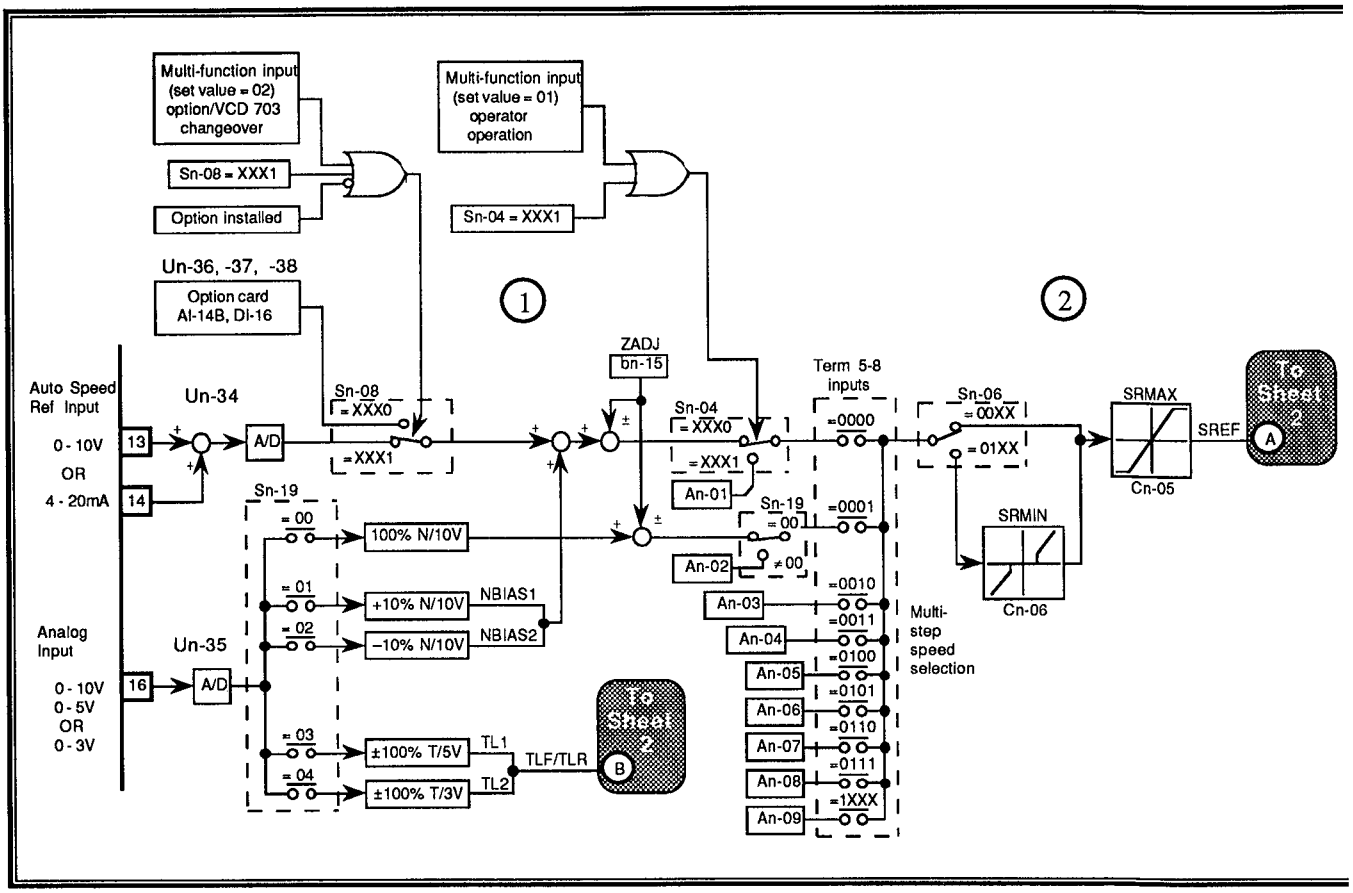
- Speed control mode
- Torque control mode

A brief description of each mode follows, and more detailed explanations of the features are covered in this section.

See paragraphs 5.25 and 5.30 for further options within each of these two control modes. In the following descriptions, a circled number (such as ②) indicates a reference point in the Control Circuit Block Diagram.

A. Speed Control Mode

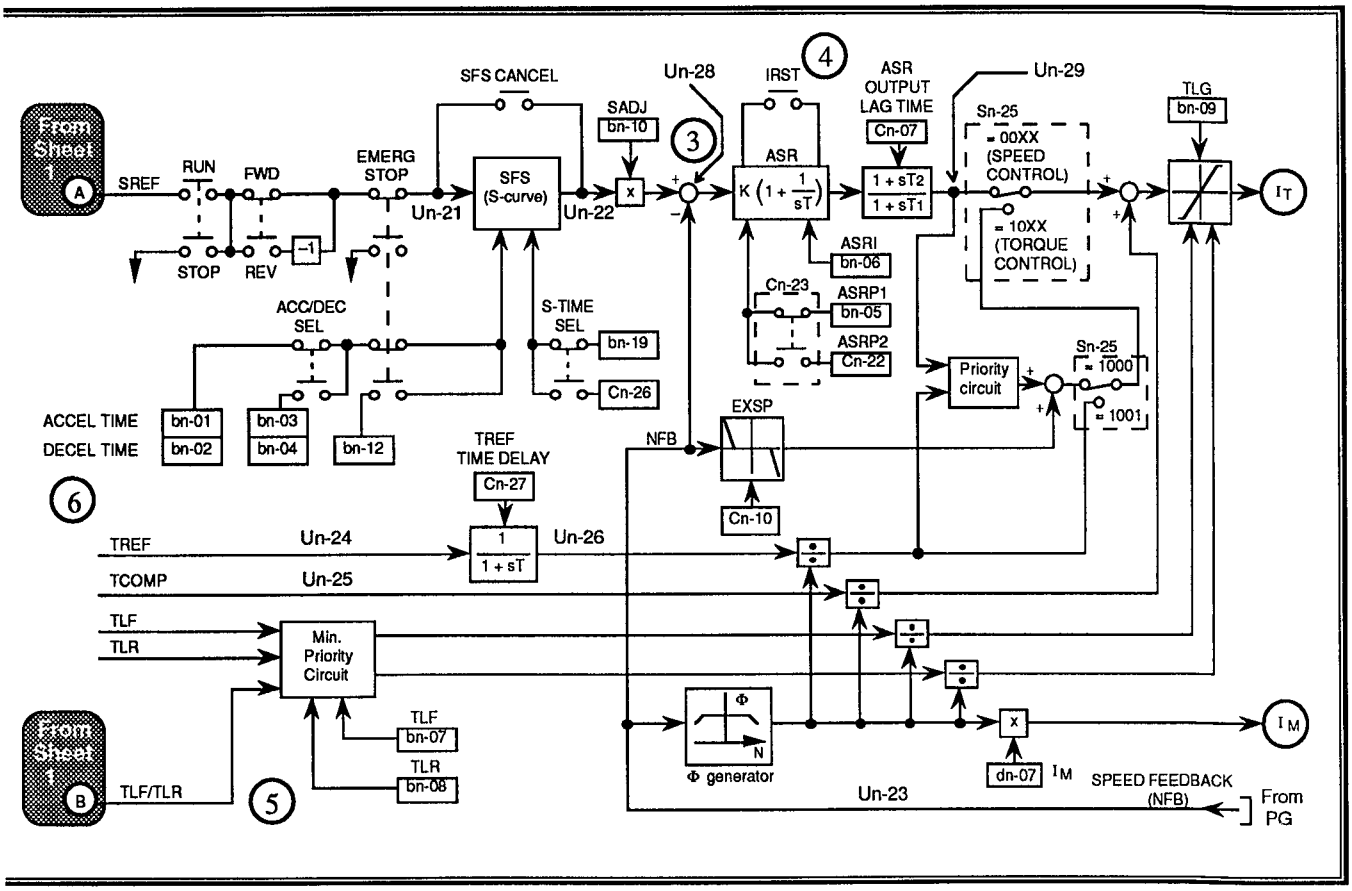
The speed control mode operation primarily regulates speed determined by a set speed reference. The speed reference can be set from an external terminal, or from the Digital Operator ① . The speed control range is from zero speed to maximum speed. Operation at low speed is determined by the speed reference block ② . The speed reference is then compared to the speed feedback signal ③ , which is determined by the encoder (PG). The Automatic Speed Regulator (ASR) ④ controls the dynamic response characteristics during load changes. Another feature available in the speed control mode is the adjustable torque limit ⑤ . Although speed control is the primary function, torque performance is still controlled internally by the VCD 703 for the operating modes like zero servo and zero speed mode, where torque control is required.



Control Circuit Block Diagram - Sheet 1 of 2

B. Torque Control Mode

The torque control mode is selected through the setting of constant Sn-25. However, to input a torque reference signal, an AI-14B option card is required ⑥ . The torque reference directly controls the VCD 703 output. The speed control mode is disabled; however, the Automatic Speed Regulator (ASR) ④ circuit is still enabled in the torque control mode of operation.



Control Circuit Block Diagram - Sheet 2 of 2

Table 5-1. List of Features Defined By Constants

FEATURE NAME	PARA.	PAGE
Accel/Decel Time	5.2	5-6
Automatic Motor Tuning	5.2a	5-7a
Automatic Speed Regulator (ASR)	5.3	5-8
Auto-restart	5.4	5-11
Digital Display Selection	5.5	5-13
Display Mode (Power-Up) Selection	5.6	5-14
Encoder (PG) Constants	5.29	5-51
Excitation Command	5.7	5-15
External Fault Inputs	5.8	5-17
Jog Speed Reference	5.9	5-20
Low Noise Operation	5.9a	5-21b
Momentary Power Loss Ride-thru	5.10	5-22
Monitor Display (Digital Operator)	5.11	5-23
Motor Overload Detection (oL1)	5.12	5-25
Multi-function Analog Input	5.13	5-26
Multi-function Analog Monitor Output	5.14	5-28
Multi-function Input Terminals	5.15	5-29
Multi-function Output Terminals	5.16	5-33
Multi-step Speed Operation (see Remote/Local and Speed Reference Selection)	5.20	5-38
Overspeed Detection (for oS fault)	5.17	5-35
Overvoltage Control	5.18	5-36
Rated Speed Adjustment	5.19	5-37

Table 5-1. List of Features Defined By Constants - Continued

FEATURE NAME	PARA.	PAGE
Remote/Local and Speed Reference Selection	5.20	5-38
Reset Codes / Constant Access Codes	5.21	5-44
S-Curve Characteristics	5.22	5-46
Speed Coincidence	5.23	5-47
Speed Command Bias	5.24	5-48
Speed Control (Command)	5.25	5-48
Speed Deviation (for " dEu " fault)	5.26	5-49
Speed Reference Upper Limit	5.27	5-50
Stop Methods at Fault	5.28	5-50
Torque Control (Command)	5.30	5-52
Torque Detection	5.31	5-54
Torque Limit	5.32	5-56
Zero Servo Control	5.33	5-59
Zero Speed Control	5.34	5-61

5.2 ACCEL/DECEL TIME

A. **bn-01:** Accel Time 1
bn-02: Decel Time 1
bn-03: Accel Time 2
bn-04: Decel Time 2

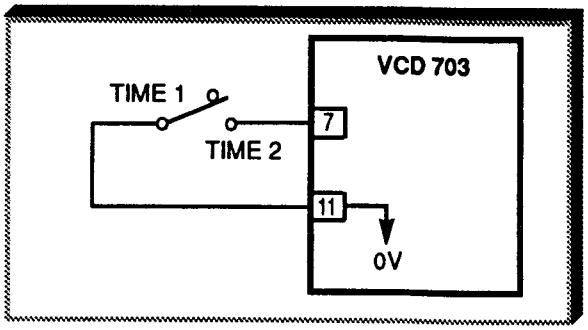
Factory setting (each): ***10.0*** seconds
Range (each): 0.0 to 3000.0 seconds

The VCD 703 incorporates two sets of individually programmable acceleration and deceleration times. Accel/Decel times are determined by bn-01 and bn-02, unless re-programmed using multi-function input (see below).

B. **Sn-15 thru Sn-18:** Multi-function Input Terminal Function Selection (Term. 5 thru 8)

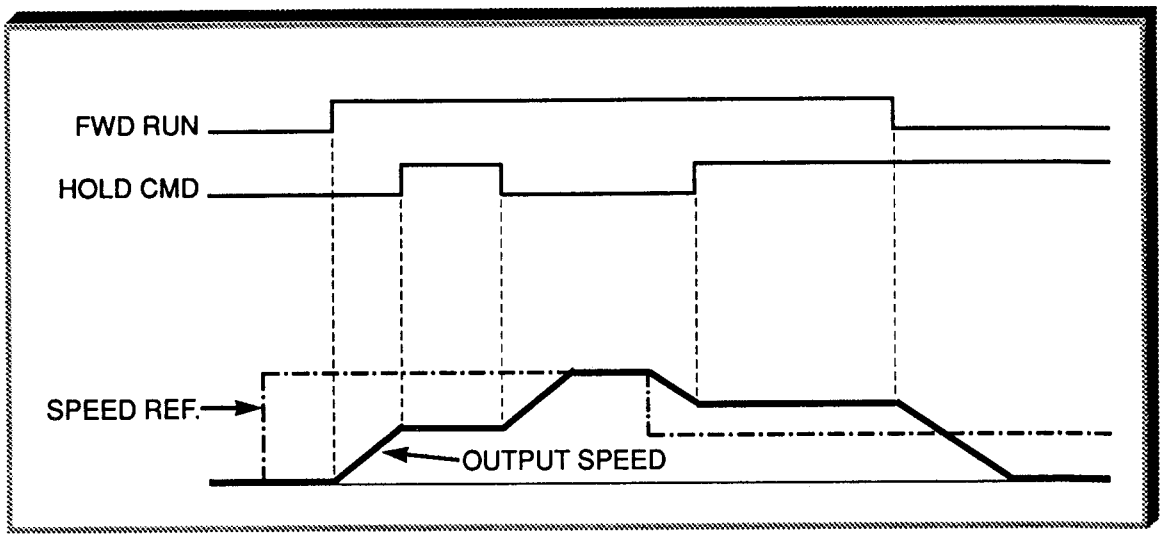
Data ***07*** : Accel/Decel Time Selection

By programming data ***07*** into one of the multi-function input system constants (Sn-15 thru Sn-18), one of the multi-function input terminals (5 thru 8) becomes a time selection input. When the input terminal (i.e. external contact) is open, Time 1 (bn-01/bn-02) is selected. When the input terminal is closed, Time 2 (bn-03/bn-04) is selected.



Data ***0A*** : Accel/Decel Hold (Speed HOLD Command)

By programming data ***0A*** into one of the multi-function input system constants (Sn-15 thru Sn-18), one of the multi-function input terminals (5 thru 8) becomes a HOLD command input. As long as the HOLD command is present, accel and decel are in a prohibit state, and the output speed is held at the level it was at the time the HOLD command was input. When the HOLD command is removed while the system is still in Run condition, accel or decel will again become active to allow output to reach set speed. If Stop is initiated while the HOLD command is present, the prohibit state is cancelled and the system enters stop operation.



HOLD Function Timing

5.2a AUTOMATIC MOTOR TUNING

NOTE: A TRQ-A option card is required for automatic motor tuning.

Automatic motor tuning "fine tunes" some of the dn-XX settings. It is not necessary to run automatic motor tuning for every application; however, it can improve torque linearity and dive response. This feature can be sepecially useful when the VCD 703 is used with a motor that is NOT a MagneTek VCM induction AC motor.

Before using any of the auto-tuning functions, the motor must be separated (de-coupled) from the load and the brake released (if the motor has a brake). The auto-tuning function will accelerate the motor to a high speed. Personnel in the area need to be advised of the motor operation. If the key on the motor shaft is not secured, it needs to be removed because it can be thrown from the motor shaft and cause personal injury.

NOTE: Use of the automatic motor tuning function is described in section 2.3a.

Sn-37: Motor Tuning Selection Factory Setting: ***00***

DATA: XX

00	Normal operation
01	Motor primary resistance (dn-08) tuning
02	Motor cable lead resistance (Cn-13) tuning
03	Motor constant tuning using nameplate motor kW
04	Motor constant tuning using dn-XX constants
0F	Motor constant tuning using nameplate motor HP

Sn-37 = 00 The VCD 703 operates normally and will not go through automatic tuning functions.

Sn-37 = 01 When the RUN key is pressed on the Digital Operator, the VCD 703 will energize the motor leads and measure the resistance of the motor stator. During this time the display will be falshing " CAL11 " (" CAL21 " for motor 2). When this operation is over, " End " will momentarily be displayed on the Digital Operator, and the measured resistance will be stored in dn-08 (dn-28 for motor 2).

Sn-37 = 02 When the RUN key is pressed on the Digital Operator, the VCD 703 will energize the motor leads and measure the motor cable lead resistance. During this time the display will be flashing " CAL12 " (" CAL22 " for motor 2). When this operation is over, " End " will momentarily be displayed on the Digital Operator and the measured resistance value will be stored in Cn-13 (dn-41 for motor 2).

Sn-37 = 03 ** This setting takes motor nameplate data and does tests and calculations in order to properly set the motor constants. Because of this, the motor nameplate data needs to be entered into dn-51 thru dn-58 * (when using this setting, the "units" for dn-51 is kW). When the RUN key is pressed on the Digital Operator, the VCD 703 will energize the motor leads and make several measurements. The motor will accelerate, run and decelerate several times. During this time the display will be flashing " CAL13 " (" CAL23 " for motor 2). When this operation is over, " End " will momentarily be displayed on the Digital Operator and the meaasured values will be stored in dn-01 thru dn-18 (dn-21 thru dn-38 for motor 2). It is possible that Sn-09 will be changed when using this setting.

Sn-37 = 04 This setting takes the existing motor constants and does tests and calculations in order to "fine tune" them. When the RUN key is pressed on the Digital Operator, the VCD 703 will energize the motor leads and make several measurements. The motor will accelerate, run and decelerate several times. During this time the display will be flashing " CAL14 " (" CAL24 " for motor 2). When this operation is over, " End " will momentarily be displayed on the Digital Operator and the measured vaules will be stored in dn-01 thru dn-18 (dn-21 thru dn-38 for motor 2).

Sn-37 = 0F ** This setting takes motor nameplate data and does tests and calculations in order to properly set the motor constants. Becuase of this, the motor nameplate data needs to be entered into dn-51 thru dn-58 * (when using this setting, the "units" for dn-51 is horsepower). When the RUN key is pressed on the Digital Operator, the VCD 703 will energize the motor leads and make several measurements. The motor will accelerate, run and decelerate several times. During this time the display will be flashing " CAL1F " (" CAL2F " for motor 2). When this operation is over, " End " will momentarily be displayed on the Digital Operator and the measured values will be stored in dn-01 thru dn-18 (dn-21 thru dn-38 for motor 2). It is possible that Sn-09 will be changed when using this setting.

* When power is removed from the VCD 703, constants dn-51 thru dn-58 are reset back to zero.

** When either of these two settings is used, the value of Sn-02 changes to " 0FFF ".

5.3 AUTOMATIC SPEED REGULATOR (ASR)

A. **bn-05:** ASR Proportional Gain (ASRP1)

Factory Setting: ***20***
Range: 0 to 300

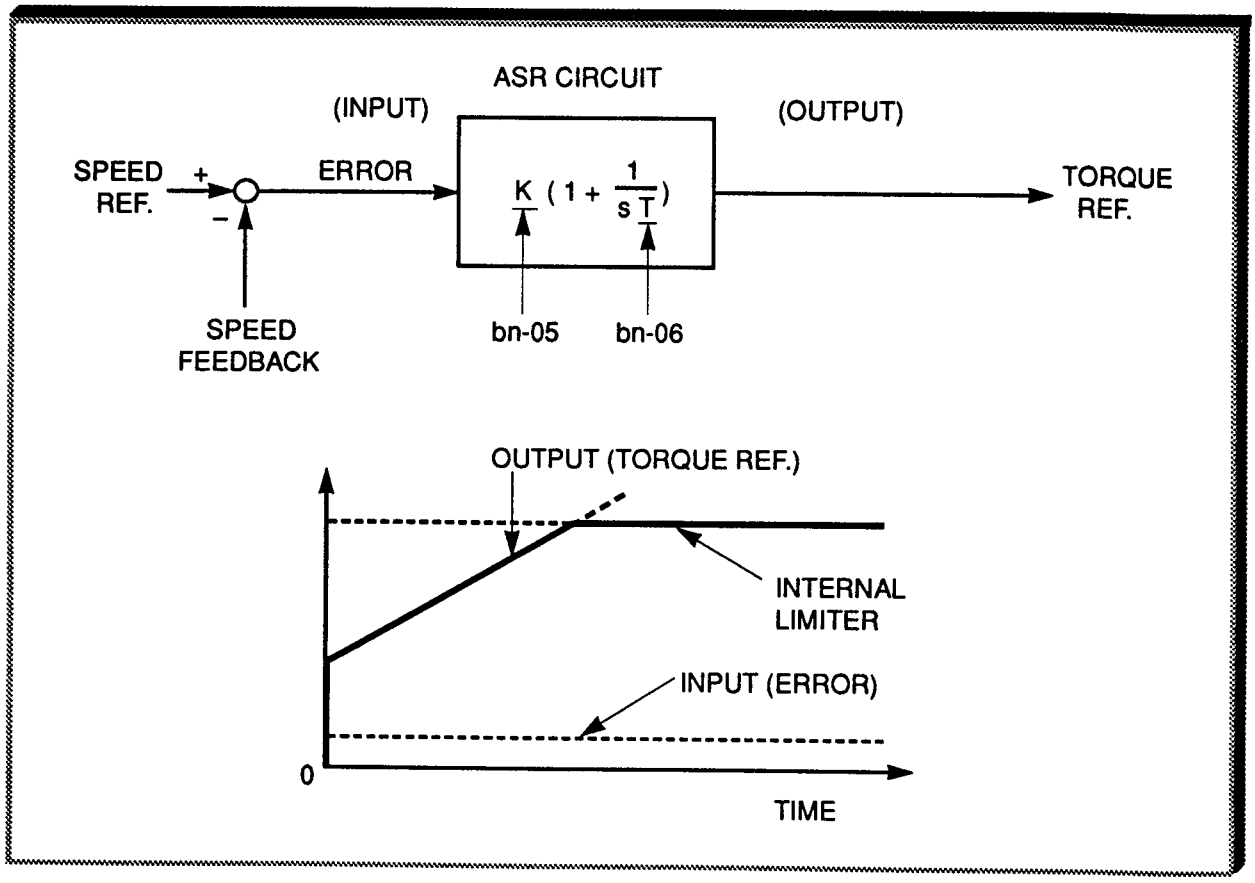
bn-06: ASR Integral Time (ASRI)

Factory setting: ***1000*** msec
Range: 0 to 30000 msec

Constants bn-05 and bn-06 provide adjustments to enable the optimum performance during load disturbances. The proportional gain (bn-05) adjusts the amount of instantaneous droop as a function of loss, and provides damping from load disturbances such as speed reference change, or a change in load. The integral time (bn-06) adjusts the response time of the VCD 703 to the load disturbances.

NOTE

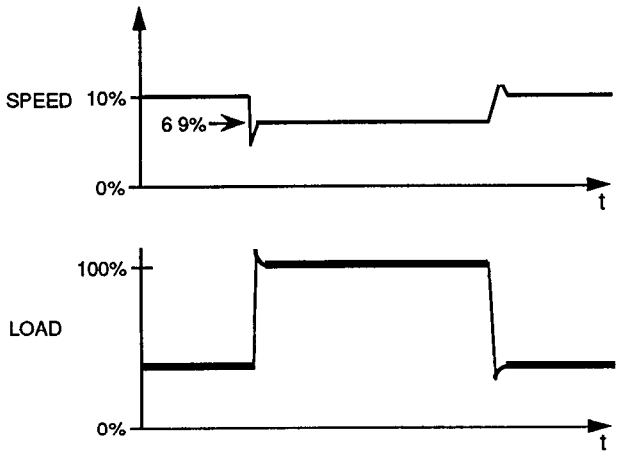
Speed control response is increased by increasing the proportional gain and decreasing the integral time. However, instability or hunting may occur between the VCD 703 and the load if bn-05 (ASR Proportional Gain) is set too high, or bn-06 (ASR Integral Time) is set too low.



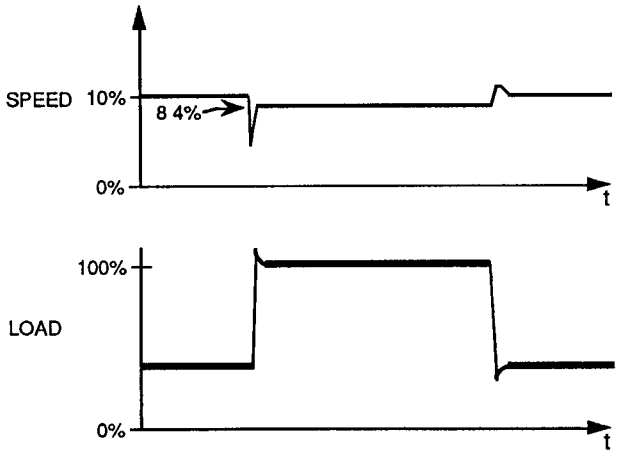
EXAMPLES OF bn-05 AND bn-06 ADJUSTMENTS

ASR Gain (bn-05) Adjustment Only

Speed Ref = 10% of max
bn-05 = 30
bn-06 = 0

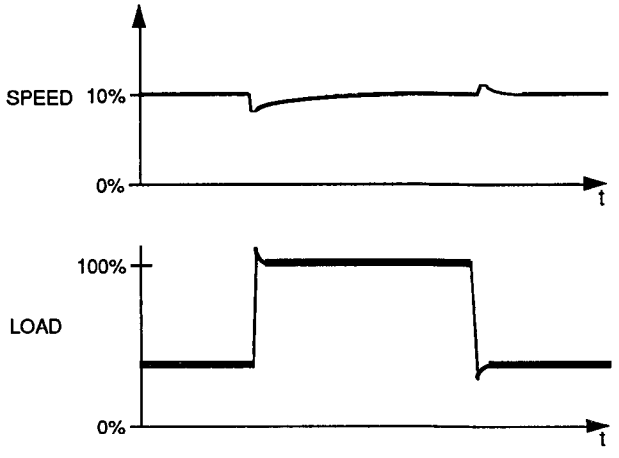


Speed Ref = 10% of max
bn-05 = 60
bn-06 = 0

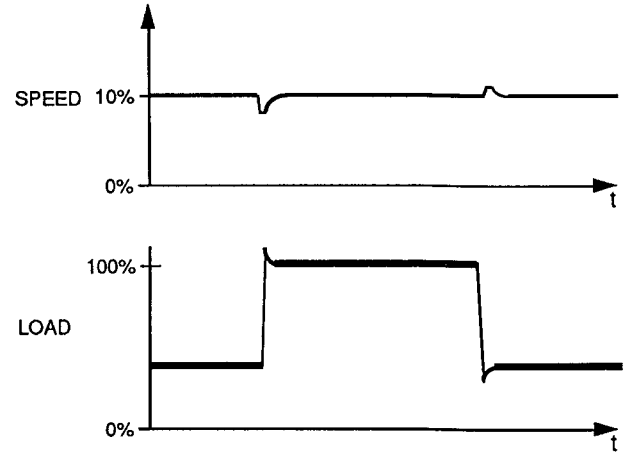


ASR Integral Time (bn-06) Adjustment Only

Speed Ref = 10% of max
bn-05 = 30
bn-06 = 1000



Speed Ref = 10% of max
bn-05 = 30
bn-06 = 100



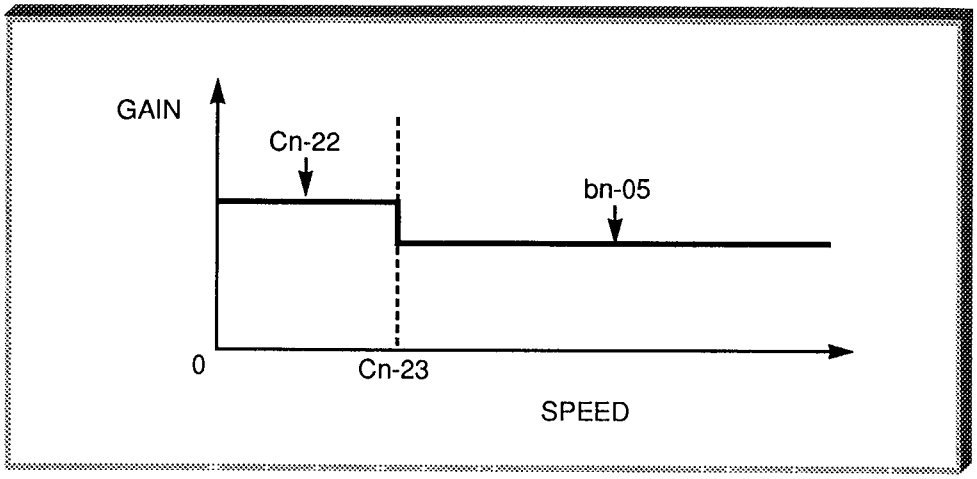
B. **Cn-22:** ASR Proportional Gain 2 (ASRP2)

Factory Setting: ***20***
Range: 0 to 300

Cn-23: ASR Proportional Gain Selection Level

Factory setting: ***0.00*** %
Range: 0.00 to 100.00 %

Constant Cn-22 is used as an additional proportional gain adjustment, and constant Cn-23 determines the speed range for Proportional Gain 2 (Cn-22). If one of the Multi-function Inputs is programmed for " 77 ", this function is disabled.



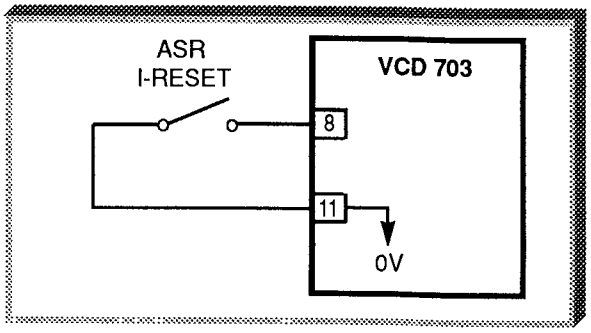
NOTE

Cn-22 setting will not affect ASR operation if either (a) Cn-22 < bn-05, or (b) Cn-23 = ***0.00*** .

C. **Sn-15 thru Sn-18:** Multi-function Input Terminal Function Selection (Term. 5 thru 8)

Data ***0E*** : ASR Integral Reset (IRST)

By programming data ***0E*** into one of the multi-function input system constants (Sn-15 thru Sn-18), one of the multi-function input terminals (5 thru 8) becomes an ASR integral reset. When there is a long time lag between the applying of control power and actual run operation, output voltage may be produced due to the integrator offset. In such cases, the integral reset function should be ON until the start of the run operation.



C. (Continued)

Data *74*: Integral Hold (ASR)

This function is used to prevent the ASR from integrating while a downstream limit is exceeded. The integral error must be clamped (held) to avoid unexpected results.

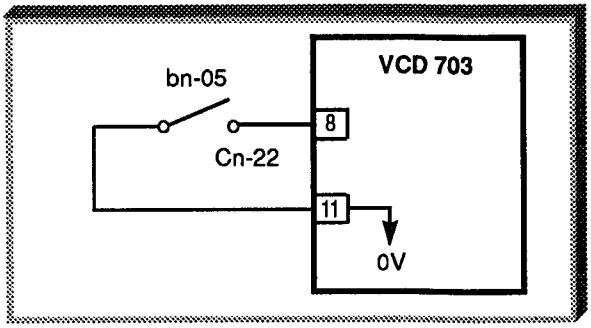
NOTE

This function should be considered whenever drive limits (downstream) are involved, such as torque limit, speed limit, etc.

D. **Sn-15 thru Sn-18:** Multi-function Input Terminal Function Selection (Term. 5 thru 8)

Data *77*: ASR Proportional Gain Changeover

By programming data *77* into one of the multi-function input system constants (Sn-15 thru Sn-18), one of the multi-function input terminals (5 thru 8) becomes a proportional gain selector. When the multi-function input is closed, the gain in Cn-22 will be used in the ASR. When the multi-function input is open, the gain in bn-05 will be used in the ASR.



E. **Cn-07:** ASR Output Lag Time

Factory Setting: *4* msec
Range: 0 to 500 msec

This function is used as a filter for mechanical problems such as mechanical backlash, play, etc., which may prevent the ASR proportional gain from being increased or adjusted.

5.4 AUTO-RESTART

A. **Cn-20:** Number of Auto-Restart Attempts

Factory setting: *0*
Range: 0 - 10

When a fault occurs during operation, the VCD 703 can be programmed to carry out auto-restart operation to automatically reset the fault (Sn-08 = *0XXX*). Auto-restart operation will use the number of reset attempts set in this constant, up to the maximum of 10. When set to *0*, no auto-restarts will be attempted.

- The following faults can be automatically reset:

oC:	Overcurrent	*oL2*:	Overtorque
ou:	Overvoltage	*oH*:	Overheat
oL1:	Motor overload	*Uu1*:	Undervoltage

- The following conditions WILL NOT initiate auto-restart:
  1. ***CPF _ _***, ***EF _***, ***FU***, or ***Uu3*** fault.
  2. When oC or Uu occurs during deceleration.
  3. When Sn-11, digit 3 (X **0** X X) is programmed to stop during momentary power loss (for Uu1 fault only). (See paragraph 5.10, **MOMENTARY POWER LOSS RIDE-THRU**, for further details.)

- The number of restart attempts available will be reset to the Cn-20 setting when:
  1. 10 minutes has elapsed without a fault occurring.
  2. The **RESET** key, or external RESET push button, is pressed.

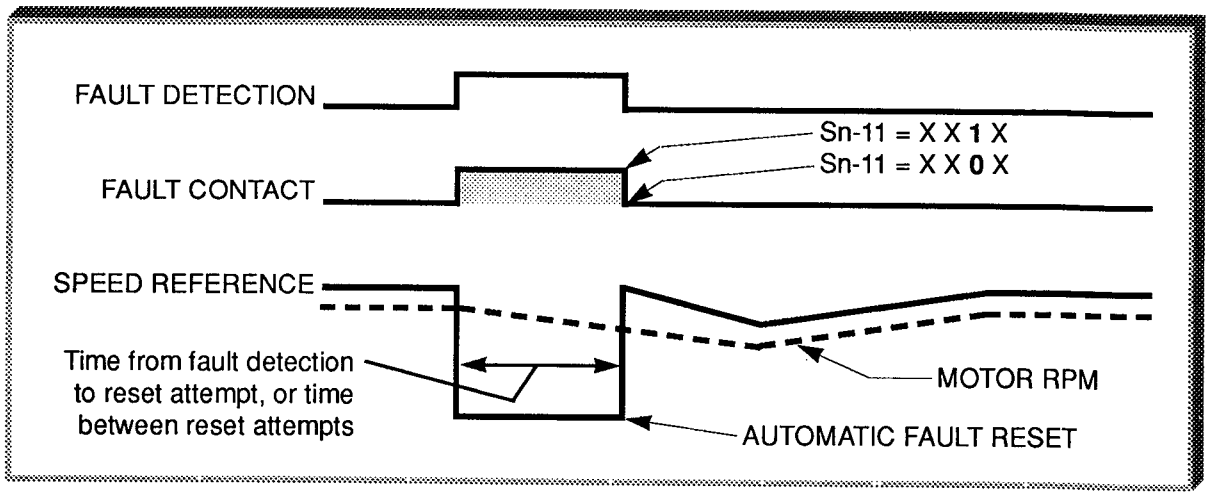
B. Sn-11: Protective Characteristics 2

Digit 2 [X X **X** X]: Fault Contact Status During Auto-Restart

This digit controls how the fault contact responds to a VCD 703 fault during the auto-restart operation:

0: Fault contact will not actuate during auto-restart attempts

1: Fault contact actuates during auto-restart attempts



Auto-Restart Operation Timing

Cn-12: Operator Display Mode

Factory setting: *0*
Range: 0 to 39999

This constant designates what Drive parameter will be displayed on the Digital Operator when the VCD 703 is in the Drive mode. It will be displayed where "SPEED REFERENCE [% Maximum Speed]" was previously displayed.

DATA	PARAMETER DISPLAY
0 (factory setting)	Speed reference, as a percentage (%) of motor maximum speed (dn-02).
1	Motor rpm
00040 to *39999*	Line speed or other parameter. Setting must be 5 digits. X X X X X Parameter value at rated speed (include leading zeroes if necessary) Location of decimal point: *0* = XXXX *1* = XXX.X *2* = XX.XX *3* = X.XXX (See **CAUTION** below) EXAMPLE: To display Line Speed, based on 54.32 FPM at rated speed: Cn-12 setting = *25432*

CAUTION

When setting a 5 digit value in Cn-12, the decimal point position selected will also affect the "n" display only. All speed reference memory settings (An-XX constants; see Table 5-4) will be a percentage of the rated speed programmed into Cn-12.

Example:

Cn-12	*33000*	3.000 (Rated speed value) Decimal point at X.XXX
"n"	1.000	(3.000 rated speed)
An-01	*33.33*	(33% of rated speed)
An-09	*10.00*	(10% of rated speed)

5.6 DISPLAY MODE (POWER-UP) SELECTION

bn-13: Monitor Number After Power-up

Factory setting: *1*
Range: 1 to 3

This function determines which parameter is displayed when the VCD 703 is powered up.

bn-13 Setting	Monitor Selection
1	Speed Reference (%)
2	Speed Feedback (%)
3	Output Current (A)

NOTE

Speed reference or speed feedback units and value can be changed by Cn-12 (Digital Display Selection). See paragraph 5.5.

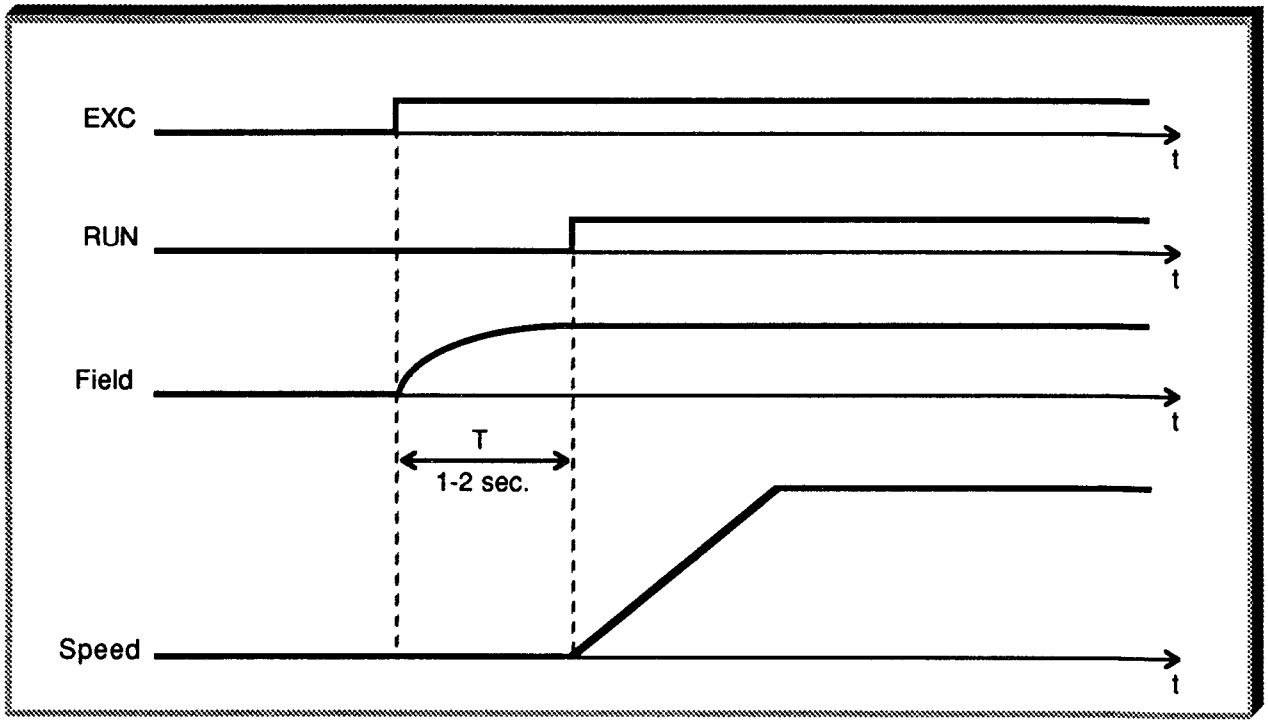
5.7 EXCITATION COMMAND

Sn-15 thru Sn-18: Multi-function Input Terminal Function Selection (Term. 5 thru 8)

Data *70:* Excitation Command

By programming data ***70*** into one of the multi-function input system constants (Sn-15 thru Sn-18), one of the multi-function input terminals (5 thru 8) becomes an excitation command selection input. When the input terminal (i.e. external contact) is open, the excitation command is NOT applied, and when the contact is closed, the excitation command is applied to the motor.

This function is used to build up the magnetic field in the motor before starting. The excitation command should be activated for at least 1-2 seconds before a Run command.



Excitation Command Timing

Cn-08: Initial Excitation Timer

Factory Setting: ***0.0*** seconds
Range: 0.0 to 10.0 seconds

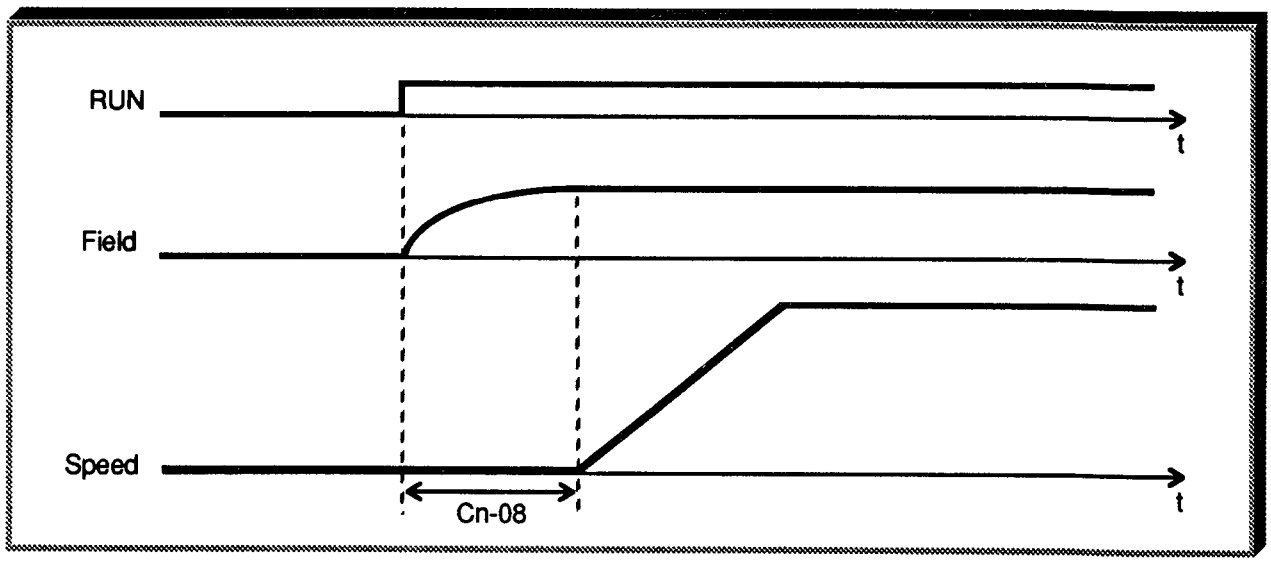
This function sets the time allowed for magnetic field build up in the motor before starting. This rise time is 2-3 times faster than the secondary time constant (dn-12).

This function WILL NOT be performed if:

1. Speed search at auto restart is enabled (Sn 07 = X X X **0**), and
2. Actual speed is at 2% or greater.

NOTE

This function is independent from the excitation command (Sn-15 thru Sn-18 data ***70***).



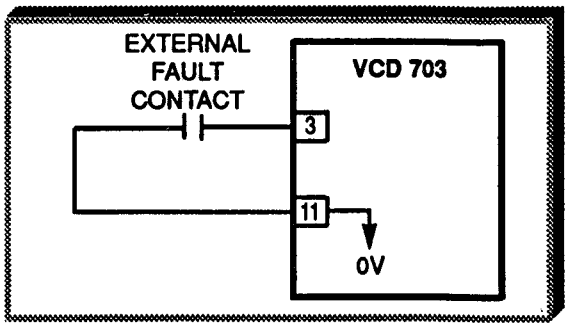
Initial Excitation Timing

5.8 EXTERNAL FAULT INPUTS

A. Sn-12: External Fault Signal Input (Terminal 3)

Factory setting: ***0100***

This function determines how the VCD 703 responds to an external input on terminal 3. The chart below lists the possible settings, and indicates how the VCD 703 will interpret the input signal.



EXAMPLE:

To program External Fault 3 (terminal 3) for a N.C. contact, always detected, and VCD 703 to continue operation:

Sn-12 = 1 1 0 1

- 1 — N.C. contact
- 1 — Always detected
- 0 — Mode 3: Continuous operation

Sn-12 Data	Mode (Note 2) 0	1	2	3	Always Detected	During Operation	Term. 3 (Note 1) N.O.	N.C.
0000	X				X		X	
0001	X				X			X
0010	X					X	X	
0011	X					X		X
0100 (Factory Set)		X			X		X	
0101		X			X			X
0110		X				X	X	
0111		X				X		X
1000			X		X		X	
1001			X		X			X
1010			X			X	X	
1011			X			X		X
1100				X	X		X	
1101				X	X			X
1110				X		X	X	
1111				X		X		X

NOTES

1. N.O. = normally open contact; N.C = normally closed contact.
2. Mode 0 = Ramp to Stop (decel time per bn-02);
   Mode 1 = Coast Stop;
   Mode 2 = Emergency Stop (decel time per bn-12);
   Mode 3 = Continuous operation (minor fault).

B. Sn-15 thru Sn-18: Multi-function Input Terminal Function Selection (Term. 5 thru 8)

Data ***20 - 2F***:	External Fault 1 (terminal 5)
Data ***30 - 3F***:	External Fault 2 (terminal 6)
Data ***40 - 4F***:	External Fault 3 (terminal 7)
Data ***50 - 5F***:	External Fault 4 (terminal 8)

The multi-function input terminals can be used to define various modes of external faults. When the External Faults 1-4 are inputted, ***EF5*** to ***EF8*** are displayed on the Digital Operator (steady for a major fault situation, blinking for a minor fault situation). The second digit of the Sn-15 thru Sn-18 setting is entered as a hexadecimal value; when converted to its binary equivalent, it defines what type of external fault contact is used and how the VCD 703 will react to the fault input.

Binary — 0 0 0 0

- 0 = N.O.contact
  1 = N.C. contact
- 0 = always detected
  1 = during operation
- 00 = ramp to stop
  01 = coast to stop
  10 = emergency stop
  11 = continue operation (minor fault)

BINARY TO HEX CONVERSION

BINARY	HEX
0 0 0 0	0
0 0 0 1	1
0 0 1 0	2
0 0 1 1	3
0 1 0 0	4
0 1 0 1	5
0 1 1 0	6
0 1 1 1	7
1 0 0 0	8
1 0 0 1	9
1 0 1 0	A
1 0 1 1	B
1 1 0 0	C
1 1 0 1	D
1 1 1 0	E
1 1 1 1	F

EXAMPLE:

To program External Fault 1 (terminal 5) for a N.C. contact, always detected, and VCD 703 to continue operation, solve for X:

Sn-15 data = ***2*** X

X = 1 1 0 1

- N.C. contact
- always detected
- continue operation

= 1 1 0 1 (binary) = D (hex)

Sn-15 data = ***2D***

For the same type of input at External Fault 2 (terminal 6):

Sn-16 data = ***3D***

C. Sn-28: Digit 2 [X X **X** X]: Terminal 3 Input Selection

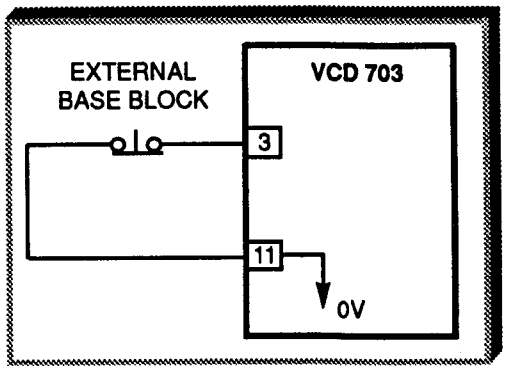
Factory Setting: X X **0** X

This digit selects between external fault or base block as the function of the input at terminal 3.

X X **0** X : External fault input at terminal 3 (see description in part A of this paragraph).

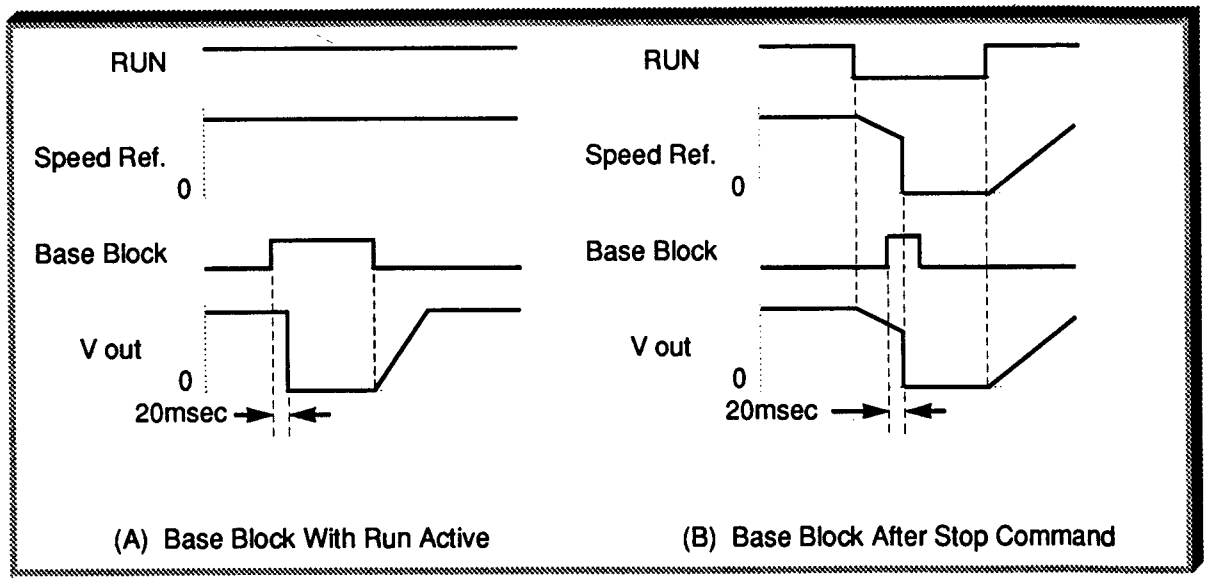
X X **1** X : External base block input at terminal 3; see following description.

External Base Block By N.C. Contact



- When either the Forward Run command or Reverse Run command is closed, and the external Base Block command is also active (i.e. contact open), coast stop is accomplished (after a 20 msec delay), while the speed reference is maintained.
  When the Base Block command is removed, the drive will recover in a manner similar to that of a speed search operation.

- When both the Forward Run command and Reverse Run command are open, and the external Base Block command is active (i.e. contact open), coast stop is accomplished and after a 20 msec delay the speed reference is changed to 0%.
  When the Base Block command is removed, the drive will remain in stopped condition until Forward Run command or Reverse Run command is again closed.



5.9 JOG SPEED REFERENCE

An-09: Jog Speed Reference

Factory setting: ***10.00*** %
Range: 0.00 to 109.22 %

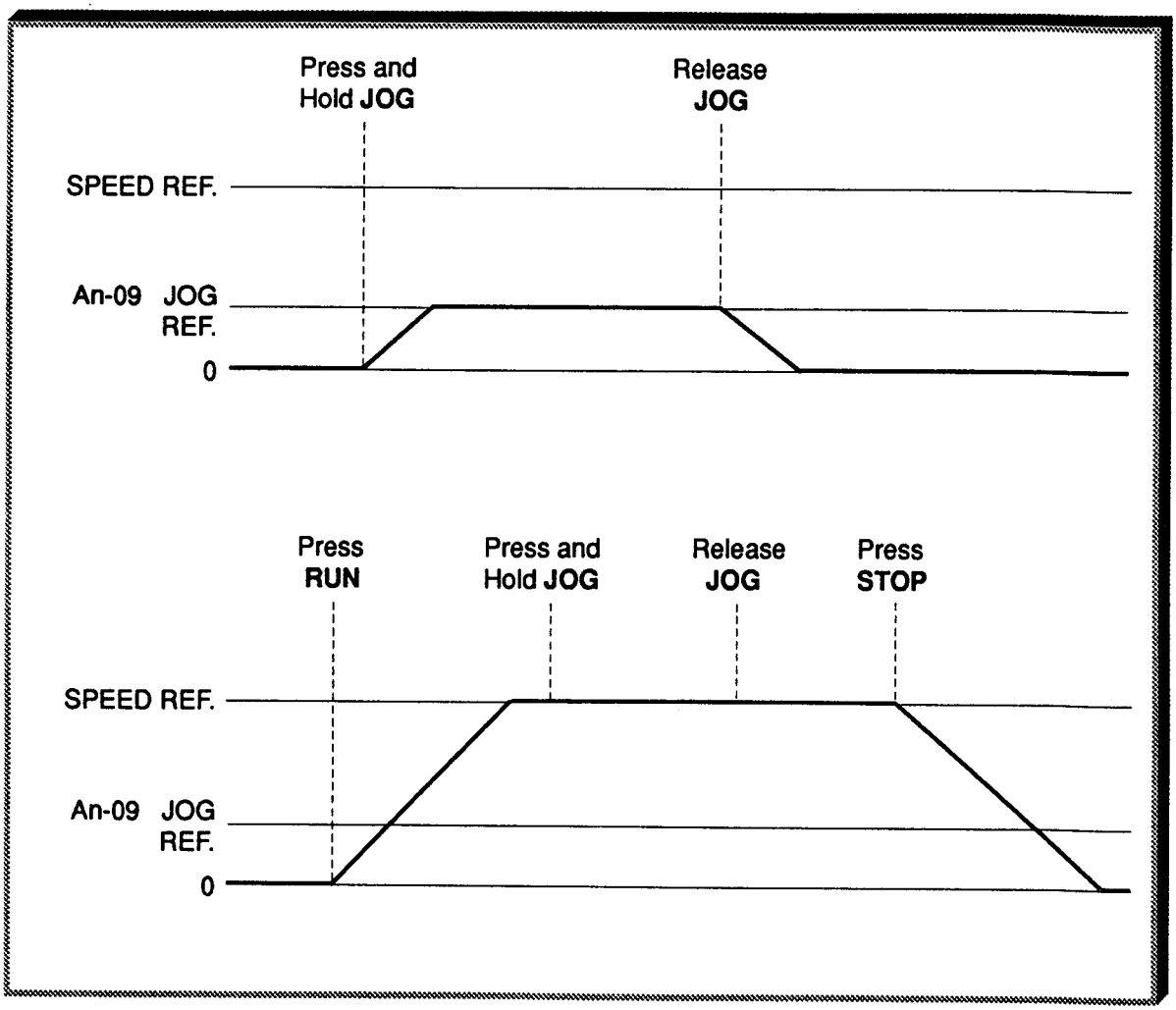
When jog operation is selected (either by the Digital Operator **JOG** key, or by external Jog and Run signals), the VCD 703 output will ramp to the output level set by this constant.

When the Digital Operator is used, Jog can only be initiated from the stopped condition. When the drive is running, the **JOG** key will have no effect on VCD 703 output.

When an external Jog signal is present, it will override the existing operation mode and the VCD 703 will ramp to the level set by this constant.

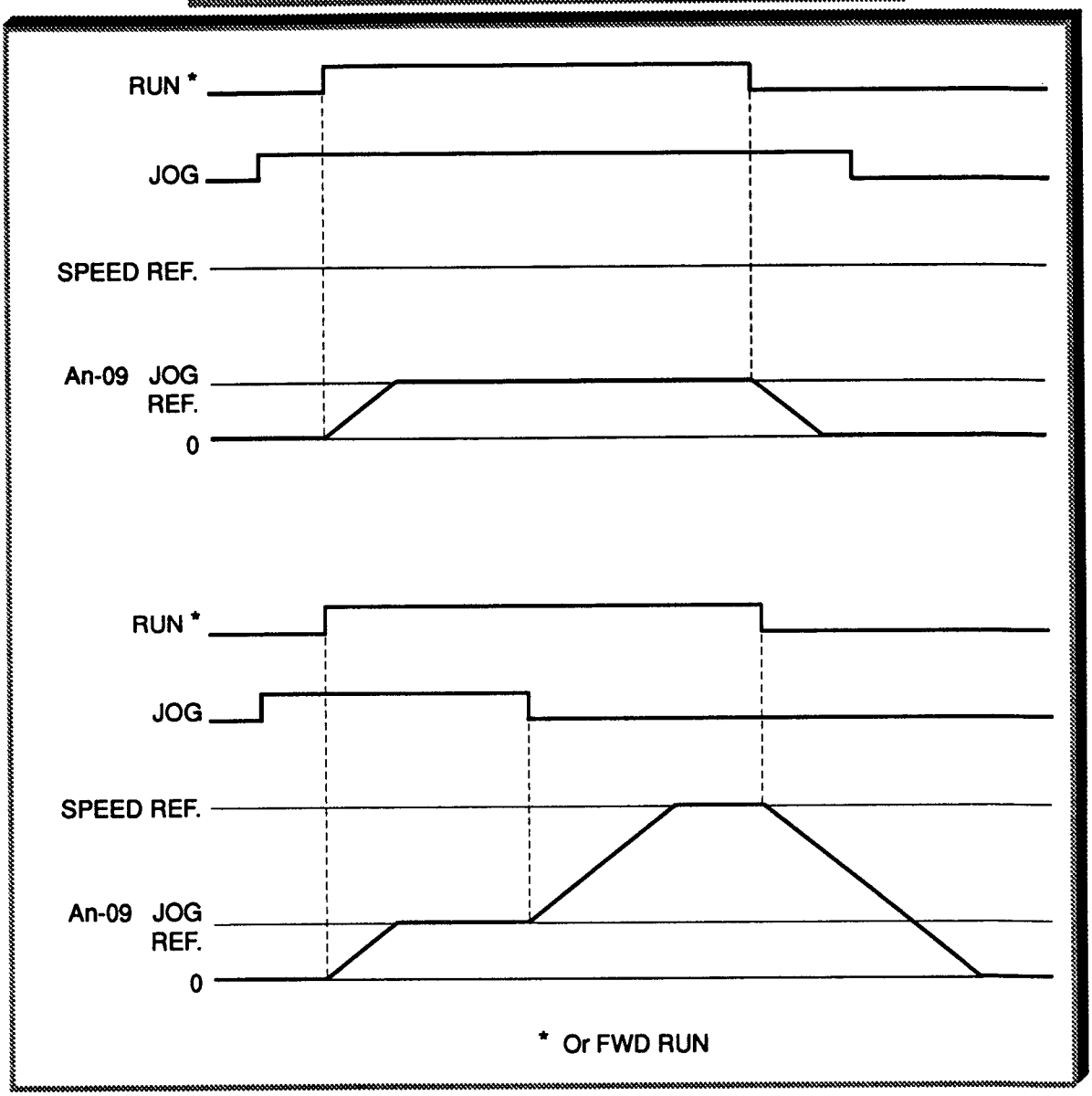
EXAMPLES:

OPERATION FROM DIGITAL OPERATOR



EXAMPLES: (Continued)

OPERATION BY REMOTE SIGNAL INPUT (RUN & JOG)



NOTES:

1. Use of external Jog input is selected by setting data ***06*** in one of the multi-function input system constants, Sn-15 thru Sn-18.
   - The factory configuration for two-wire control is Sn-17 = ***06***, for JOG input at terminal 7.
   - The factory configuration for three-wire control is Sn-18 = ***06***, for JOG input at terminal 8.

Also see descriptions of **MULTI-FUNCTION INPUT TERMINALS** and **RESET CODES**.

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5.9a LOW NOISE OPERATION

A: Sn-09: Operation Mode Selection 6

Digit 4 [**X** X X X]
Factory Setting: **0** X X X

This digit will determine whether the VCD 703 will use the 2kHz carrier frequency or the carrier frequency specified in constant Cn-52. NOTE: With a carrier frequency higher than 2kHz, the VCD 703 may be de-rated. See table and graphs below.

Sn-09 Data X X X X

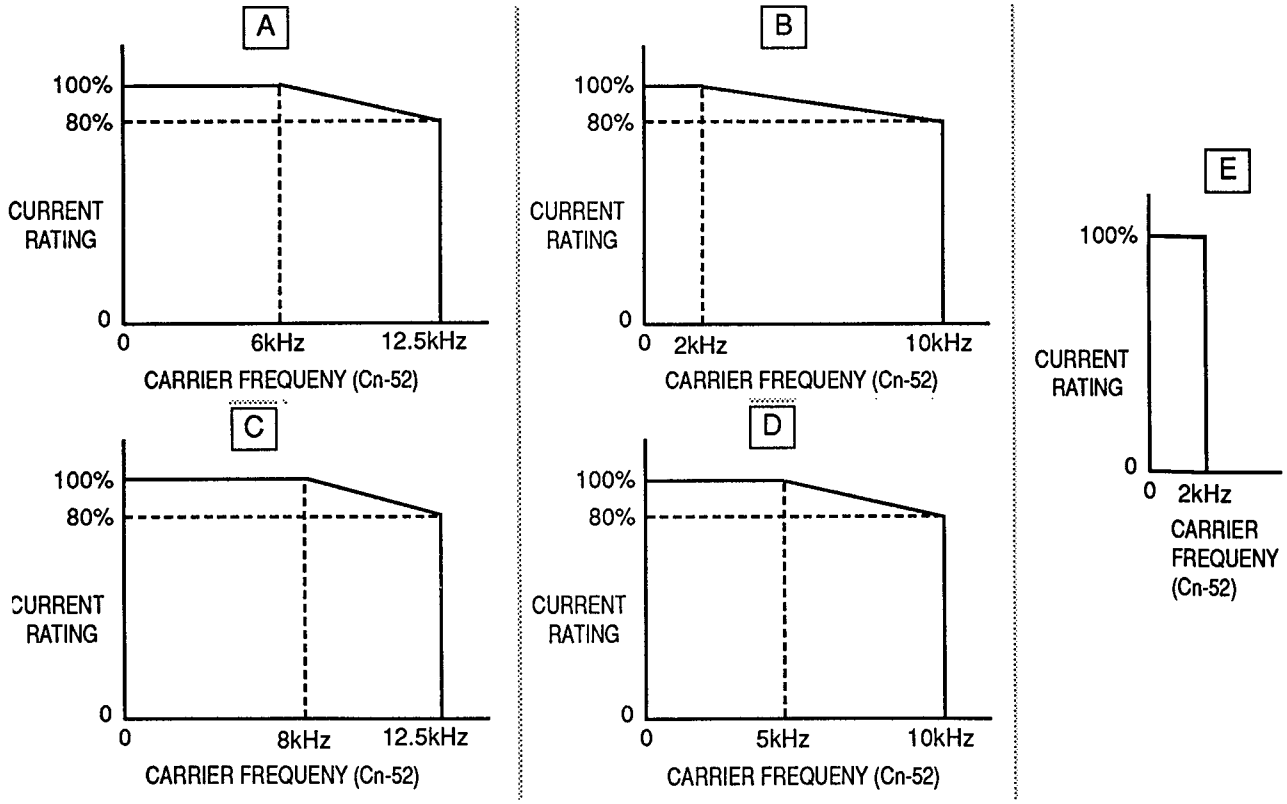
B: Cn-52: Carrier Frequency Selection

Factory Setting: Sn-01 dependent
Range: ***2*** to ***12.5*** kHz

This constant sets the value of carrier frequency, in increments of 1kHz, when Sn-09 is set to **1** X X X.

0 : 2kHz carrier frequency
1 : Carrier frequency set in Cn-52

Voltage	Model Number VCD703-	Characteristic De-rating Curve
230	A001 - A030	A
	AL40 - AL50	B
460	B001 - B050, BL60	C
	BL75 - BL200	D
	B250 - B400	E



5.10 MOMENTARY POWER LOSS RIDE-THRU

Sn-11: Protective Characteristics 2

Digit 3 [X **X** X X] : Momentary Power Loss Ride-thru Protection
X ***0*** X X = Disabled (Factory setting) X ***1*** X X = Enabled

This function either enables or disables the ride-thru feature of the VCD 703. If disabled, the unit will stop whenever a power loss occurs. If enabled, the VCD 703 will continue to operate during a momentary power loss above 80%, under the following conditions:

If the power loss exceeds the identified time period, the VCD 703 will stop.

— all units 5HP and above - max "ride-thru": 2 seconds (2000 msec).

— all units 3HP and less - max "ride-thru": 1 second (1000 msec). The maximum "ride-thru" time can be extended to 2 seconds (2000 msec) with the addition of an optional external capacitor unit.

If the power loss exceeds the length of time identified by Cn-19, the VCD 703 will stop.

Cn-19: Momentary Power Loss Ride-Thru Time

Factory Settong: See Table 2-1
Range: 0.00 to 2.00 seconds

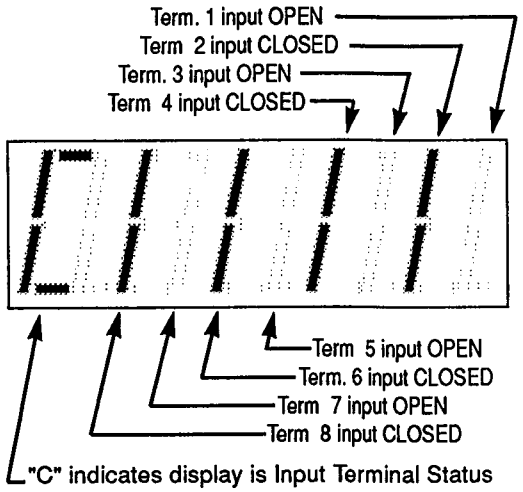
The factory setting of this constant, which is set in 0.01 second increments, is related to the VCD 703's capacity, as set by Sn-01.

5.11 MONITOR DISPLAY (DIGITAL OPERATOR)

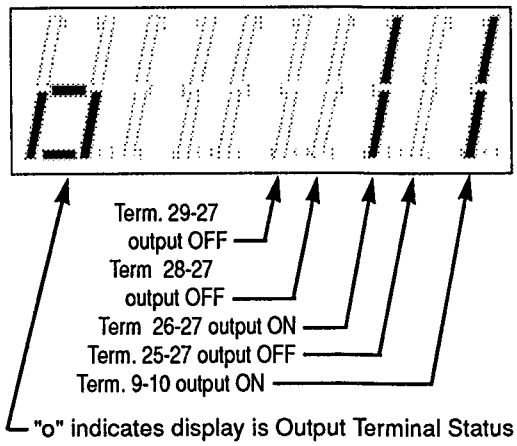
While in the Drive mode, different information will appear on the Digital Operator display when each of the Un-XX constants is selected (see page 4-7).

CONSTANT Un-	MONITORED ITEM	DISPLAY EXAMPLE
01	Not Used	
02	Drive output current (A)	*12.5 A*
03	Drive output current (A)	*12.5 A*
04	Voltage reference (V)	*460u*
05	DC Bus voltage (V P-N)	*Pn650*
06	Not Used	
07	Input terminal status	*C I I I* *
08	Output terminal status	*o I I* **
09	LED lamp check	*8.8.8.8.8.*
10	Control Section Software No. (last 4 digits of PROM Part No. : NSW 67XXXX)	*0020*
11	Optional Section Software No. (for Dig. Ref. option card) (last 4 digits of PROM Part No. : NST 67XXXX)	*1234*
12	DI-16 (option) Input Status (Lower 8 Bits)	*I I I I* ***
13	DI-16 (option) Input Status (Upper 8 Bits)	*I I I I I* ***
14	DO-08 (option) Output Terminal Status	*I I I I* ***
15	Motor control command 1	
16	Motor control command 2	
17	Internal Control Status 1	Δ
18	Internal Control Status 2	ΔΔ
19	Not Used	
20	Not Used	
21	Speed Reference (%) (at input to S-curve circuit)	
22	Speed Reference (%) (at output of S-curve circuit)	
23	Speed Feedback (Nfb) (%)	

* Actual **Un-07** display appearance:



** Actual **Un-08** display appearance:

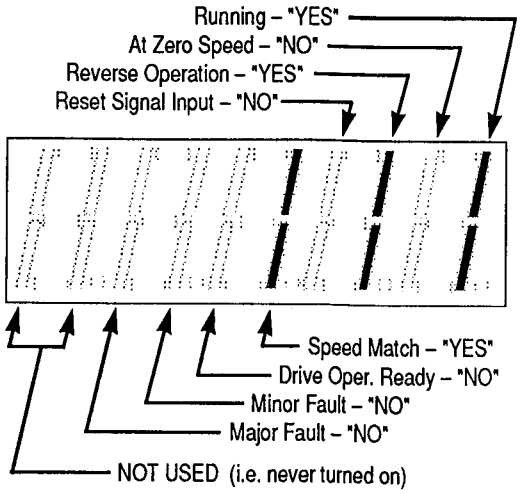


*** For explanation of display, refer to separate instruction sheet for the appropriate option.

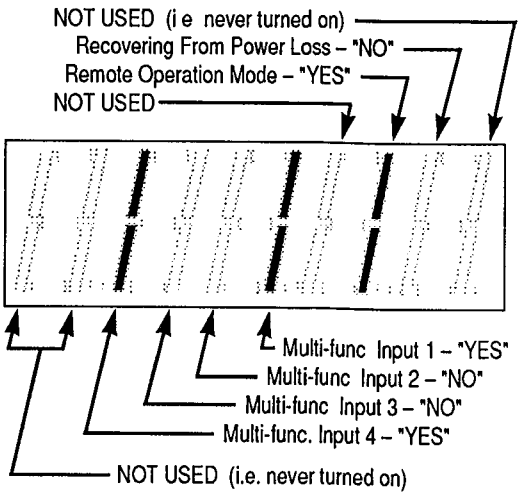
(Continued on next page)

CONSTANT Un-	MONITORED ITEM	DISPLAY EXAMPLE
24	External Torque Ref. (%)	
25	Torque Compensation (%)	
26	Torque Reference (%)	
27	Torque Feedback (%)	
28	Speed Controller Circuit (ASR) Input (%) (Speed Deviation)	
29	Speed Controller Circuit (ASR) Output (%) (after filter)	
30	Slip Frequency Ref. (%)	
31	Primary Frequency Ref. (%)	
32	Motor Temperature (°C)	
33	Zero Servo Moving Pulse (x4)	
34	Ext. Terminal 13 (or 14) Input Voltage (V)	
35	Ext. Terminal 16 Input Voltage (V)	
36	AI-14B (option) CH1 Input Voltage (V)	
37	AI-14B (option) CH2 Input VOltage (V)	
38	AI-14B (option) CH3 Input Voltage (V)	
39	Magnetic Flux Feedback (%) (Phase α)	
40	Magnetic Flux Feedback (%) (Phase β)	
41	ACR Compensation (%)	
42	Magnetic Flux Feedback (only w/ TRQ-A card)	*50.0*
43	Magnetic Flux Controller Output (only w/ TRQ-A)	
44	Output Power (kW)	
49	Accumulated Operation Time (hours)	*1234*

Δ Actual **Un-17** display appearance:



ΔΔ Actual **Un-18** display appearance:



5.12 MOTOR OVERLOAD DETECTION (OL1)

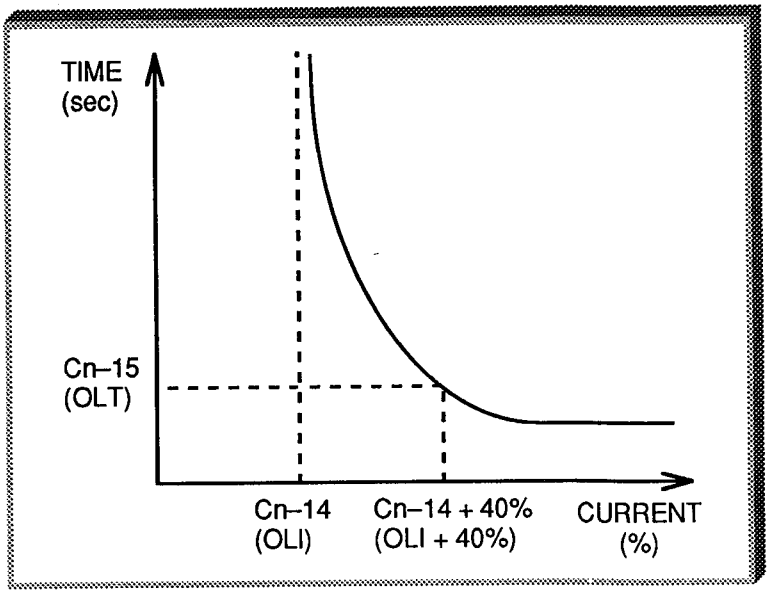
A. Cn-14: Motor OL Detection Starting Current (OLI)

Factory Setting: ***110*** %
Range: 50 to 200 %

Cn-15: Motor OL Operation Time (OLT)

Factory Setting: ***60*** sec
Range: 1 to 120 sec

This function provides motor overload (OL) protection which is based on the motor rated current. The value set in Cn-14 determines the current level (%) when the OL function will start, and Cn-15 determines the time at Cn-14 +40% to trip.



Formula for calculating overload time [I(%) > OLI(%)]:

$$\text{Time (OL1)} = \frac{40\%}{\text{I(\%)} - \text{(Cn-14)}} \times \text{(Cn-15)}$$

EXAMPLE: Calculate time at 150% current [I(%)] Factory Settings: Cn-14 = 110 %, Cn-15 = 60 sec

$$\text{Time (OL1)} = \frac{40\%}{150 - 110} \times \text{(Cn-15)}$$

Time (OL1) = 60 sec

Sn-38: Other Function Selection 2

Factory Setting: ***0000***

Data: XXX**0** = Electronic thermal protection for TENV or TEBC type motors
XXX**1** = Electronic thermal protection for TEFC type motors

The setting of Sn-38 will determine when a motor overload (OL1) will occur. After an OL1 occurs, thte behavior of the drive will be determined by Sn-14 - XXXX.

B. Sn-14: Protective Characteristics 5 (Motor Protection)

Digit 1 & 2 [XX**X X**]
Factory Setting: XX**0 1**

The setting of these digits determines the stopping method when the motor overload (OL1) time had been exceeded.

X X 0 0 : Ramp to stop (decel time per bn-02 setting)

X X 0 1 : Coast stop

X X 1 0 : Emergency stop (decel time per bn-12 setting)

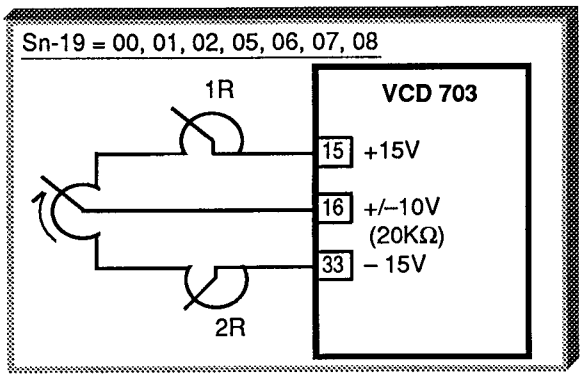
X X 1 1 : Continue operation

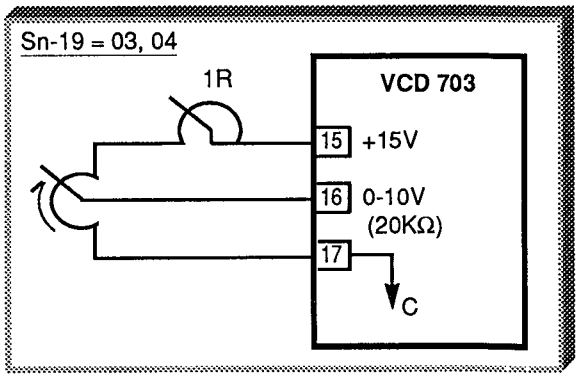
5.13 MULTI-FUNCTION ANALOG INPUT

Sn-19: Multi-function Analog Input Terminal (Term. 16) Function Selection

Factory Setting: ***00***

Programming Sn-19 per the chart below configures terminal 16 for analog control. The figures on page 5-27 show how each setting configures the analog input.



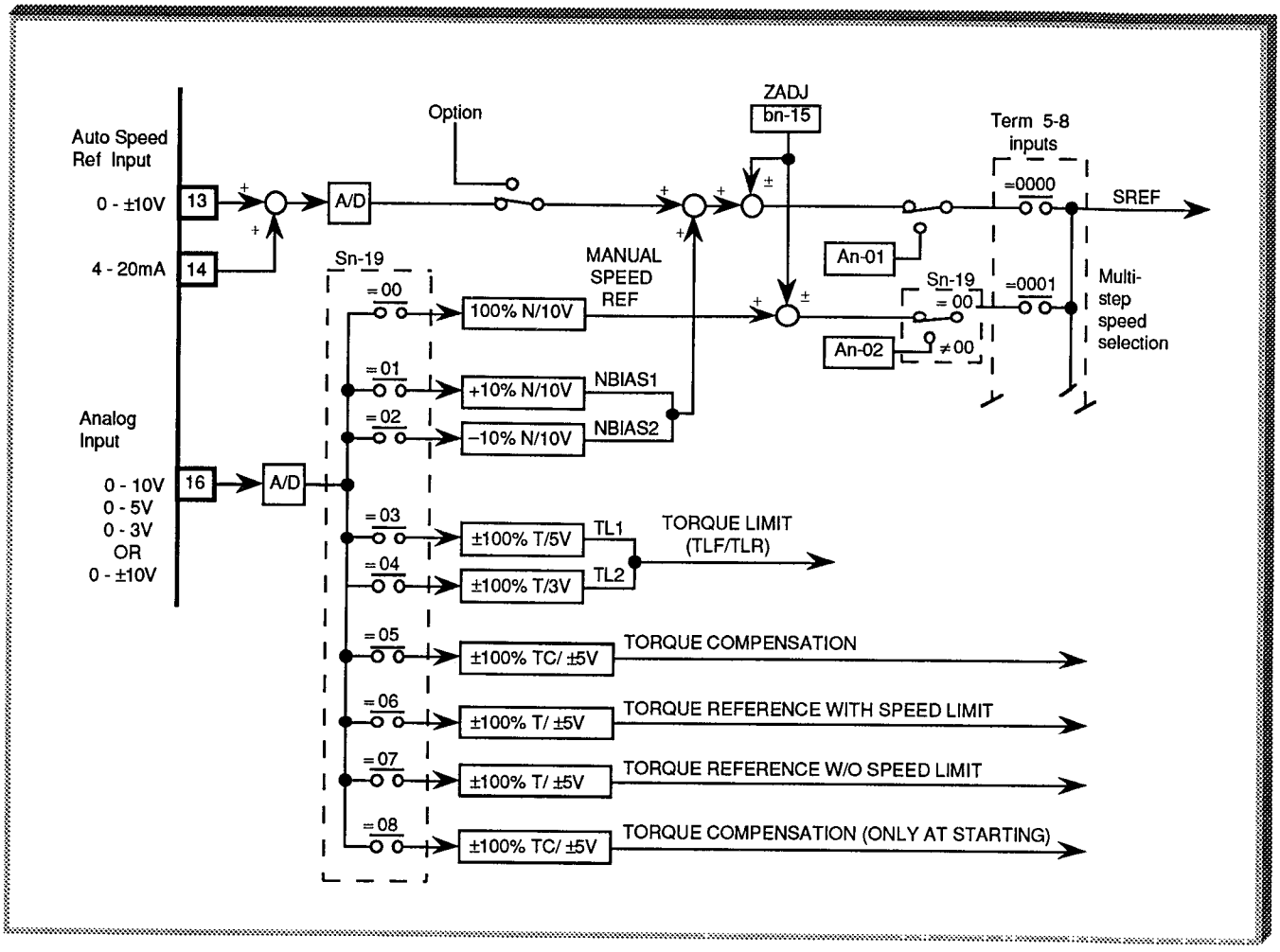


SET VALUE	FUNCTION	
00	Manual Speed Reference	(±100% N / ±10V)
01	Speed bias 1 (NBIAS1)	(±10% N / ±10V)
02	Speed bias 2 (NBIAS2)	(±10% N /∓ 10V)
03	Torque limit 1 (TL1) *	(±100% T / 5V)
04	Torque limit 2 (TL2) *	(±100% T / 3V)
05	Torque compensation	(±100% TC /±5V)
06	Torque reference (Torque control with speed limit)	(∓100% T /±5V)
07	Torque reference (Torque control w/o speed limit)	(∓100% T /±5V)
08	Torque compensation at starting	(±100% TC /±5V)

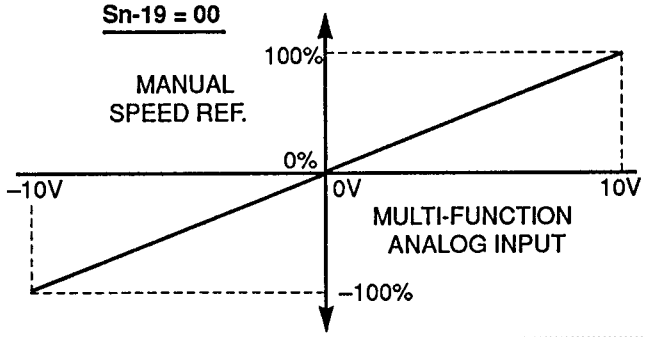
N = speed T = torque

* Both FWD and REV torque limit; see paragraph 5.32.

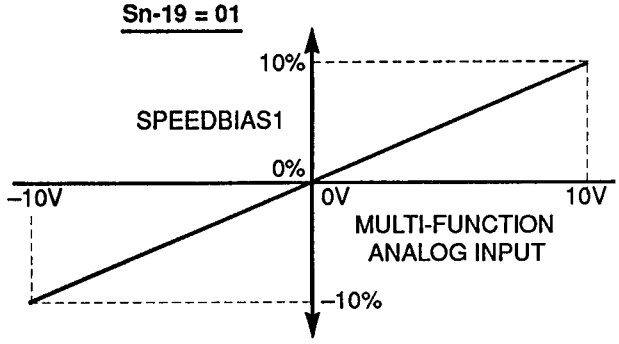
5.13 MULTI-FUNCTION ANALOG INPUT Continued



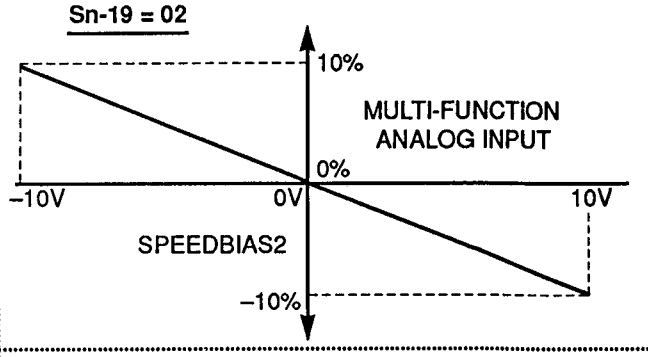
Sn-19 = 00



Sn-19 = 01

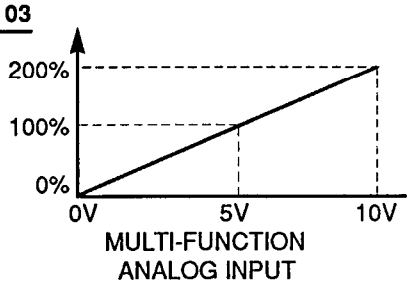


Sn-19 = 02



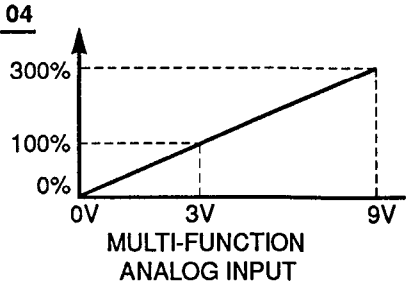
Sn-19 = 03

TORQUE LIMIT 1



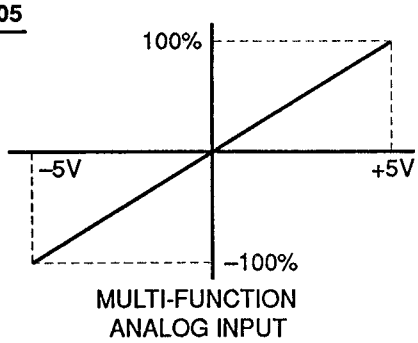
Sn-19 = 04

TORQUE LIMIT 2



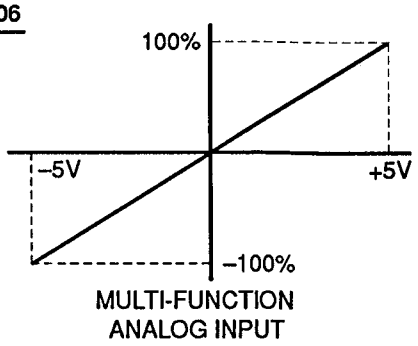
Sn-19 = 05

TORQUE COMPENSATION



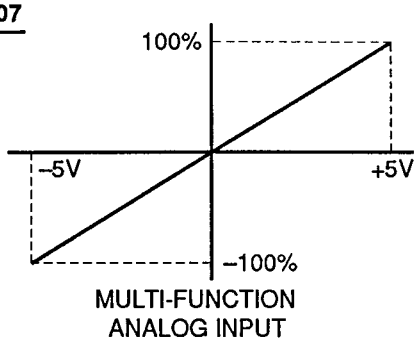
Sn-19 = 06

TORQUE REFERENCE (Torque control with speed limit)



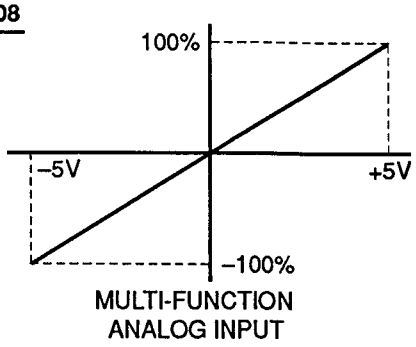
Sn-19 = 07

TORQUE REFERENCE (Torque control without speed limit)



Sn-19 = 08

TORQUE COMPENSATION AT STARTING



5.14 MULTI-FUNCTION ANALOG MONITOR OUTPUT

bn-17: Multi-function Monitor Output 1 Selection

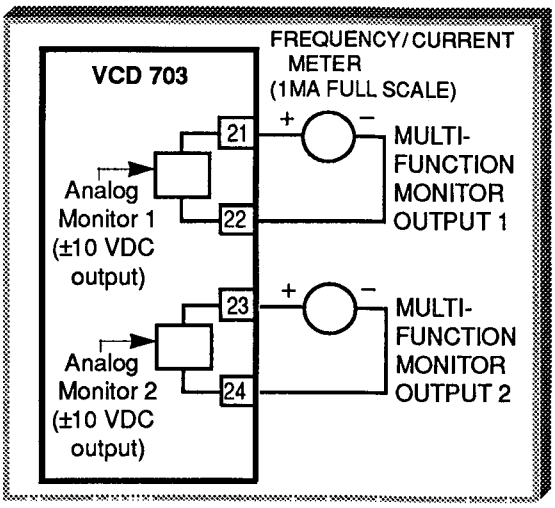
Factory Setting: ***23***
Range: 02 to 05, 21 to 44

bn-26: Multi-function Monitor Output 2 Selection

Factory Setting: ***02***
Range: 02 to 05, 21 to 44

The analog monitor outputs provide a 0-±10 VDC signal between terminals 21 & 22 (23 & 24), proportional to the value of the Un-XX constant identified by the setting of bn-17 (bn-26).
(See Table 5-10 for listing of Un-XX constants.)

Factory setting, monitor output 1 =
Un-23 : Speed Feedback (%)
Factory setting, monitor output 2 =
Un-02 : Drive ouput current
(5V = continuous
rated current)



NOTE

This output is suitable for metering, but SHOULD NOT be used for external control circuits. To produce an output signal for use by external control circuits, an Analog Monitor option card (AO-08 or AO-12) must be installed in the VCD 703.

bn-18: Multi-function Monitor Output Gain

Factory Setting: ***1.000***
Range: 0.000 to 10.000

The setting of this constant, in increments of 0.001, is used to calibrate the output at terminals 21 & 22.

bn-27: Multi-function Monitor Output Gain

Factory Setting: ***1.000***
Range: 0.000 to 10.000

The setting of this constant, in increments of 0.001, is used to calibrate the output at terminals 23 & 24.

Sn-28: Analog Output Function Selection

Digit 1 [XXX**X**]
Factory Setting: XXX**0**

This function allows the analog monitor output(s) to have a unipolar output signal (0-10V), or a bipolar output signal (0-±10V).

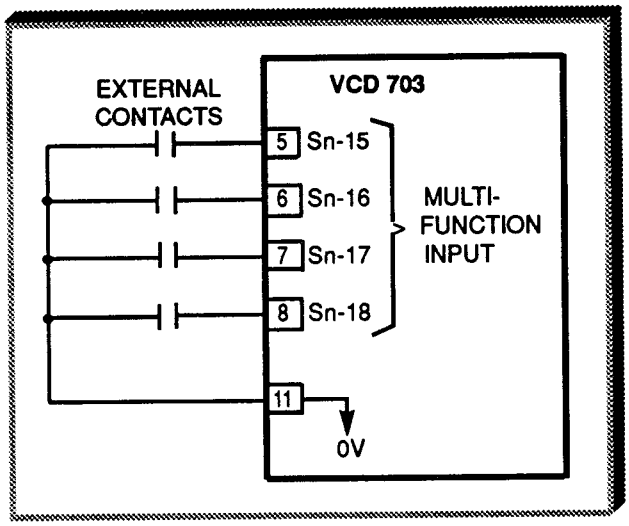
0 : Analog output is +/– voltage according to sign (direction).
1 : Analog output is + voltage only (absolute value).

5.15 MULTI-FUNCTION INPUT TERMINALS

Sn-15: Terminal 5 Function
Sn-16: Terminal 6 Function
Sn-17: Terminal 7 Function
Sn-18: Terminal 8 Function

Factory settings (for 2-wire control):
Sn-15 = ***03***
Sn-16 = ***04***
Sn-17 = ***06***
Sn-18 = ***08***

These four constants select the input signal functions for terminals 5 thru 8. Although these constants can be independently set, NOT selecting values ***00*** thru ***03***, inclusive, establishes that VCD 703 operation will be controlled by the Auto Speed Reference input.



System constant settings are checked whenever power is applied to the VCD 703, or each time VCD 703 operation is switched from Program mode to Drive mode. A constant set value failure (***oPE03***) will occur if set values are not arranged in sequence, with the smallest value in Sn-15 and the largest value in Sn-18.

Table 5-2 (next page) lists the possible data setting values for these constants, with the function and a brief description for each one.

Table 5-2. Sn-15 thru Sn-18 Data Settings

DATA	FUNCTION	DESCRIPTION Signal Levels: **0** = maintained; **1** = momentary
00	FWD/REV selection (for 3-wire control)	MUST BE SET IN Sn-15. Redefines terminals to: 1 = Run; 2 = Stop; 5 = FWD/REV select
01	Operation signal selection (Remote/Local)	Open 0 = Operates according to setting of Sn-04, digits 1 & 2 [X X ***0 0***] Closed 0 = Operates from keys of the Digital Operator **See Data description following this table**
02	Option/VCD 703 reference selection	Open 0 = Operates from installed option Closed 0 = Operates from Digital Operator and/or external terminals
03	Multi-step speed select 1	**See paragraph 5.20**
04	Multi-step speed select 2	
05	Multi-step speed select 3	
06	JOG selection	Closed 0 = Jog selected **See paragraph 5.20**
07	Accel/decel time	Open 0 = Accel/decel by bn-01/bn-02 Closed 0 = Accel/decel by bn-03/bn-04 **See paragraph 5.2**
08	External base block (N.O. contact input)	Closed 0 = Shuts off VCD 703 output (speed reference is held) **See Data description following this table**
09	External base block (N.C. contact input)	Open 0 = Shuts off VCD 703 output (speed reference is held) **See Data description following this table**
0A	Accel/decel hold (speed HOLD command)	Closed 1 = HOLD **See paragraph 5.2**
0b	External overheat	Closed 0 = ***oH2*** blinks on the Digital Operator, and operation continues (minor fault)
0C	Multi-function analog input (term. 16) effective/ineffective	Closed 0 = Analog input (term. 16) is enabled Open 0 = Analog input (term. 16) is disabled
0D	Not Used	
0E	ASR Integral Reset (IRST)	Closed 0 = Integral Reset **See paragraph 5.3**
0F	Serial Remote I/O Function	Closed 0 = Remote I/O function
10 to 1F	Not Used	

Table 5-2. Sn-15 thru Sn-18 Data Settings - Continued

DATA	FUNCTION	DESCRIPTION Signal Levels: **0** = maintained; **1** = momentary
20 to ***2F***	External fault 1	Second digit of setting is a hexadecimal value; its four-place binary equivalent defines what type of external contact is used and how the VCD 703 will react when the signal input is active **See paragraph 5.8**
30 to ***3F***	External fault 2	
40 to ***4F***	External fault 3	
50 to ***5F***	External fault 4	
64 to ***6F***	Not Used	
70	Initial excitation	Closed 0 = Excitation command **See paragraph 5.7**
71	Speed control / torque control selection	Open 1 = Speed control operation Closed 0 = Torque control operation **See paragraph 5.30**
72	Zero servo ON / OFF	Open 0 = Zero servo OFF Closed 0 = Zero servo ON **See paragraph 5.34**
73	S-curve time select	Open 0 = S-curve time 1 (bn-19) Closed 0 = S-curve time 2 (Cn-26) **See paragraph 5.22**
74	Integral hold (ASR)	Closed 0 = Integral hold **See paragraph 5.3**
75	Torque ref. polarity changeover	Closed 0 = Polarity reversed
77	ASR Proportional gain changeover	Closed 0 = Cn-22 Open 0 = Bn-05
78	Motor Selection	Closed 0 = 2nd Motor Open 0 = 1st Motor **See Data description following this table**
79	Motor Selection	Closed 0 = 1st Motor Open 0 = 2nd Motor **See Data description following this table**
7A	1st Motor Answer Back	**See Data description following this table**
7B	2nd Motor Answer Back	**See Data description following this table**
7C	Speed/Torque control changeover	Closed 0 = Torque control with speed limit Open 0 = Speed control only
7E	Load input selection (for elevator only)	Closed 0 = Load input selection
7F	Battery back up operation (for elevator only)	Closed 0 = Battery back up operation

Data *01*: Remote/Local

Set digits of Sn-04 to X X 0 0 to select external inputs as the source for speed reference and operation commands. The use of a Remote/Local command input allows switching between the Digital Operator control and the external terminal input signals, without the need of reprogramming Sn-04. If the status of the Remote/Local command input is changed while the drive is running, the Remote/Local operation selection is not completed until the next time the VCD 703 is stopped.

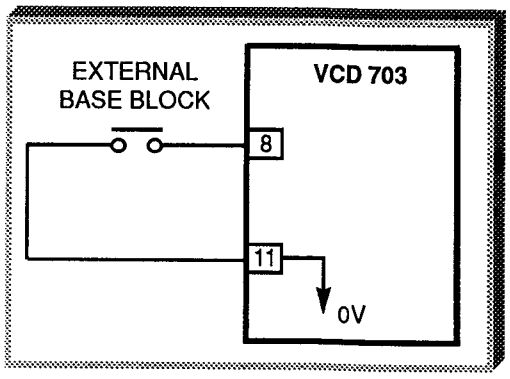
Closed = Controlled locally (Digital Operator)

Open = Controlled remotely (external terminal inputs, and Auto Speed Reference)

NOTE

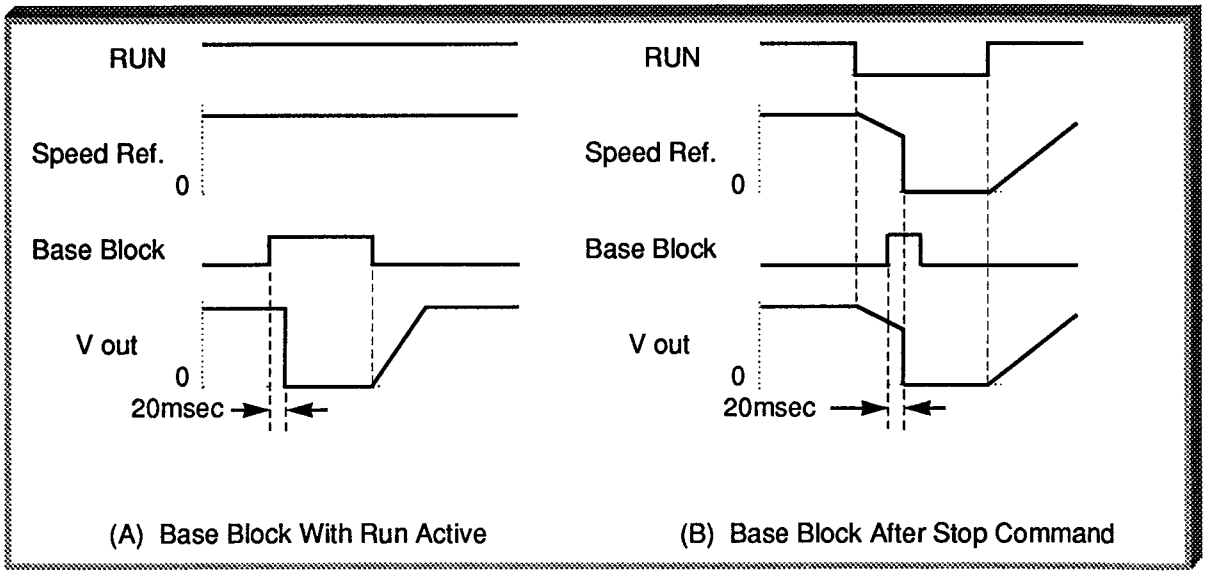
If manual speed is selected, the VCD 703 speed reference will be controlled by manual speed reference regardless of the state of the Remote/Local input.

Data *08*: External Base Block by N.O. Contact



- When either the Forward Run command or Reverse Run command is closed, and the external Base Block command is also active (i.e. contact closed), coast stop is accomplished (after a 20 msec delay), while the speed reference is maintained.
  When the Base Block command is removed, the drive will recover in a manner similar to that of a speed search operation.

- When both the Forward Run command and Reverse Run command are open, and the external Base Block command is active (i.e. contact closed), coast stop is accomplished and after a 20 msec delay the speed reference is changed to 0%.
  When the Base Block command is removed, the drive will remain in stopped condition until Forward Run command or Reverse Run command is again closed.



Data *09*: External Base Block by N.C. Contact

Base block operation is the same as described above, except that the Base Block contact must be open to be recognized as active.

Data *75*: Torque Reference Polarity Changeover

When closed, the polarity of the torque reference is reversed.

Data *78*: Motor Selection (Open: 1st motor; Closed: 2nd motor)

This is used when two different motors will be controlled at different times by the same VCD 703. When open, the dn-XX constants dn-01 thru dn-18 are used. When closed, the dn-XX constants dn-21 thru dn-38 are used. If this contact is changed when the VCD 703 is running, a " SE10 " fault will flash on the display.

Data *79*: Motor Selection (Open: 2nd motor; Closed: 1st motor)

This is used when two different motors will be controlled at different times by the same VCD 703. When open, the dn-XX constants dn-21 thru dn-38 are used. When closed, the dn-XX constants dn-01 thru dn-18 are used. If this contact is changed when the VCD 703 is running, a " SE10 " fault will flash on the display.

Data *7A*: First Motor Answer Back
Data *7B*: Second Motor Answer Back

This is used to signal the drive that the motor is ready to run. It needs to be used in conjunction with a motor selection command (a motor selection command can be accomplished by programming one of the multi-function inputs to either ***78*** or ***79***). When a motor selection command is received by the drive, the motor answer back signal needs to close within one second or a " ***SE 1 1*** " fault will occur. If an answer back signal opens while in "Run" mode, the drive will coast to a stop and display a " ***SE 1 1*** " fault which can be cleared by pressing the RESET key.

Note: It is not necessary to have a motor answer back programmed to use the motor selection function.

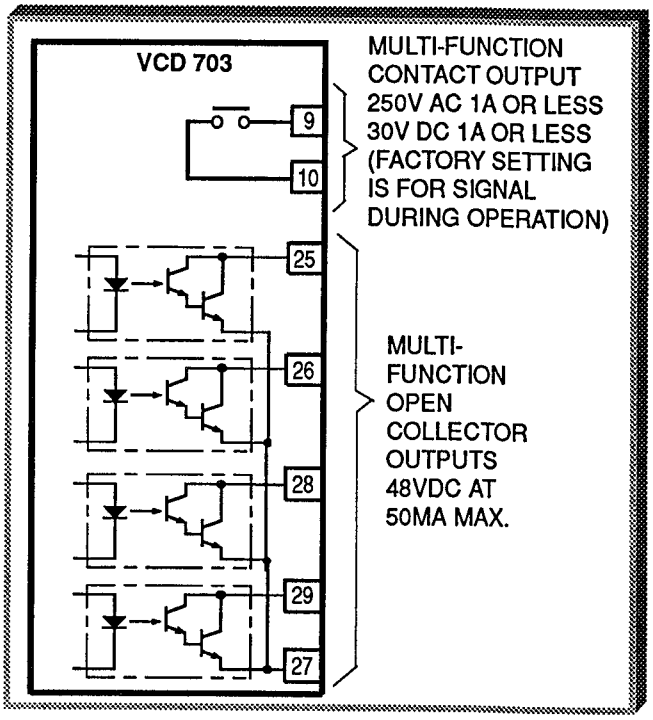
Note: It is not necessary to have both motor answer back commands programmed.

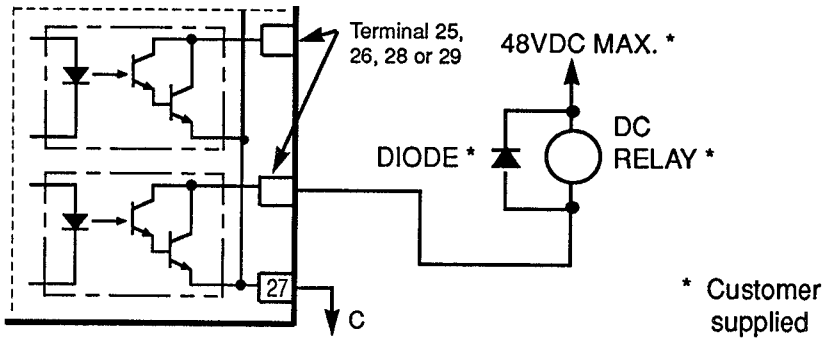
5.16 MULTI-FUNCTION OUTPUT TERMINALS

Sn-20: Contact Output (external terminals 9 & 10)
Sn-21: Open Collector Output (external terminals 25 & 27)
Sn-22: Open Collector Output (external terminals 26 & 27)
Sn-23: Open Collector Output (external terminals 28 & 27)
Sn-24: Open Collector Output (external terminals 29 & 27)

A contact, or four different open collector outputs, can be programmed to change states during any of the conditions indicated in Table 5-3 (next page).

If an open collector output is applied to a DC relay, the relay MUST be diode protected, as shown in the recommended configuration.

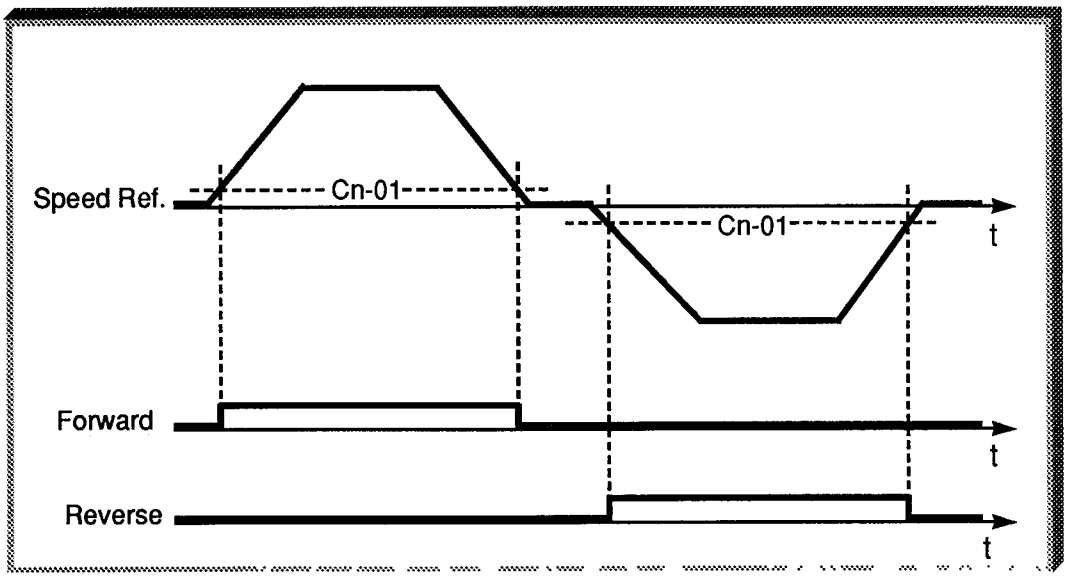




Recommended Configuration for DC Relays

Table 5-3. Multi-function Output Terminals

Set Value	Description: Condition	Description: Signal Level
00	During operation	Closed = VCD 703 is operating
0 I	Zero speed	Closed = VCD 703 output is at 0 %
02	Speed agree 1	Closed = Speed Ref. – Cn-03 ≤ output speed ≤ Speed Ref + Cn-03
03	Speed agree 2	Closed = Speed at set speed and Cn-02 – Cn-03 ≤ output speed ≤ Cn-02 + Cn-03
04	Speed detection 1	Closed = Speed ≤ Cn-02 Open = Speed > Cn-02 + Cn-03
05	Speed detection 2	Closed = Speed ≥ Cn-02 Open = Speed < Cn-02 – Cn-03
06	Operation ready	Closed = VCD 703 is ready for operation
07	Undervoltage detection (UV)	Closed = Undervoltage detected
08	Base block (bb)	Closed = VCD 703 output base block is active; motor is coasting
09	Speed reference mode	Open = Cmd by ext input, Closed = Cmd by Digital Operator
0A	Run reference mode	Open = Run by ext. input; Closed = Run by Digital Operator
0b, 0C	Not Used	
0d	Braking resistor fault (rH, rr)	Closed = Braking resistor is overheating, or has faulted
0E	Fault	Closed = VCD 703 fault has occurred (except CPF00, CPF01)
0F	Serial remote I/O function	Host controller can control output
10	Minor fault	Closed = Minor fault
11	Reset signal input	Closed = Reset signal given from terminal 4 or Digital Operator
12-2F	Not Used	
30	Torque limit	Closed = torque limit
31	Speed reference input limit	Closed = speed limit
32	Torque reference limit by regeneration side torque limit at low frequency	Closed = torque limit (Value determined by On-07)
33	Zero servo completed	Closed = Zero servo mode completed (See para. 5 33)
34	Motor temperature rise detection	Closed = Motor temperature ≥ Cn-28
35	Torque detection 1	Closed = Internal torque reference ≥ Cn-33 (See para 5 31)
36	Torque detection 2	Closed = Internal torque reference ≥ Cn-34 (See para 5 31)
37	Run operation	Closed = VCD 703 is in run mode
38	Motor overtemperature	Closed = MTEMP ≥ dn-18 x 0 95
39	Drive overheat (major fault)	Closed = Motor overheat
3A	Forward motor direction	Closed = VCD 703 is operating motor in forward direction (See Timing Diagram on next page)
3b	Reverse motor direction	Closed = VCD 703 is operating motor in reverse direction (See Timing Diagram on next page)
3C	2nd motor selection	Closed = Second motor is selected
3F	Ready for speed reference input (elevator only)	Closed = Ready for reference



Forward and Reverse Output State Timing

5.17 OVERSPEED DETECTION (for *oS* fault)

Overspeed detection compares the VCD 703 speed feedback with the overspeed detection level. When the actual speed is equal to or greater than the defined level, an overspeed condition exists. This will be indicated as an " ***oS*** " fault on the Digital Operator.

Cn-16: Overspeed Detection Level

Factory Setting: ***120*** %
Range: 50 to 130 %

Sn-10: Protective Characteristics 1

Digit 3 & 4 [**X X** X X]
Factory Setting: **0 1** X X

The setting of these digits determines VCD 703 operation after the overspeed condition is recognized:

0 0 X X : Ramp to stop (decel time per bn-02 setting)

0 1 X X : Coast stop

1 0 X X : Emergency stop (decel time per bn-12 setting)

1 1 X X : Not Used (invalid setting)

5.18 OVERVOLTAGE CONTROL

On-03: Overvoltage Control Function

Digit 3 [X **X** X X]
Factory Setting: X **0** X X

During quick deceleration of (typically) high inertia loads, the regeneration energy causes the DC bus voltage to increase, which may cause an OV trip (overvoltage). Programming On-03 enables the overvoltage control function, and extends the deceleration rate to prevent the VCD 703 from tripping on OV.

NOTE

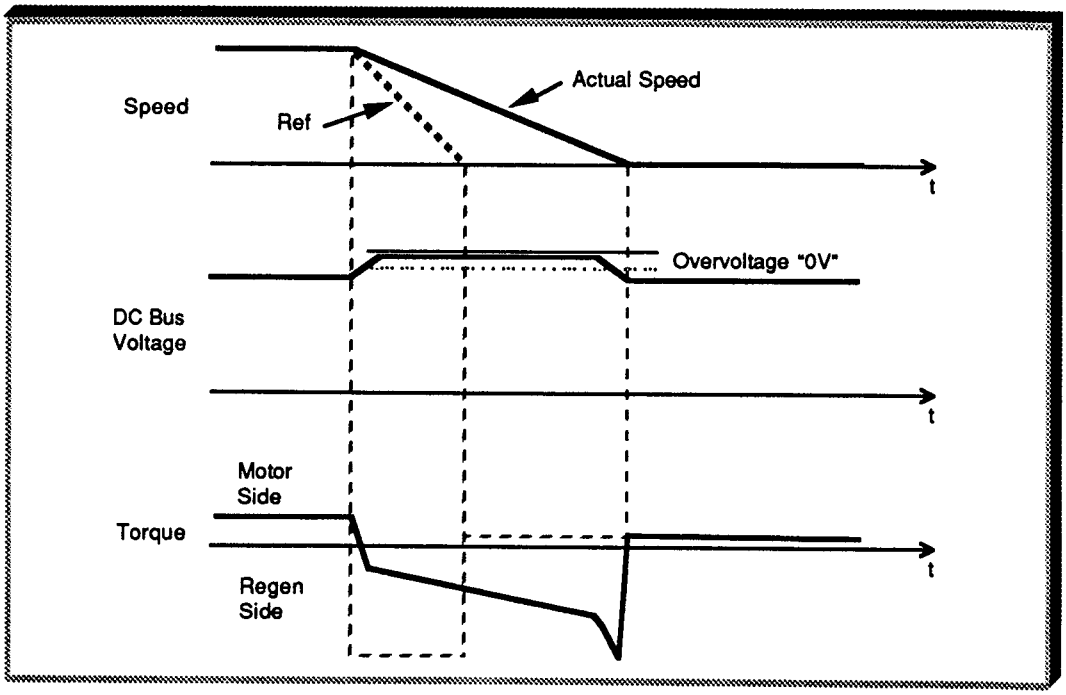
When Dynamic Braking is supplied, this function should be DISABLED.

Data X **X** X X

- 0 : Disabled
- 1 : Enabled

Programming Instruction Steps (in Program mode):

1. Set Sn-03 to 1010 .
2. Select On-03, and program 1110 .
   - 1 — Enable Overvoltage Control
3. Set Sn-03 to 0000 .
4. Select Drive mode.



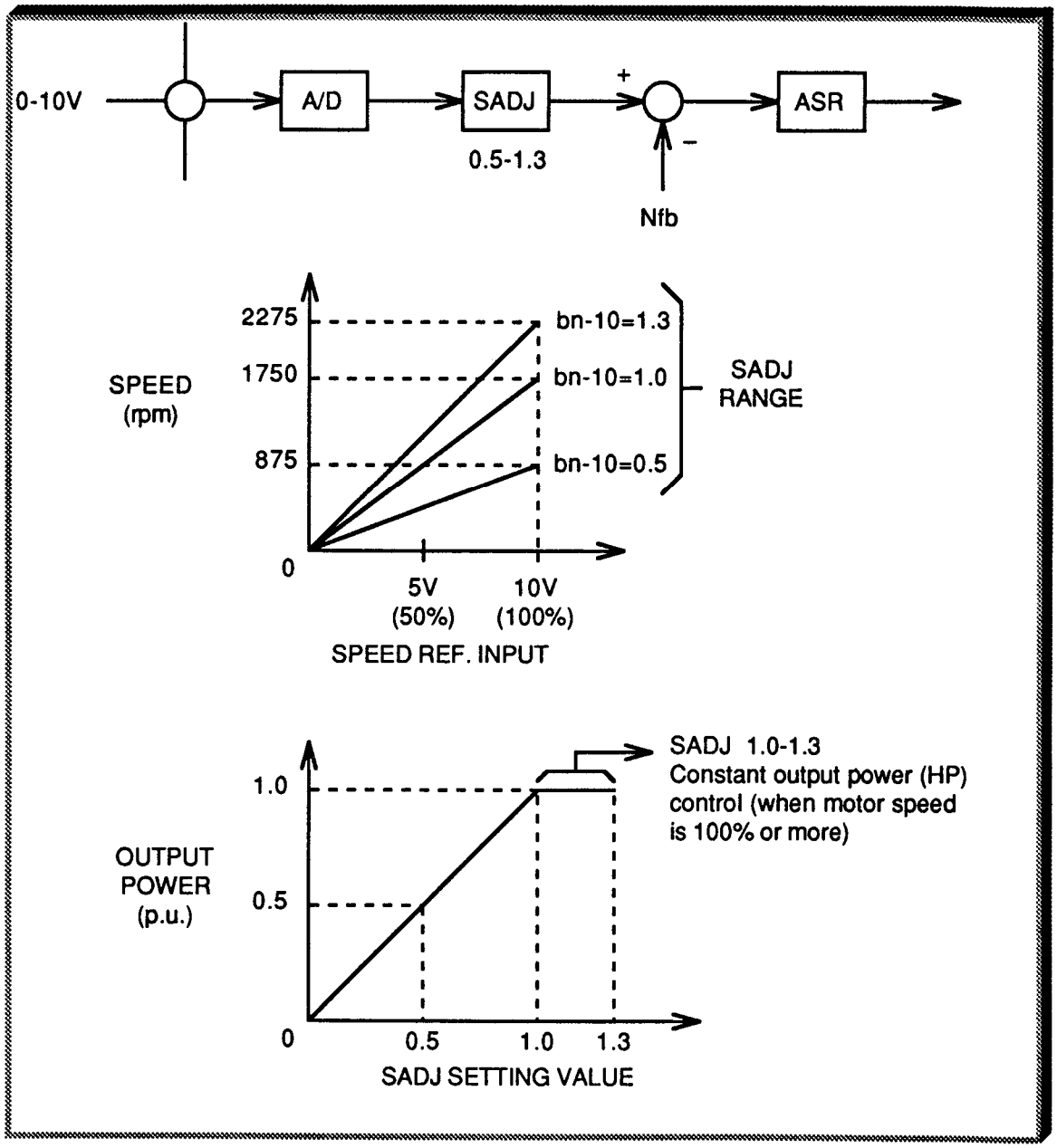
Overvoltage Control Function

5.19 RATED SPEED ADJUSTMENT

bn-10: Rated Speed Adjustment (SADJ)

Factory Setting: ***1.0000***
Range: 0.5000 to 1.3000

This constant is used as a fine adjustment of the speed reference. The adjustment may be used to compensate for differences in actual RPM due to gears, belt ratios, etc.



Rated Speed Adjustment

An-01: Speed Ref. 1 **An-02:** Speed Ref. 2 **An-03:** Speed Ref. 3
An-04: Speed Ref. 4 **An-05:** Speed Ref. 5 **An-06:** Speed Ref. 6
An-07: Speed Ref. 7 **An-08:** Speed Ref. 8 **An-09:** Jog Speed Reference (See paragraph 5.9)

Sn-19: Multi-function Analog Input Function Selection (see paragraph 5.13)
Sn-04: Operation Mode Selection 1
Sn-15 thru Sn-18: Multi-function Input Terminal Function Selection; data ***03***, ***04***, ***05*** and ***06***, respectively
Sn-08: Operation Mode Selection 5

The VCD 703 allows selection of one of twelve speed references. Two are analog inputs at control terminals, nine are stored in memory, and one can be from an option card, either analog or digital. In most configurations either the local Speed Reference (An-01) or the remote AUTO Speed Reference will be utilized.

5.20.1 Remote/Local Speed Reference Selection

Sn-04 data: X X X ***0*** = Remote; X X X ***1*** = Local

By programming Sn-04 to X X X ***0***, the Auto Speed Reference will be used. If Sn-04 is programmed to X X X ***1***, the value in An-01 will be used as a (local) Speed Reference. One point to remember about An-01 is that it will change each time the operator enters a new speed reference from the Digital Operator's " ***n XXX. X*** " prompt. Another way to think about this is that when the VCD 703 is first powered up, the Digital Operator display requests a speed reference by displaying " ***n XXX. X*** ". The value displayed is the current setting of An-01. If the operator changes the display, then An-01 will also be changed.

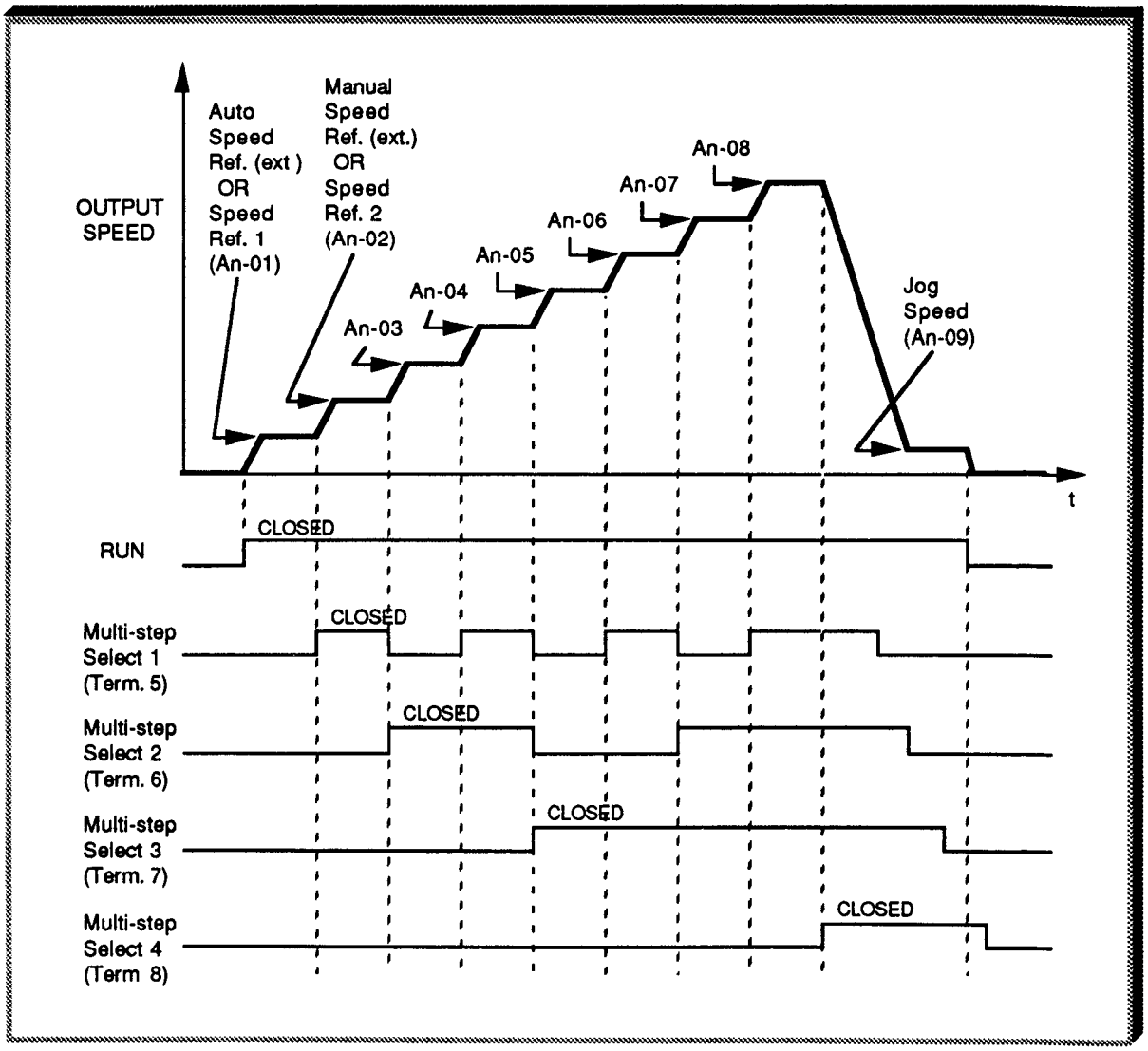
5.20.2 Multiple Speed Reference Configuration [Multi-step Speed Operation]

In a multiple reference configuration, four modes may be selected, as described on the following pages.

NOTE

In the descriptions of Mode 1 thru Mode 3, the external terminal listings differ depending on whether the drive is set for 2-wire or 3-wire control. For 3-wire control, terminal 5 is dedicated to FWD/REV selection; therefore, multiple reference operation will use fewer of the memory settings and is a more limited function.

Depending on the control wiring configuration and the multi-step mode chosen, the motor can be operated at up to nine different speed steps.



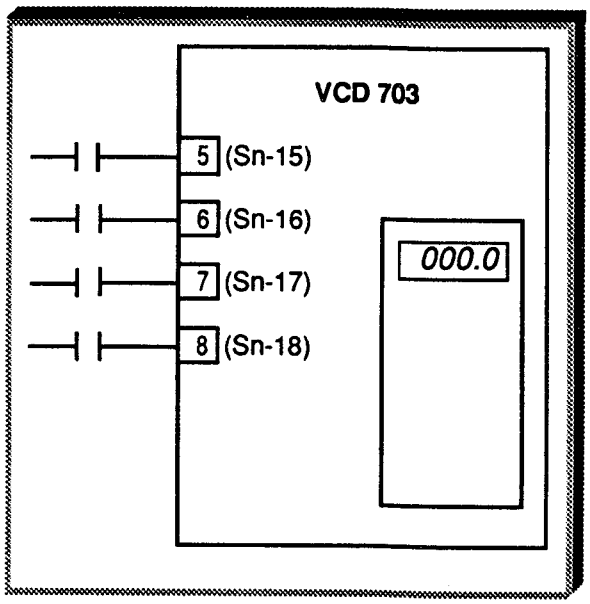
Typical Multi-step Speed Operation

Mode 1 (Memory Data Only)

2-WIRE CONTROL	3-WIRE CONTROL
Sn-04 = X X X ***1***	Sn-04 = X X X ***1***
Sn-15 = ***03***	Sn-15 = ***00***
Sn-16 = ***04***	Sn-16 = ***03***
Sn-17 = ***05***	Sn-17 = ***04***
Sn-18 = ***06***	Sn-18 = ***06***
Sn-19 = *	Sn-19 = *

Mode 1 uses only memory locations An-01 thru An-09.

Sn-04 = local operation.
Sn-15 = speed select 1 at terminal 5.
Sn-16 = speed select 2 at terminal 6.
Sn 17 = speed select 3 at terminal 7.
Sn-18 = JOG select at terminal 8.
Sn-19 = Multi-function analog input at terminal 16.



The input commands at terminals 5 thru 8 are binary coded to select the appropriate reference command, where An-01 is selected by binary zero and An-09 (Jog) is selected by binary 8. For example, if the value in An-04 is the desired speed reference, enter 0011 at terminals 5 thru 8. As a standard, the right-most bit and terminal 5 are the least significant bit (LSB).

3-WIRE CONTROL

Freq. Ref.	External Terminal 8	7	6	5
An-01	0	0	0	■
An-02 *	0	0	1	■
An-03	0	1	0	■
An-04	0	1	1	■
An-09	1	X	X	■

1 = Closed; 0 = Open;
X = No effect; ■ = FWD/REV

2-WIRE CONTROL

Freq. Ref.	External Terminal 8	7	6	5
An-01	0	0	0	0
An-02 *	0	0	0	1
An-03	0	0	1	0
An-04	0	0	1	1
An-05	0	1	0	0
An-06	0	1	0	1
An-07	0	1	1	0
An-08	0	1	1	1
An-09	1	X	X	X

* Sn-19 selects the function of the multi-function analog input at terminal 16. If An-02 setting is to be utilized, then Sn-19 MUST NOT be set to ***00***.

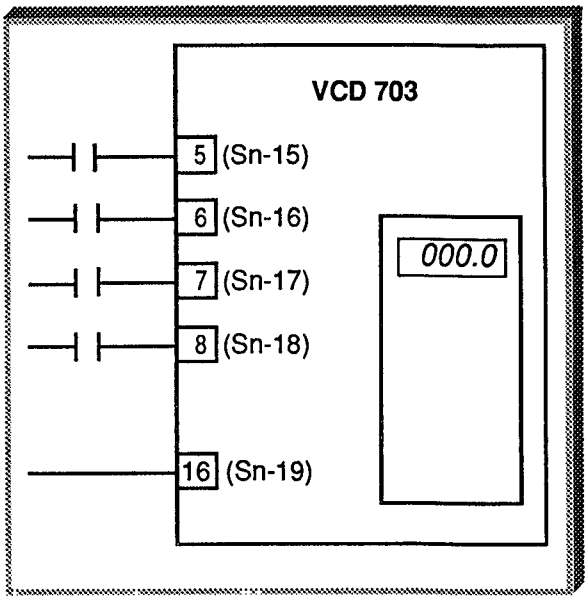
Mode 2 (Auto, Manual, An-03 thru An-09)

2-WIRE CONTROL	3-WIRE CONTROL
Sn-04 = X X X ***0***	Sn-04 = X X X ***0***
Sn-15 = ***03***	Sn-15 = ***00***
Sn-16 = ***04***	Sn-16 = ***03***
Sn-17 = ***05***	Sn-17 = ***04***
Sn-18 = ***06***	Sn-18 = ***06***
Sn-19 = ***00*** **	Sn-19 = ***00*** **

Mode 2 uses Auto Speed Ref., Manual Speed Ref., and An-03 thru An-09.

Sn-04 = remote operation.
Sn-15 = speed select 1 at terminal 5.
Sn-16 = speed select 2 at terminal 6.
Sn 17 = speed select 3 at terminal 7.
Sn-18 = JOG select at terminal 8.
Sn-19 = "Manual Speed Ref." at terminal 16.

The input commands at terminals 5 thru 8 are binary coded to select the appropriate reference command, where Auto is selected by binary zero and An-09 (Jog) is selected by binary 8. For example, if the value in An-04 is the desired speed reference, enter 0011 at terminals 5 thru 8. As a standard, the right-most bit and terminal 5 are the LSB.



3-WIRE CONTROL

Freq. Ref.	External Terminal 8	7	6	5
Auto Δ	0	0	0	■
Manual ** (term. 16)	0	0	1	■
An-03	0	1	0	■
An-04	0	1	1	■
An-09	1	X	X	■

1 = Closed; 0 = Open;
X = No effect; ■ = FWD/REV
Δ Speed reference input at terminal 13 or 14, or from option card

2-WIRE CONTROL

Freq. Ref.	External Terminal 8	7	6	5
Auto Δ	0	0	0	0
Manual ** (term. 16)	0	0	0	1
An-03	0	0	1	0
An-04	0	0	1	1
An-05	0	1	0	0
An-06	0	1	0	1
An-07	0	1	1	0
An-08	0	1	1	1
An-09	1	X	X	X

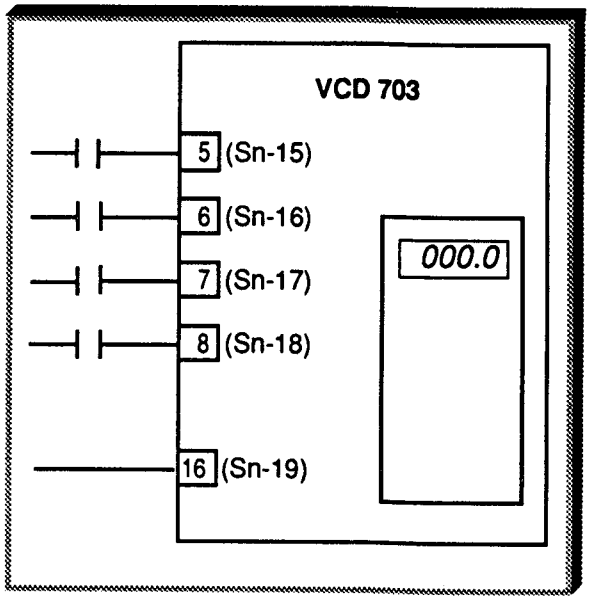
** With Sn-19 set to 00, speed reference 2 (An-02 setting) is not used.

Mode 3 (An-01, Manual, An-03 thru An-09)

2-WIRE CONTROL	3-WIRE CONTROL
Sn-04 = X X X *1*	Sn-04 = X X X *1*
Sn-15 = ***03***	Sn-15 = ***00***
Sn-16 = ***04***	Sn-16 = ***03***
Sn-17 = ***05***	Sn-17 = ***04***
Sn-18 = ***06***	Sn-18 = ***06***
Sn-19 = ***00*** **	Sn-19 = ***00*** **

Mode 3 uses An-01, Manual Speed Ref., and An-03 thru An-09.

Sn-04 = local operation.
Sn-15 = speed select 1 at terminal 5.
Sn-16 = Speed select 2 at terminal 6.
Sn 17 = speed select 3 at terminal 7.
Sn-18 = JOG select at terminal 8.
Sn-19 = "Manual Speed Ref." at terminal 16.



The input commands at terminals 5 thru 8 are binary coded to select the appropriate reference command, where An-01 is selected by binary zero and An-09 (Jog) is selected by binary 8. For example, if the value in An-04 is the desired speed reference, enter 0011 at terminals 5 thru 8. As a standard, the right-most bit and terminal 5 are the LSB.

3-WIRE CONTROL

Freq. Ref.	External Terminal 8	7	6	5
An-01	0	0	0	■
Manual ** (term. 16)	0	0	1	■
An-03	0	1	0	■
An-04	0	1	1	■
An-09	1	X	X	■

1 = Closed, 0 = Open;
X = No effect; ■ = FWD/REV

2-WIRE CONTROL

Freq. Ref.	External Terminal 8	7	6	5
An-01	0	0	0	0
Manual ** (term. 16)	0	0	0	1
An-03	0	0	1	0
An-04	0	0	1	1
An-05	0	1	0	0
An-06	0	1	0	1
An-07	0	1	1	0
An-08	0	1	1	1
An-09	1	X	X	X

** With Sn-19 set to 00, speed reference 2 (An-02 setting) is not used.

Mode 4

The final consideration for multiple speed command configuration modes is that any combination of binary weighted values may be configured for operation. As an example, if only three speed steps are required, then the following programming will work.

Sn-04 = X X X ***1***
Sn-15 = ***03***
Sn-16 = ***04***
Sn-19 = ***00*** **

Sn-04 = local operation.
Sn-15 = speed select 1 at terminal 5.
Sn-16 = speed select 2 at terminal 6.
Sn-19 = "Manual Speed Ref." at terminal 16.

Freq. Ref.	External Terminal 8	7	6	5
An-01	0	0	0	0
Manual ** (term. 16)	0	0	0	1
An-03	0	0	1	0

** With Sn-19 set to 00, speed reference 2 (An-02 setting) is not used.

5.21 RESET CODES / CONSTANT ACCESS CODES

Sn-03: Operator Status

Data *1110* = 2-Wire Reset
Data *1111* = 3-Wire Reset

By entering either of these two codes into this constant, a reset to factory configuration is accomplished. The constants which are **NOT** affected are:

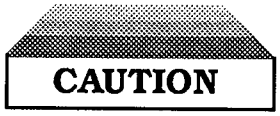
Sn-01: VCD 703 Capacity
Sn-02: Motor Selection
Cn-09: PG Constant
On-17 thru On-20: DSP A/D Converter
On-22: AO Output Offset

Factory configuration for 2-wire control:

Sn-15 = ***03*** — Speed Select 1
Sn-16 = ***04*** — Speed Select 2
Sn-17 = ***06*** — Jog Speed
Sn-18 = ***08*** — External Base Block (Coast to Stop)

Factory configuration for 3-wire control:

Sn-15 = ***00*** — FWD/REV Select
Sn-16 = ***03*** — Speed Select 1
Sn-17 = ***04*** — Speed Select 2
Sn-18 = ***06*** — Jog Speed



Know your application before using the Reset function of constant Sn-03.
1110 = Factory 2-Wire control reset (Maintained RUN Contact)
1111 = Factory 3-Wire control reset (Momentary START/STOP Contact)
When either of these reset codes is entered, all constants are returned to factory settings (EXCEPT Sn-01, Sn-02, Cn-09, On-10, On-14, On-15, On-17 thru On-20, On-22, On-34 thru On-47, and dn-XX constants); Sn-03 automatically returns to 0000.

If the VCD 703 is connected for 3-Wire control and this constant is set to 1110 (2-Wire control reset), the motor may run in reverse direction WITHOUT A RUN COMMAND APPLIED. Equipment damage or personnel injury may result.

Data ***0000*** = Constants Access
Data ***1010*** = Constants Access
Data ***1001*** = Constants Access

Entering one of these three codes into this constant will establish which lists of constants can be viewed while in the Drive mode, and whether or not they can be have their settings changed while the drive is running.

Constants	Sn-03 Set Value				
	0000	1010	1001	1110	1111
An-XX	●	●	●	2-wire Initial-ization (reset) *	3-wire Initial-ization (reset) *
bn-XX	●	●	●		
Cn-XX	○	○	●		
dn-XX	○	○	●		
On-XX	X	○	●		
Sn-XX	○	○	○		

●: Setting can be changed in either Drive or Program mode.

○: Settings can only be changed in Program mode.

X : Not shown in either Drive or Program mode.

* Sn-03 returns to ***0000*** after initialization is complete.

5.22 S-CURVE CHARACTERISTICS

A. **bn-19:** S-Curve Time 1
Cn-26: S-Curve Time 2

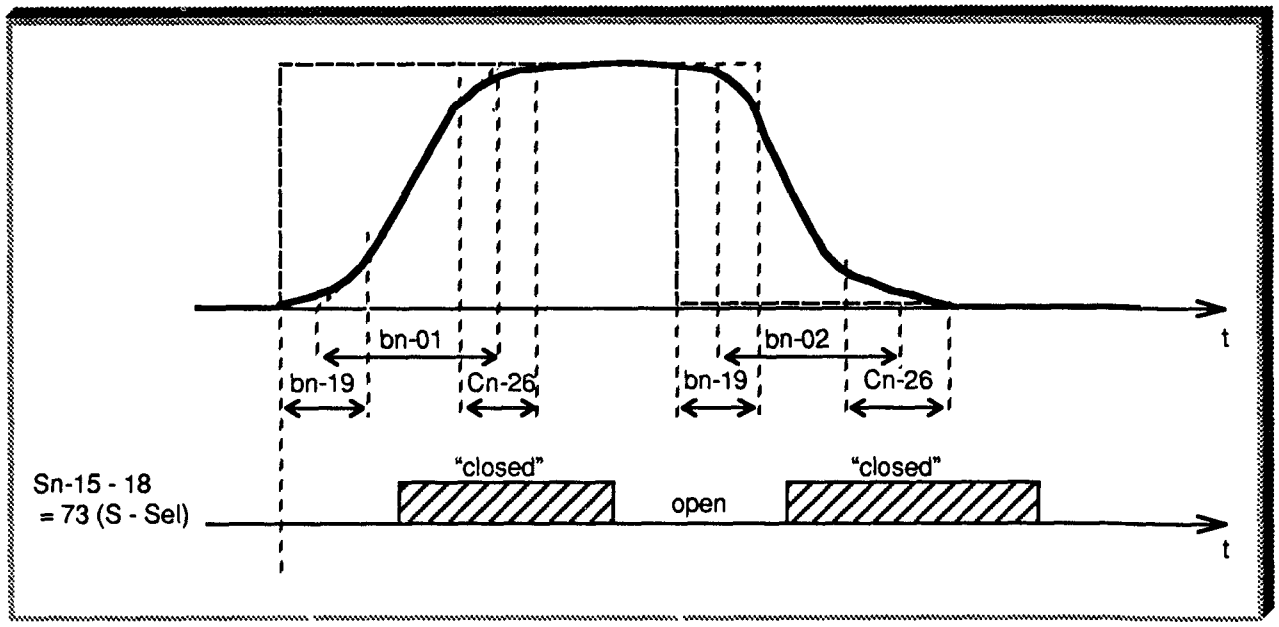
Factory Setting (each): ***0.0*** sec
Range (each): 0.0 to 10.0 sec

These constants determine the S-curve characteristics of the acceleration and deceleration ramp. When the setting of bn-19 is 0.0 (factory setting), the S-curve function is disabled. The S-curve in Cn-26 can only be selected by use of the Multi-function Input terminals, as described below.

B. **Sn-15 thru Sn-18:** Multi-function Input Terminal Function Selection (Term. 5 thru 8)

Data ***73*** : S-Curve Time Selection [Time 1 / Time 2]

By programming data ***73*** into one of the multi-function input system constants (Sn-15 thru Sn-18), one of the multi-function input terminals (5 thru 8) becomes a S-curve time selection input. When the input terminal (i.e. external contact) is open, Time 1 (bn-19) is selected. When the input terminal is closed, Time 2 (Cn-26) is selected.



S-curve Time Selection Function

5.23 SPEED COINCIDENCE

Cn-02: Speed Coincidence Level

Factory setting: ***100.00*** %
Range: 0.00 to 100.00 %

Cn-03: Speed Coincidence Width

Factory setting: ***2.00*** %
Range: 0.00 to 100.00 %

Speed coincidence is used to control an output contact at terminals 9 & 10, or one of the open collector outputs at terminals 25, 26, 28, or 29 (with respect to terminal 27), when selected by Sn-20 thru Sn-24.

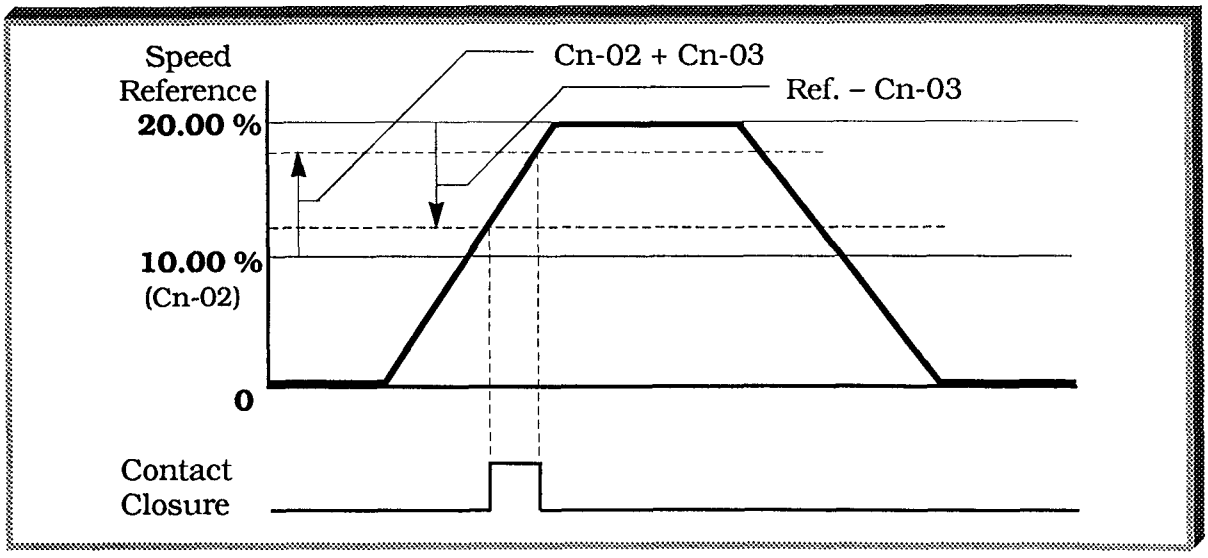
Sn-20: Multi-function Output 1 – Contact (terminals 9 & 10)
Sn-21: Multi-function Output 2 – Open Collector (terminals 25 & 27)
Sn-22: Multi-function Output 3 – Open Collector (terminals 26 & 27)
Sn-23: Multi-function Output 4 – Open Collector (terminals 28 & 27)
Sn-24: Multi-function Output 5 – Open Collector (terminals 29 & 27)

Data ***02***, ***03***, ***04*** or ***05*** (See paragraph 5.15, **MULTI-FUNCTION OUTPUT TERMINALS**)

The output contact will close, or the open collector output will go low, when the selected condition is met.

EXAMPLE:

If Cn-02 = ***10.00*** %, Cn-03 = ***3.00*** % and Sn-20 = ***03*** , then the contact at terminals 9 & 10 will be closed from 13 % to 17 %.

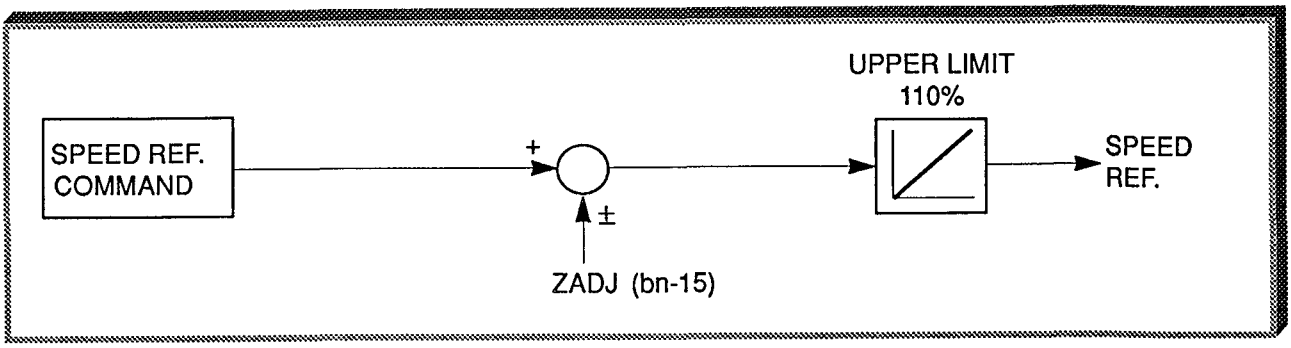


5.24 SPEED COMMAND BIAS

bn-15: Zero Speed Bias (ZADJ)

Factory setting: ***0.00*** %
Range: -50.00 to +50.00 %

Speed Command Bias sets the auto-speed command bias, in increments of 1%. This function applies to all speed reference commands, except An-XX's. It DOES NOT apply to torque reference command.



5.25 SPEED CONTROL (COMMAND)

Sn-25: AI-14B (Option) Input Function Selection

Digit 4 [**X** X X X]
Factory Setting: **0** X X X

This digit determines whether the VCD 703 is in the speed control mode or torque control mode. With AI-14B installed, Sn-04 must be reprogrammed for X X X **0** (Remote reference).

Data X X X X
- 0 : Speed control mode
- 1 : Torque control mode

X X **X X** digits define the functions of inputs to the AI-14B card.

Sn-25 SET VALUE	CONTROL MODE *	AI-14B INPUTS		
		CH 1 **	CH 2 **	CH 3 **
0000	ASR I	Speed Reference	Not Used	Not Used
0001	ASR II	Speed Reference	Speed Ref. Trim	Torque Compensation
0010	ASR III	Speed Reference	Fwd. Torque Limit (TLF)	Rev. Torque Limit (TLR)
0011	ASR IV	Speed Reference	Torque Limit (TLF, TLR)	Torque Compensation
1000	ATR I	Speed Limit	Torque Reference	Torque Compensation
1001	ATR II	Not Used	Torque Reference	Not Used

* ASR : Speed control mode, ATR : Torque control mode

** Gain adjustment for input channels is described in paragraph 5.32, part C.

5.27 SPEED REFERENCE UPPER LIMIT

Cn-05: Speed Reference Upper Limit (SRMAX)

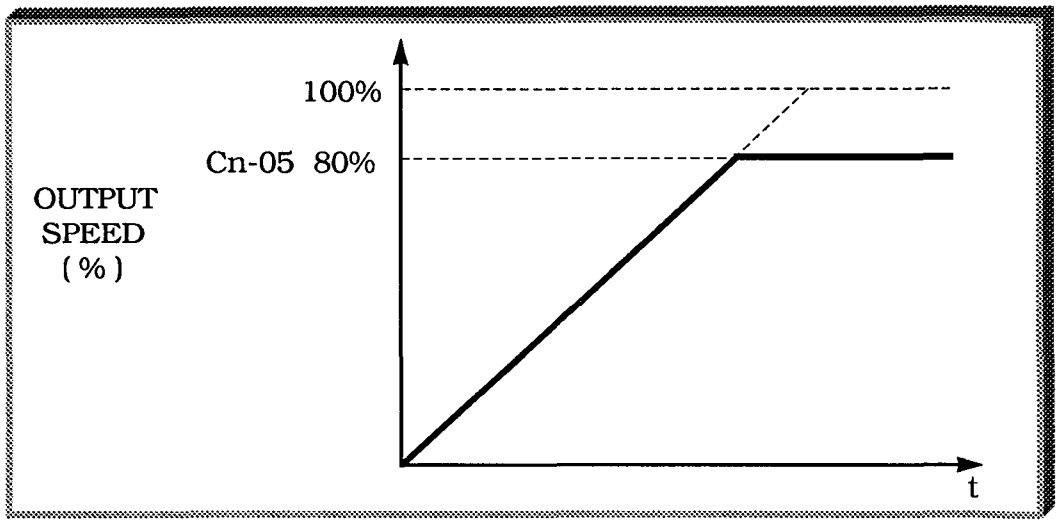
Factory setting: ***109.00*** %
Range: 0.00 to 109.22 %

This constant sets the range for the speed command signal, and is set, in increments of 1%, as a percentage of maximum speed.

NOTE: All references are affected by the upper limit point.

EXAMPLE:

Max. speed = 1750 rpm (100%)
Cn-05 = ***80.0*** % = 1400 rpm



5.28 STOP METHODS AT FAULT

The chart below identifies the faults that can be programmed for a defined stop sequence. The stop sequences are used to coordinate multiple drives when a fault occurs.

FAULT TYPE		RELATED SYSTEM CONSTANT	OTHER RELATED CONSTANTS
Excessive Speed Deviation	DEV	Sn-10. X X X X	Cn-04
Overspeed	OS	Sn-10 X X X X	Cn-16
External Fault Detection (Term. 3)	EF3	Sn-12: X X X X	—
Drive Overload	OL2	Sn-13: X X X X	—
Cooling Fan Fault	FAN	Sn-13: X X X X	—
Motor Overload	OL1	Sn-14. X X X X	Cn-14, Cn-15
Motor Overheat	OH1	Sn-14· X X X X	dn-18
Thermistor Line Break	THM	Sn-14 X X X X	—

5.29 ENCODER (PG) CONSTANTS

A. Cn-09: Encoder (PG) Constant For Motor 1

Factory Setting: ***1024*** ppr
Range: 0 to 6000 ppr

This constant is set to the Pulses Per Revolution (ppr) of the encoder used with the motor. The VCM uses a 1024 ppr encoder. The constant is factory set, and should not need to be changed unless a encoder with a different ppr is used.

B. dn-39: Encoder (PG) Constant For Motor 2

Factory Setting: ***1024*** ppr
Range: 0 to 6000 ppr

This constant is set to the Pulses Per Revolution (ppr) of the encoder used with the motor. The VCM uses a 1024 ppr encoder. The constant is factory set, and should not need to be changed unless a encoder with a different ppr is used.

Note: When dn-39 is set to ***0***, Control Without PG is enabled for the second motor.

C. Cn-18: PG Disconnection Detection Time

Factory Setting: ***1.00*** seconds
Range: 0.00 to 2.00 seconds

This constant sets the amount of time delay between when the encoder (PG) signal is disconnected and when a PG loss (PGo) fault occurs.

5.30 TORQUE CONTROL (COMMAND)

A. Sn-25: AI-14B (Option) Input Function Selection

Digit 4 [**X** X X X]
Factory Setting: **0** X X X

This digit determines whether the VCD 703 is in the speed control mode or torque control mode. To enable torque control, an AI-14B card (option) must be installed, and Sn-04 must be programmed for X X X **0** (Remote reference).

Data X X X X

- 0 : Speed control mode
- 1 : Torque control mode

NOTE: For speed control mode, the AI-14B card is not required.

X X X **X** digit defines the functions of torque control mode inputs to the AI-14B card.

Sn-25 SET VALUE	CONTROL MODE *	AI-14B INPUTS		
		CH 1 **	CH 2 **	CH 3 **
0000	ASR I	Speed Reference	Not Used	Not Used
0001	ASR II	Speed Reference	Speed Ref. Trim	Torque Compensation
0010	ASR III	Speed Reference	Fwd Torque Limit (TLF)	Rev. Torque Limit (TLR)
0011	ASR IV	Speed Reference	Torque Limit (TLF, TLR)	Torque Compensation
1000	ATR I	Speed Limit	Torque Reference	Torque Compensation ***
1001	ATR II	Not Used	Torque Reference	Not Used

* ASR : Speed control mode; ATR . Torque control mode

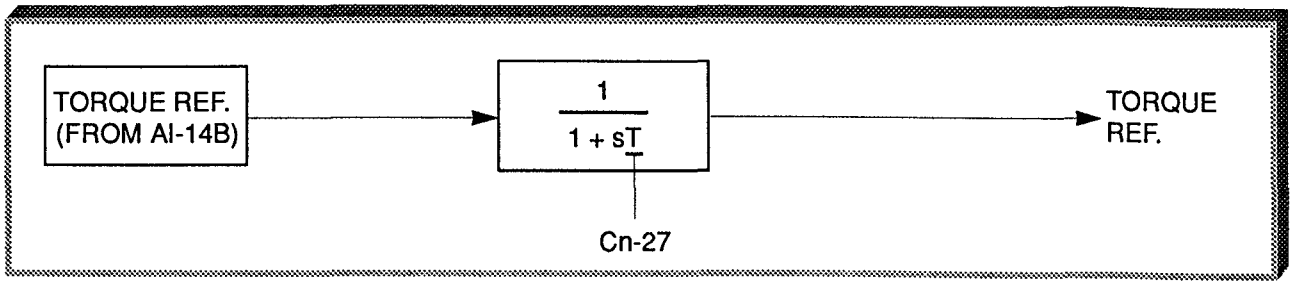
** Gain adjustment for input channels is described in paragraph 5.32, part C.

*** When torque compensation is not selected, the internal value is set to 0% automatically.

B. Cn-27: Torque Reference Delay Time

Factory setting: ***0*** milliseconds
Range: 0 to 1000 milliseconds

This function is used to avoid excessive changes in torque, which may be caused by abnormal resonance when the torque reference changes rapidly.

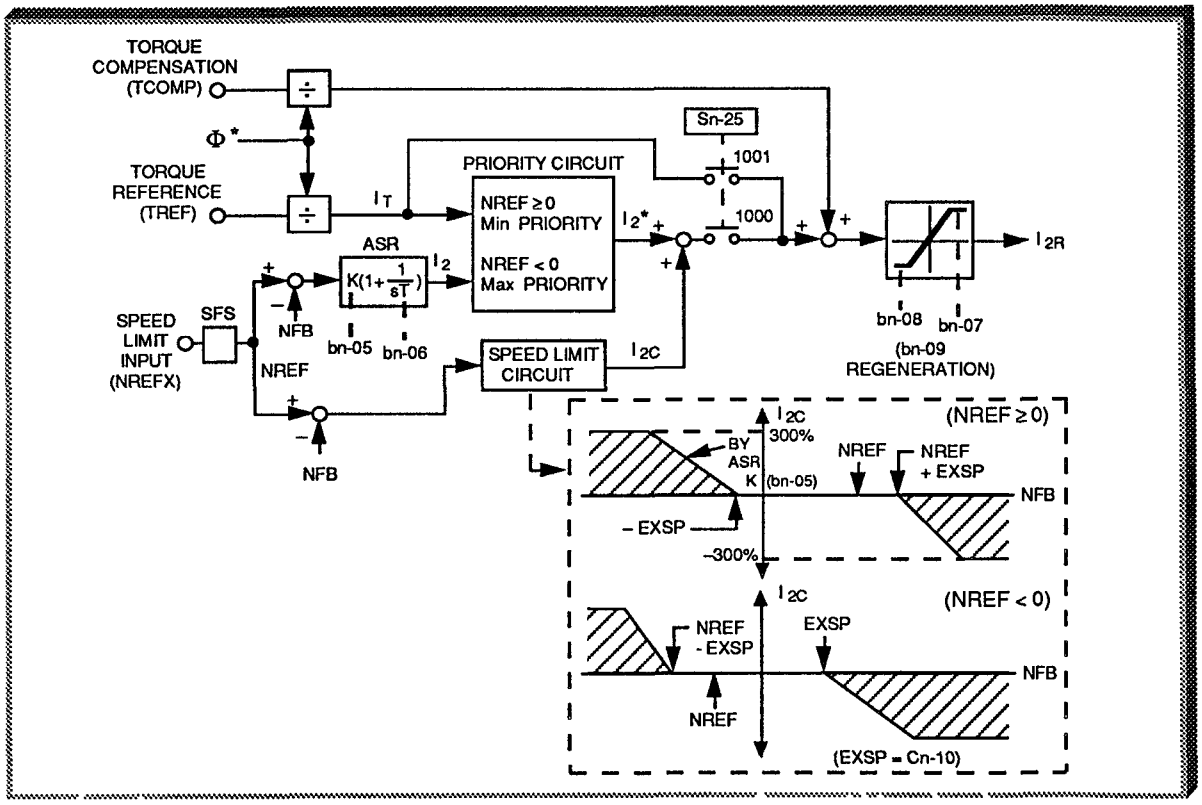


C. Cn-10: Speed Limit Bias (EXSP)

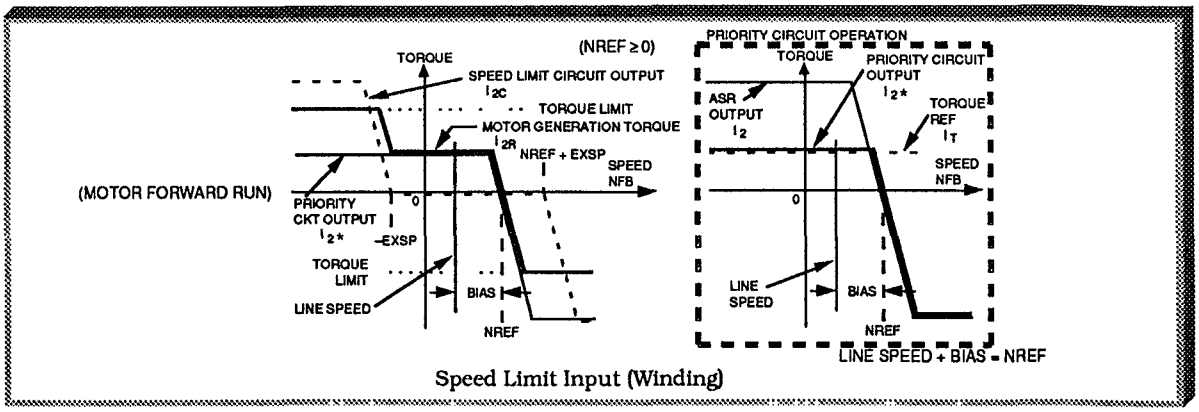
Factory Setting: ***0.00***
Range: 0.00 to 109.22

This function is typically used in winder applications. When the AI-14B option is programmed for ATR I (Sn-25 = 1000), the speed limit bias (Cn-10) function provides protection for conditions in the system that may cause an overspeed condition (such as web break) while in the torque control mode. The value of Cn-10 determines the output speed limit value, and also determines the value at which the torque reference will be decreased (based on the ASR gain).

NOTE: When AI-14B is programmed for ATR II (Sn-25 = 1001), the speed bias circuit is disabled.

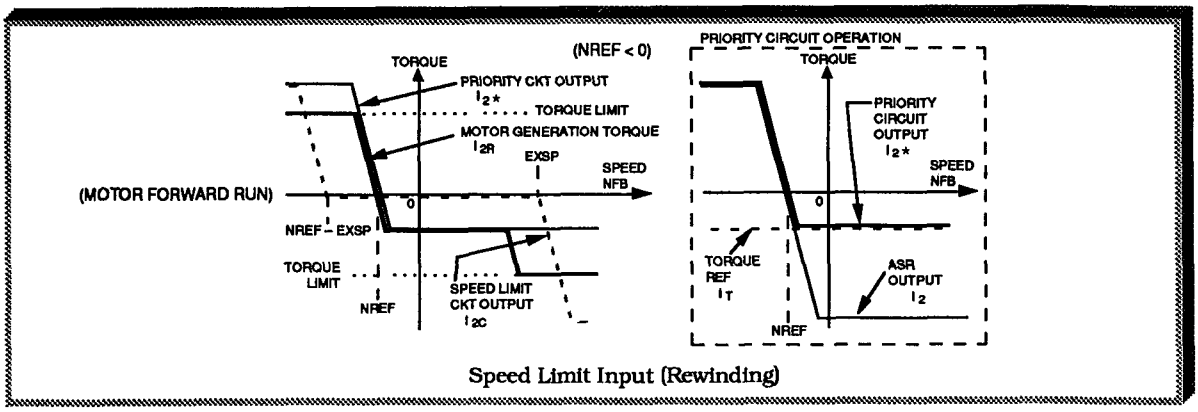


EXAMPLE OF WINDER OPERATION



Speed Limit Input (Winding)

EXAMPLE OF REWINDER OPERATION



Speed Limit Input (Rewinding)

D. Sn-15 thru Sn-18: Multi-function Input Terminal Function Selection (Term. 5 thru 8)

Data *71* : Speed Control / Torque Control Selection

By programming data *71* into one of the multi-function input system constants (Sn-15 thru Sn-18), one of the multi-function input terminals (5 thru 8) becomes a selection between speed control and torque control. Sn-25 must be set to 0011 (ASR IV). When the input terminal (i.e. external contact) is open, ASR IV is selected. When the input terminal is closed, ATR II is selected.

5.31 TORQUE DETECTION

Cn-33: Torque Detection Level 1
Cn-34: Torque Detection Level 2

Factory Setting (each): ***100.00*** %
Range (each): 0.00 to 300.00 %

Sn-20 thru Sn-24: Multi-function Output 1 thru 5 [Function Selection]

Data *34* : Torque Detection 1
Data *35* : Torque Detection 2

The torque detection function compares the VCD 703's internal torque reference with the values programmed into Cn-33 and Cn-34. When the torque reference is greater than or equal to one of the programmed values, the drive continues running and the torque detection will be indicated by a multi-function output, provided the appropriate data setting (*34* or *35*) is programmed for one of the multi-function outputs:

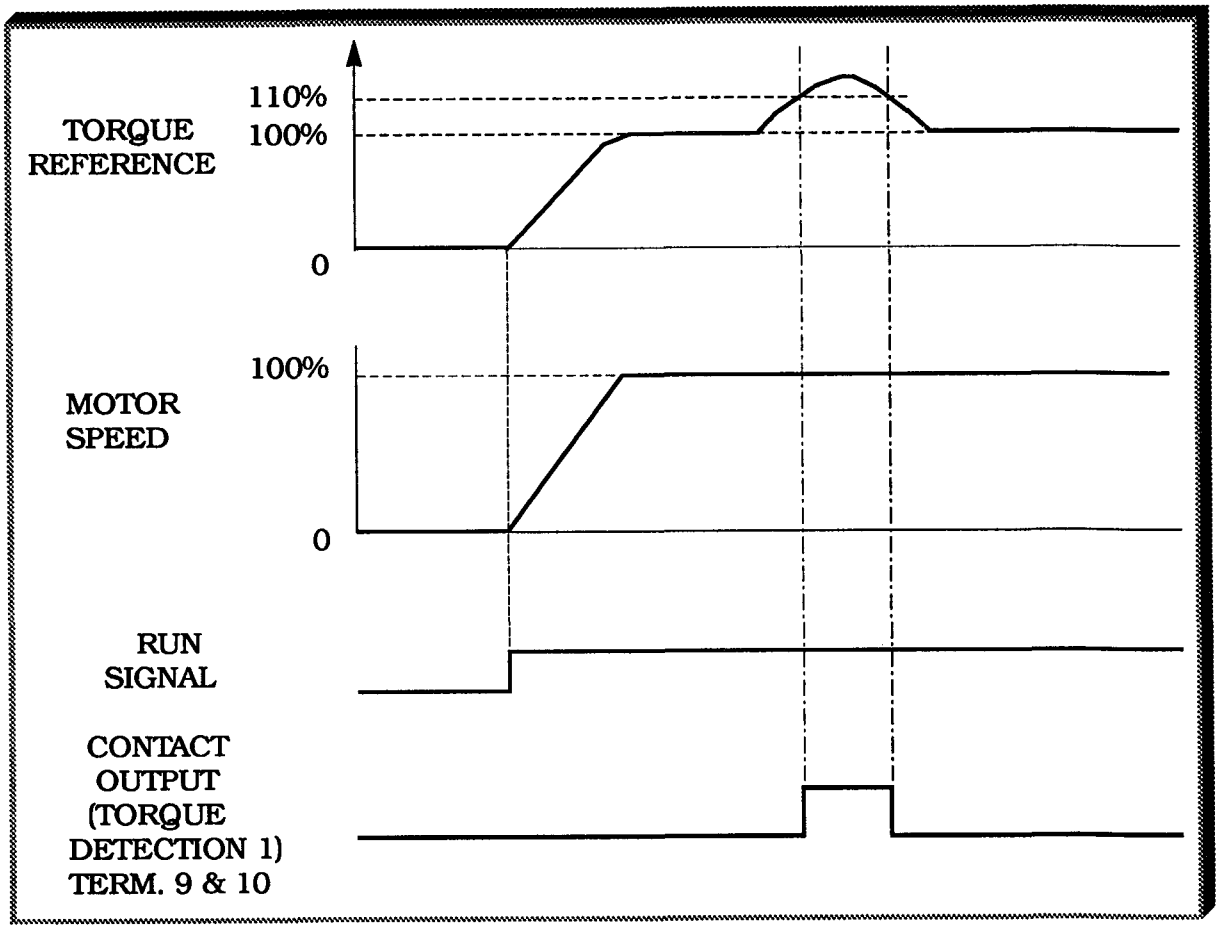
Sn-20 : Multi-function Output 1 — Contact Output (terminals 9 & 10)
Sn-21 : Multi-function Output 2 — Open Collector Output (terminal 25, ref. terminal 27)
Sn-22 : Multi-function Output 3 — Open Collector Output (terminal 26, ref. terminal 27)
Sn-23 : Multi-function Output 4 — Open Collector Output (terminal 28, ref. terminal 27)
Sn-24 : Multi-function Output 5 — Open Collector Output (terminal 29, ref. terminal 27)

For further description of these outputs, refer to **MULTI-FUNCTION ANALOG OUTPUTS.**

EXAMPLE OF TORQUE DETECTION

Sn-20 setting: ***34*** — Output contact programmed for torque detection 1

Cn-33 setting: ***110*** % — Level at which torque detection 1 is sensed



Torque Detection Timing Diagram

5.32 TORQUE LIMIT

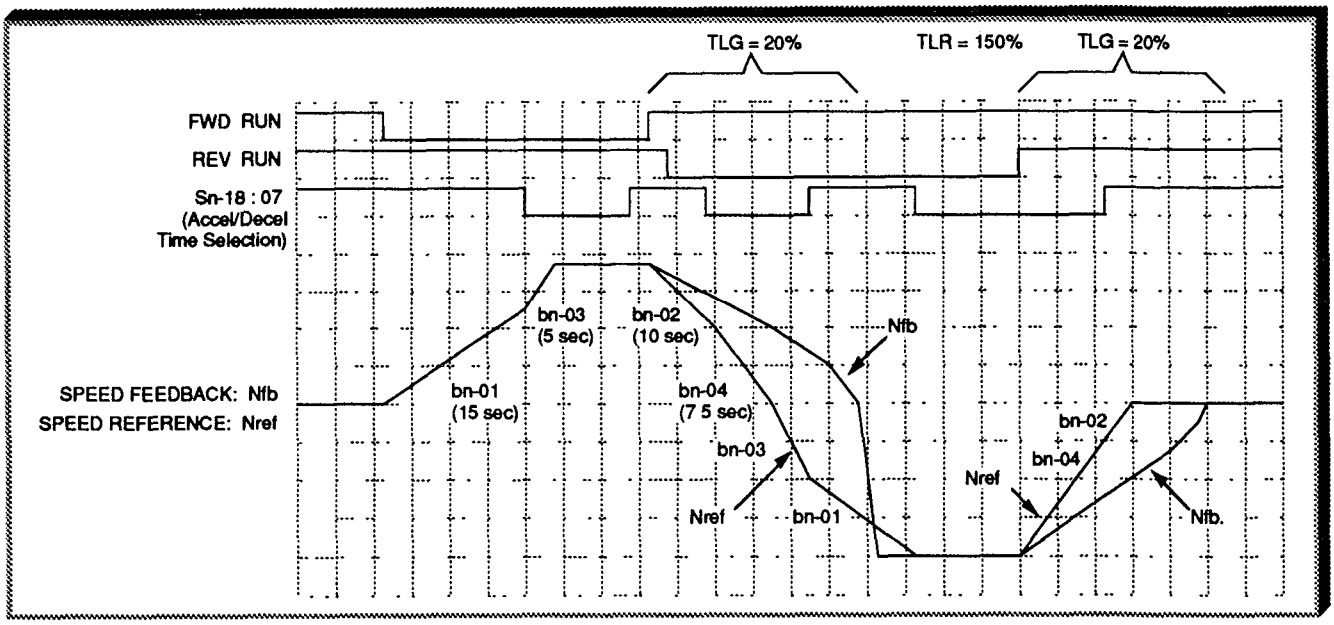
A. **bn-07:** FWD (+) Torque Limit (TLF)
bn-08: REV (−) Torque Limit (TLR)
bn-09: Regenerative Torque Limit (TLG)

Factory Setting (each): ***150.00*** %
Range (each): 0.00 to 300.00 %

This function provides the ability to limit the amount of torque produced by the motor in all four quadrants of operation: FWD motoring, REV motoring, and REGEN. The torque limit functions as a torque current reference limit. Torque limit is active in both speed mode and torque mode.

EXAMPLE:

bn-07 (TLF) = ***150*** %
bn-08 (TLR) = ***150*** %
bn-09 (TLG) = ***20*** %

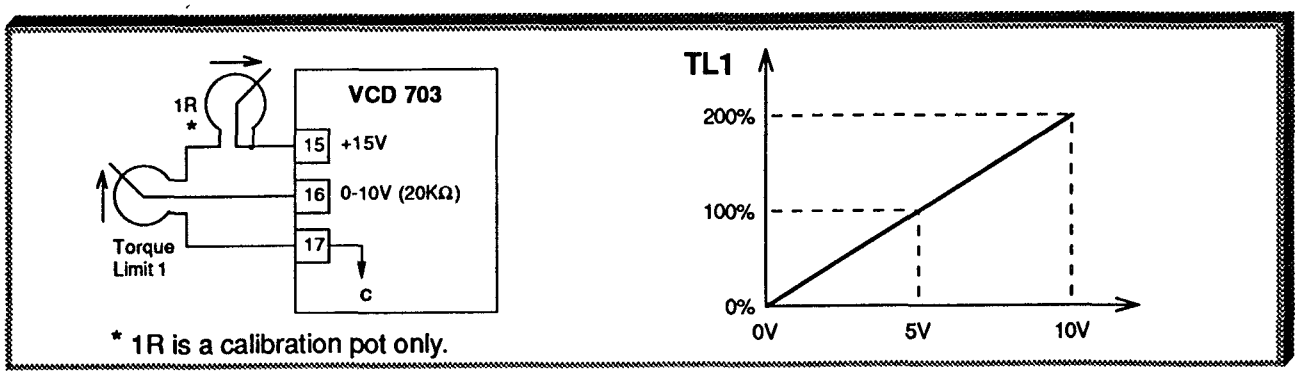


During regeneration, the regeneration torque limit (TLG) has been exceeded, thus the actual speed (Nfb) doesn't follow the speed reference (Nref). This example also demonstrates the dual accel/decel select (Sn-18 data ***07***).

B. Sn-19: Multi-function Analog Input Terminal (Term. 16) Function Selection

Data ***03***: Torque Limit 1 (TL1)

The multi-function analog input at terminal 16 may be configured to allow analog control of the torque limit for both FWD & REV modes. However, the analog reference controls both the FWD & REV torque limits.

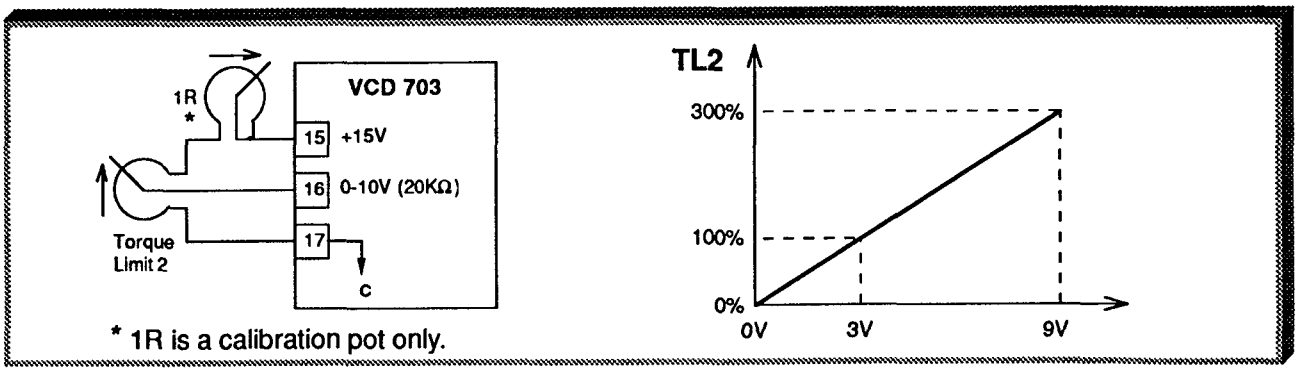


NOTE: A minimum priority circuit is associated with the torque limit function, which means that the lowest value torque limit setting will have priority.

EXAMPLE: FWD (+) Torque Limit bn-07 = ***100*** %
Torque Limit 1 (Term. 16) = 150 % (7.5V)

The bn-07 value will have priority over the TL1 value.

Data ***04***: Torque Limit 2 (TL2)



NOTES:

1) To use Torque Limit 2 (TL2), the VCD 703 combination must be sized appropriately.

2) A minimum priority circuit is associated with the torque limit function, which means that the lowest value torque limit setting will have priority.

EXAMPLE: FWD (+) Torque Limit bn-07 = ***100*** %
Torque Limit 2 (Term. 16) = 200 % (6V)

The bn-07 value will have priority over the TL2 value.

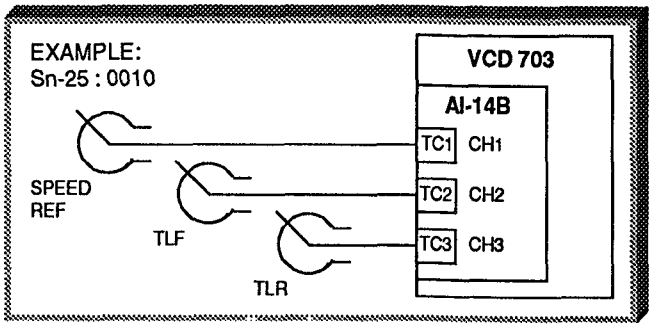
C. Sn-25: AI-14B (option) Input Function Selection

Digits 1 & 2 : [XX<u>XX</u>]
Factory Setting: XX<u>**00**</u>

When the AI-14B option is installed, the VCD 703 can be programmed to accept external torque limit signals. The torque limits can be either controlled independently, or controlled simultaneously:

Sn-25 : 0 0 1 0
CH2: FWD (+) Torque Limit (TLF)
CH3: REV (–) Torque Limit (TLR)

0 0 1 1
CH2: FWD/REV Torque Limit (TLF/TLR).



This DOES NOT APPLY to REGEN torque limit. (See paragraph 5.25 for additional information about AI-14B inputs.)

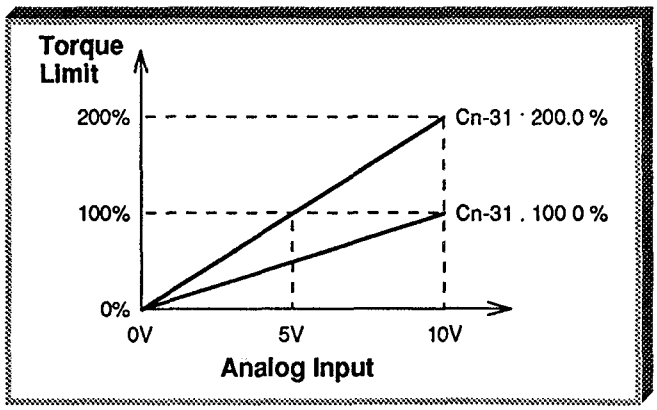
Torque limit adjustments will be limited to 100%, unless the gains for CH2 & CH3 are adjusted (see below).

Cn-31: AI-14B (option) CH2 Input Gain
Cn-32: AI-14B (option) CH3 Input Gain

Factory Setting (each): ***100.0*** %
Range (each): –999.9 to 1000.0 %

This function provides gain adjustments for the analog inputs into the AI-14B option card. These adjustments may be necessary for the torque limit function, because when the AI-14B is installed and programmed for torque limit, the upper limit is 10V = 100%. To change the upper limit to 10V = 200%, reprogram Cn-31 and/or Cn-32 to ***200*** %.

EXAMPLE:



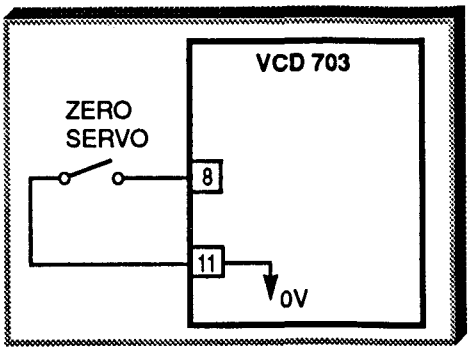
NOTE

To enter (–) gain, move to left most digit, press "down arrow" key, and change setting, then press ENTER. A negative number will be displayed.

5.33 ZERO SERVO CONTROL

A. Sn-15 thru Sn-18: Multi-function Input Terminal Function Selection (Term. 5 thru 8)

Data *72* : Zero Servo Control (for Speed control mode only)



By programming data *72* into one of the multi-function input system constants (Sn-15 thru Sn-18), one of the multi-function input terminals (5 thru 8) becomes a zero servo control selection input. When the input terminal (i.e. external contact) is open, the zero servo function is disabled, and when the contact is closed, the zero servo function is enabled.

The purpose of the zero servo function is to provide position control capability at zero speed. When zero servo is enabled, and the actual speed is less than zero speed level (Cn-01), the shaft position is maintained by monitoring the PG feedback pulses, and correcting the position error. However, this function doesn't have the same capabilities of a position controller, because there is no marker pulse feedback. Therefore, it will not stop in the same position every time the servo function is enabled.

CAUTION

Applications that require decelerating large inertia loads in very short decel times may cause overshoots, and a possible runaway condition, causing equipment damage. Adjustment of zero servo gain (Cn-24) may be required. Setting Cn-24 to 0 may correct a runaway condition.

Cn-01: Zero Speed Level

Factory Setting: *2.00* %
Range: 0.00 to 20.00 %

The speed level at which the zero servo function is enabled is determined by Cn-01 (Zero Speed Level), and the closure of the multi-function input. This function also determines operation at zero speed. Refer to paragraph 5.34.

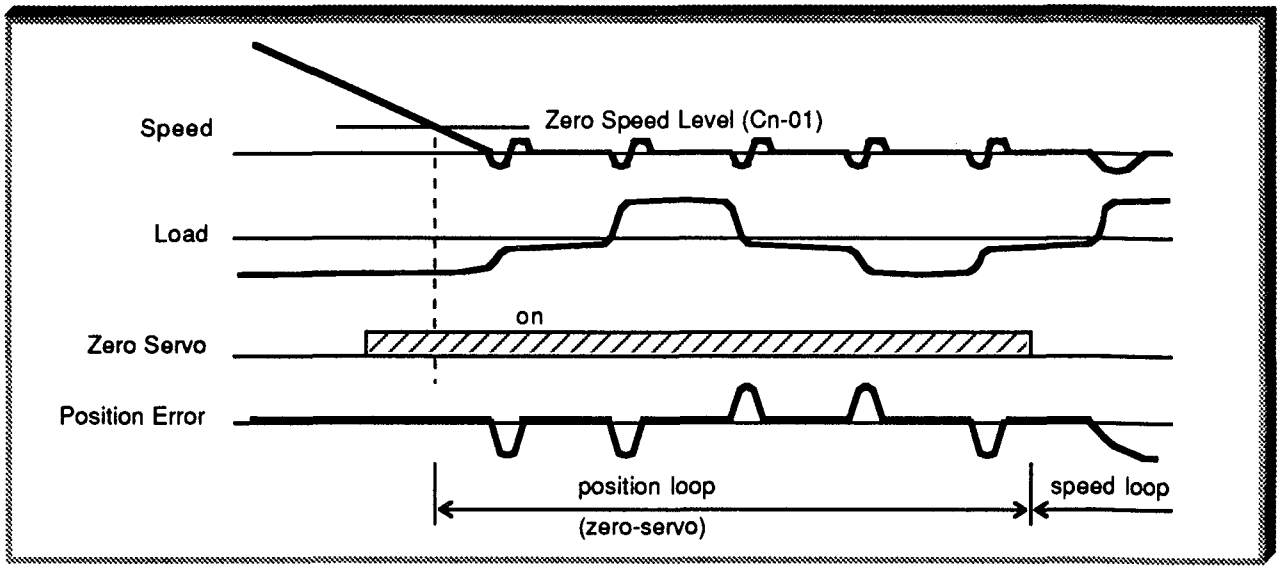
B. Cn-24: Zero Servo Gain

Factory Setting: ***5***
Range: 0 to 100

This function provides an adjustment for the position loop gain.

CAUTION

The higher the gain, the better the response. However, too high a gain can cause hunting or overshoot, and possible runaway condition.



Zero Servo Timing

C. Cn-25: Zero Servo Completion Width

Factory Setting: ***10*** pulses
Range: 0 to 16383 pulses

Sn-20 thru Sn-24: Multi-function Output Terminal Function Selection (Term. 9-10, 25, 26, 28, 29)

Data ***33*** : Zero Servo Completed

(See paragraph 5.16)

The function of Cn-25 is to set the number of pulses used for the multi-function output terminals. During zero servo, the multi-function output will be closed (ON) until the number set into Cn-25 has been completed. After the number of pulses have been completed, the multi-function output changes to the open (OFF) state.

5.34 ZERO SPEED CONTROL

A. Sn-06: Operation Mode Selection 3 (SRMIN)

Digits 3 & 4 [**X X** X X]
Factory Setting: **0 0** X X

The setting of these two digits determines when the Zero Speed mode operation is enabled (see figures on following pages).

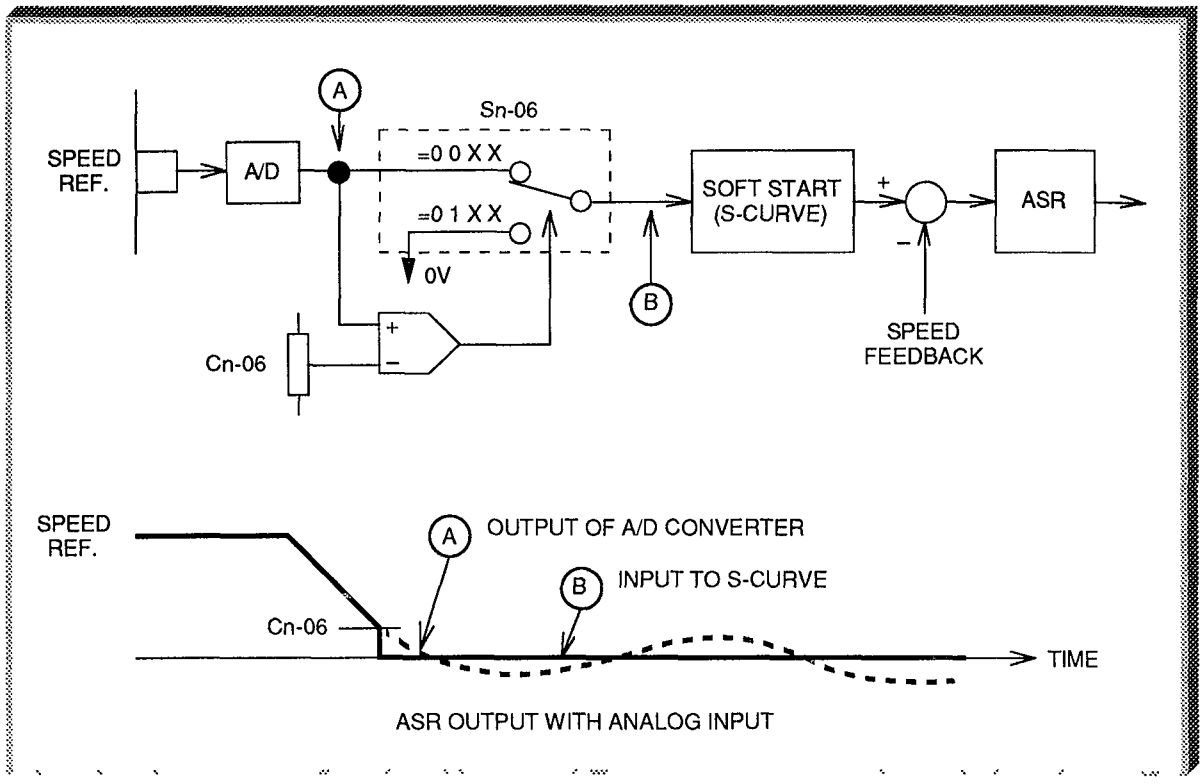
Data **X X** X X

- 00 : Enabled only at zero speed (Cn-06 ineffective)
- 01 : Zero Speed mode is enabled (Cn-06 effective) when external Speed Ref ≤ Cn-06 (internal speed ref = 0)
- 10 : Zero Speed mode is enabled when external Speed Ref ≥ Cn-06, RUN command is active; when external Speed Ref ≤ Cn-06, STOP command is active
- 11 : External Speed Ref ≤ Cn-06, internal speed ref = Cn-06

Cn-06: Minimum Speed Reference

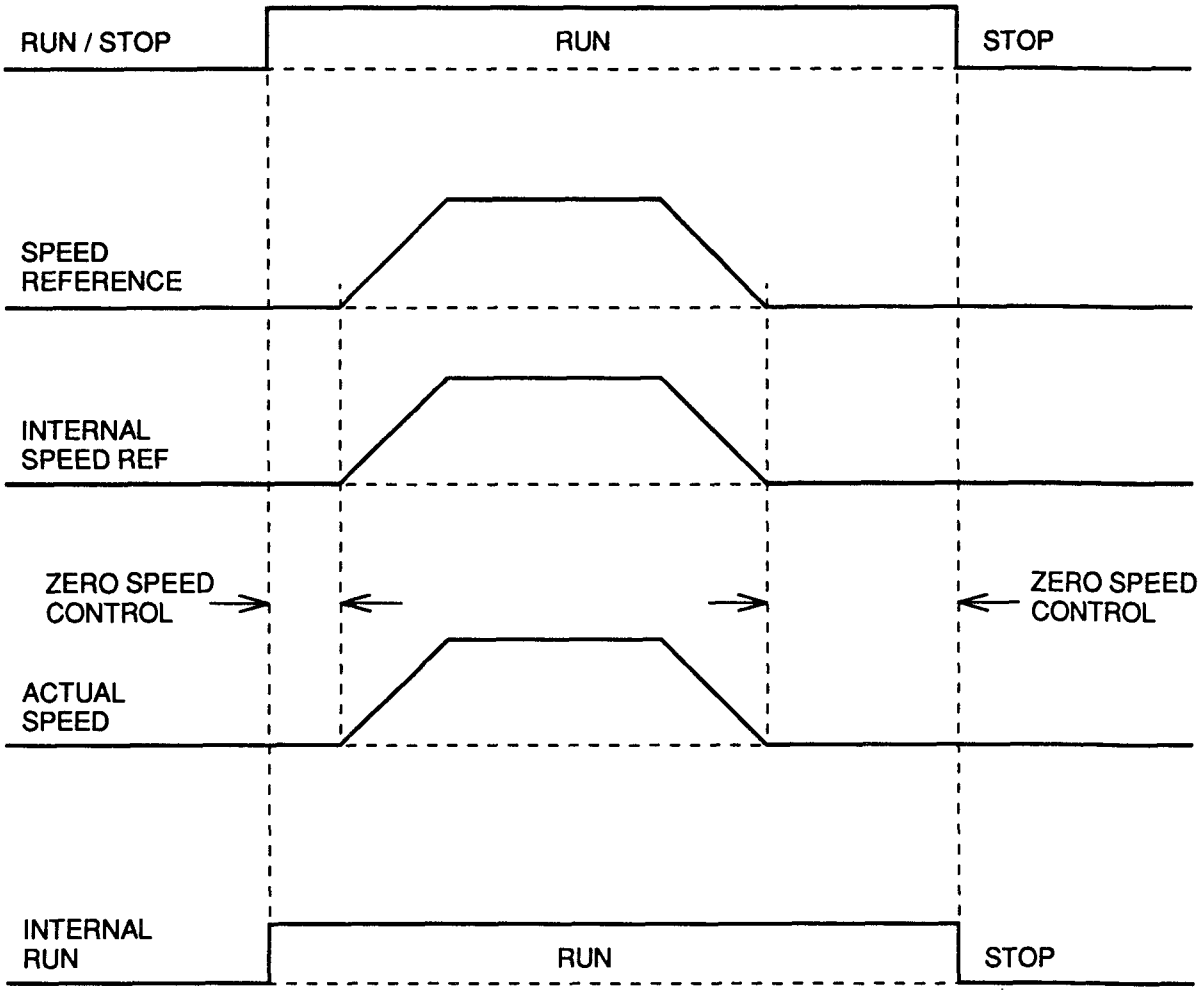
Factory Setting: ***2.00*** %
Range: 0.00 to 20.00 %

This constant sets the speed reference level at which Zero Speed mode operation will activate in accordance with the selection programmed in Sn-06 (see figures on following pages).

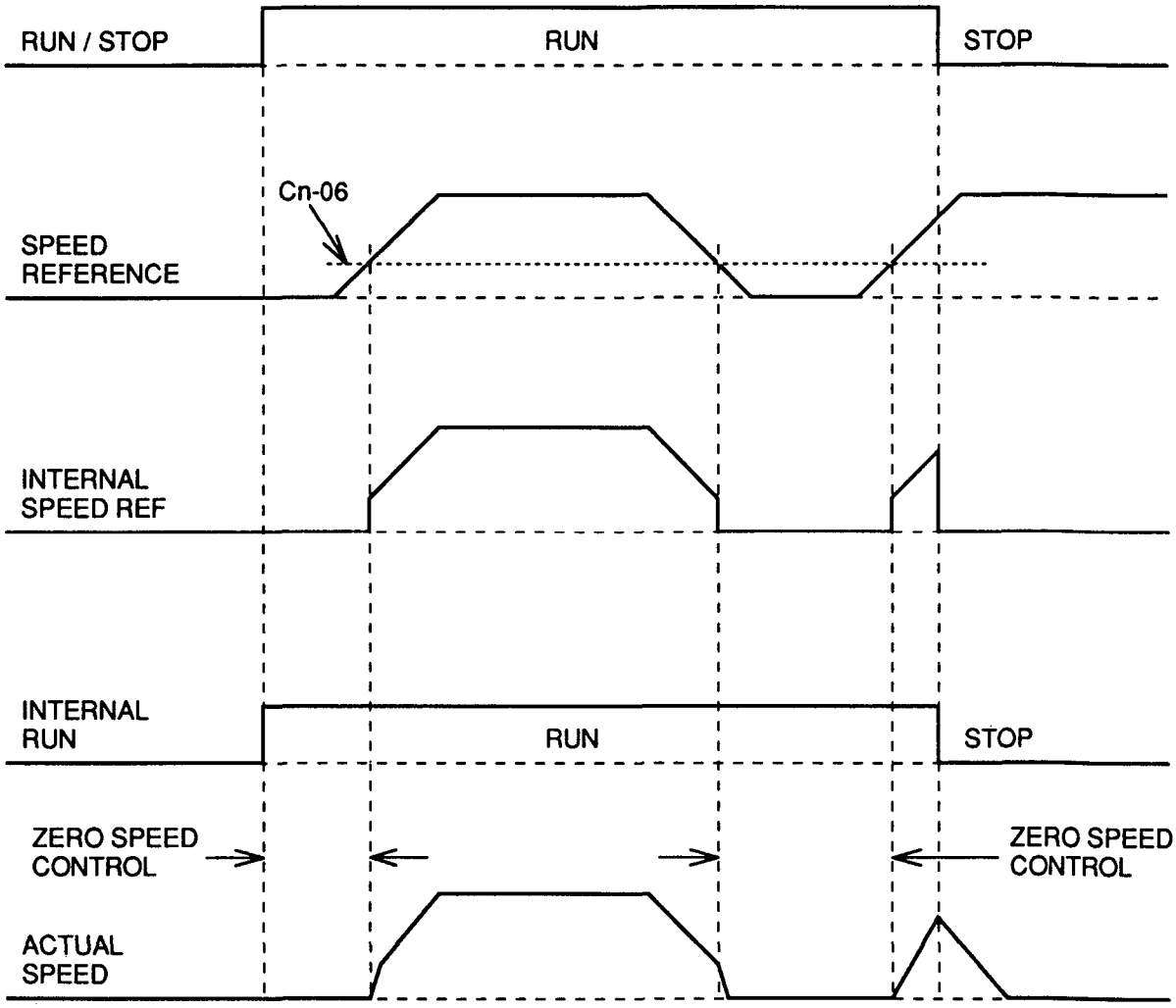


When the Speed Reference input is an analog signal, Zero Speed mode operation over long periods of time will cause the output to drift.

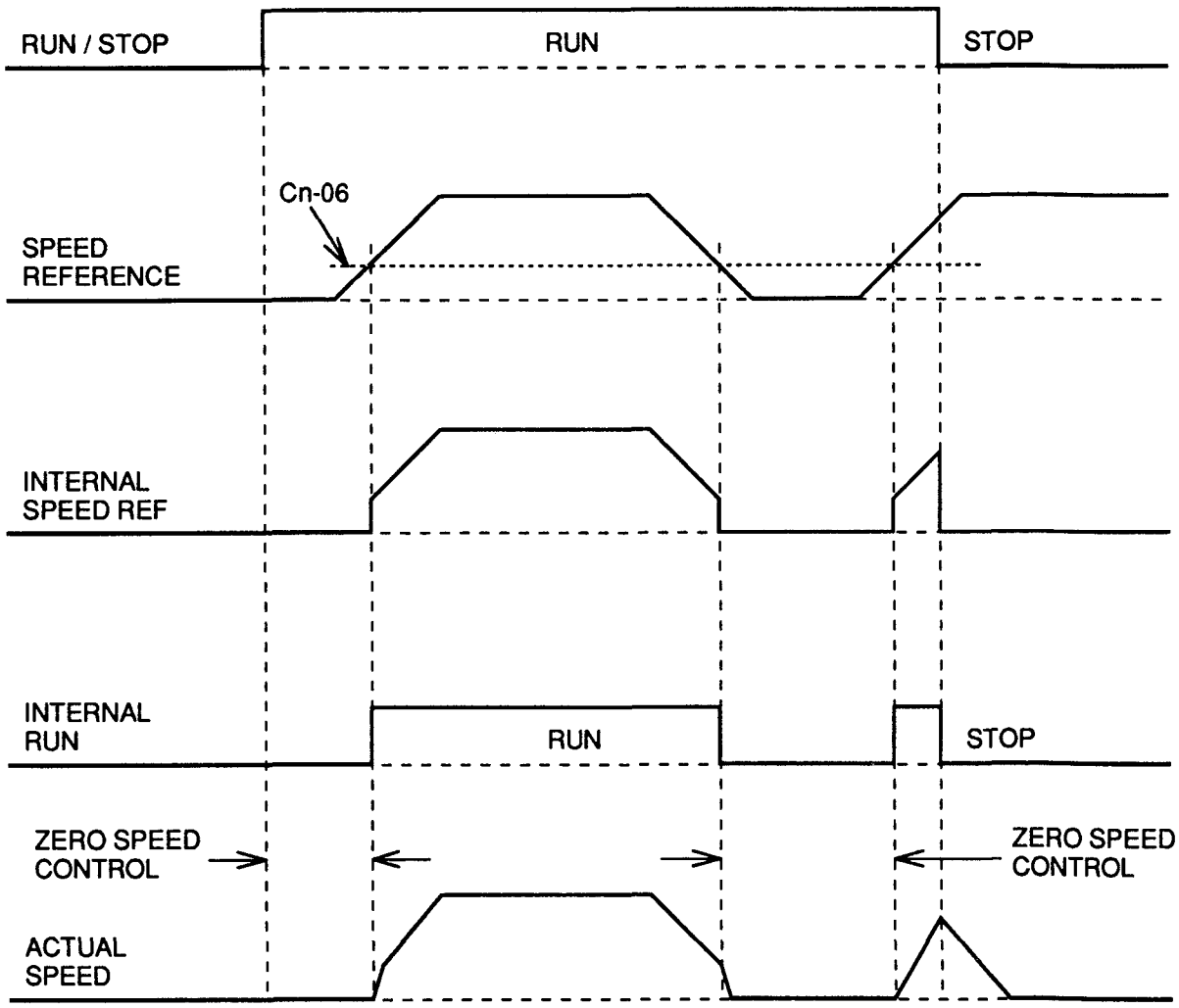
Sn-06 : 0 0 X X
Cn-06 : (Minimum Speed Reference) ineffective



Sn-06 : 0 1 X X
Cn-06 : (Minimum Speed Reference) effective

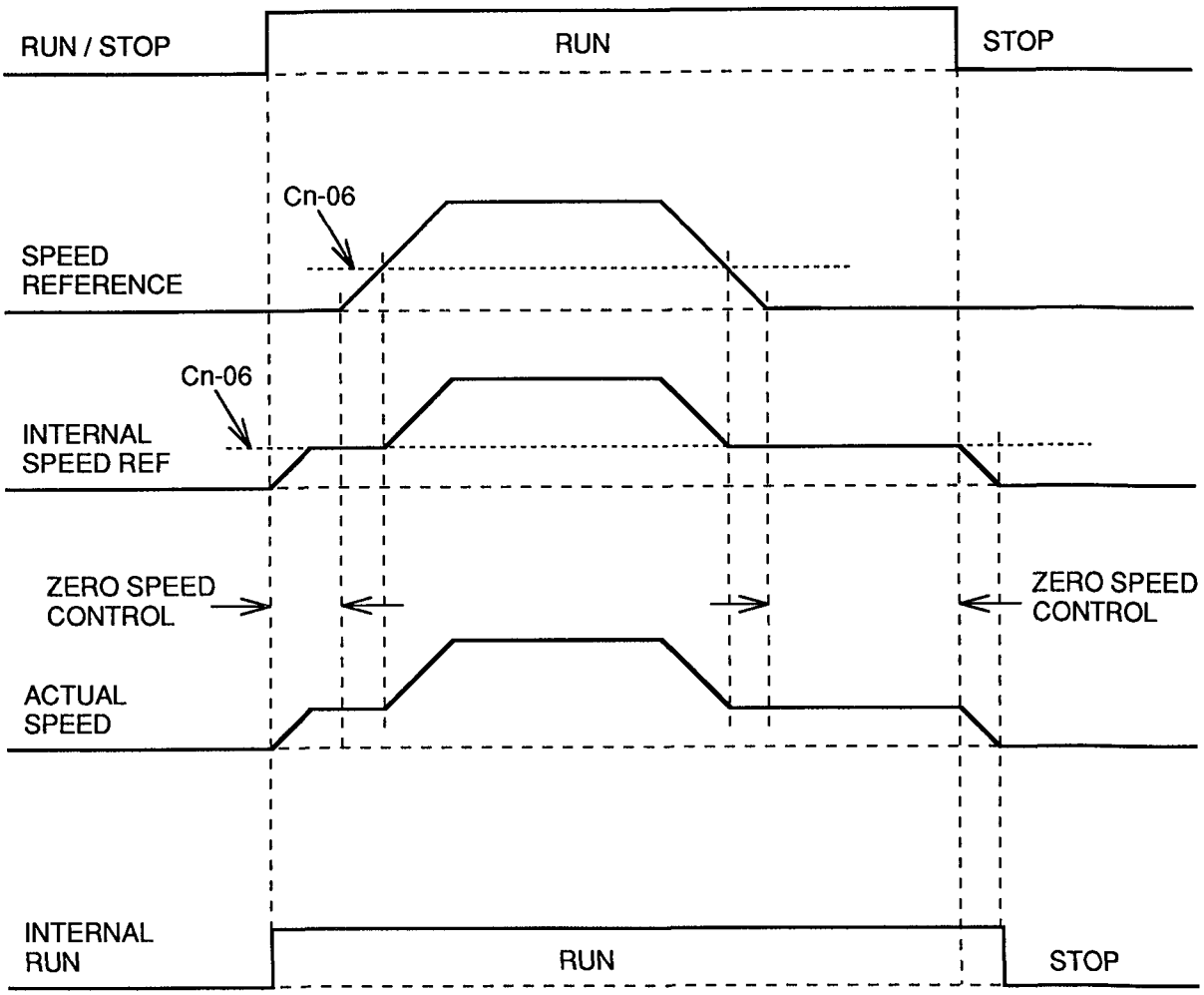


Sn-06 : 1 0 X X
Cn-06 : (Minimum Speed Reference) effective



5.34 ZERO SPEED CONTROL Continued

Sn-06 : 1 1 X X
Cn-06 : (Minimum Speed Reference) effective



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B. Cn-01: Zero Speed Level

Factory setting: ***2.00*** %
Range: 0.00 to 20.00 %

This constant determines the speed level at which the speed control mode, zero servo mode, and stop timer mode are either enabled or disabled.

Zero servo mode (when selected; refer to paragraph 5.33):

Speed > Cn-01 : Normal operation
Speed ≤ Cn-01 : Zero servo mode

Speed control mode:

Speed ref. > Cn-01 : Normal operation (P-I control)
Speed ref. ≤ Cn-01 : Speed control mode (determined by Sn-07)

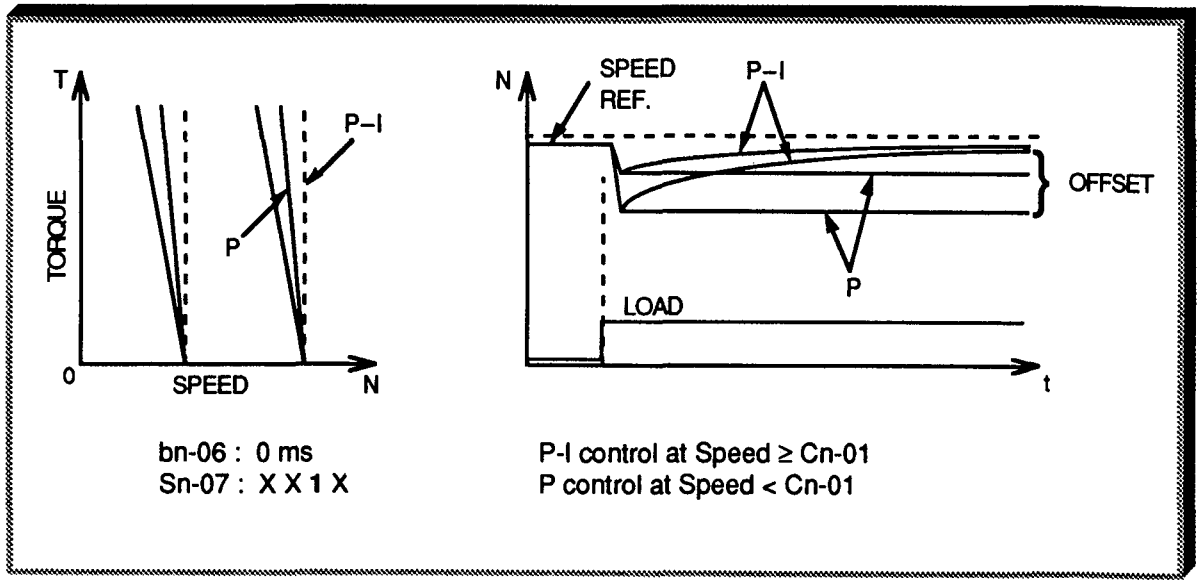
This function also determines when the stop timer function is disabled (when selected). See part C of this paragraph.

Sn-07: Operation Mode Selection 4

Digit 2 [X X **X** X] : Speed Control Mode at Low Speed
Factory Setting: X X **0** X

When the speed reference is less than the value of Cn-01 (Zero Speed Level), this function determines whether the control is under P-I control (proportional-integral gain) or P-control (proportional gain).

Data X X **X** X
└——0 : P-I control
1 : P-control (integral reset)



C. Cn-21: Stop Timer

Factory Setting: ***1.0*** sec
Range: 0.0 to 10.0 sec

This function allows operation under speed control when the reference is less than the level programmed into Cn-01 (Zero Speed Level). The amount of time for speed control is determined by the value in Cn-21. Typical operation is coast stop when speed is less than Cn-01, after a STOP command has been initiated.

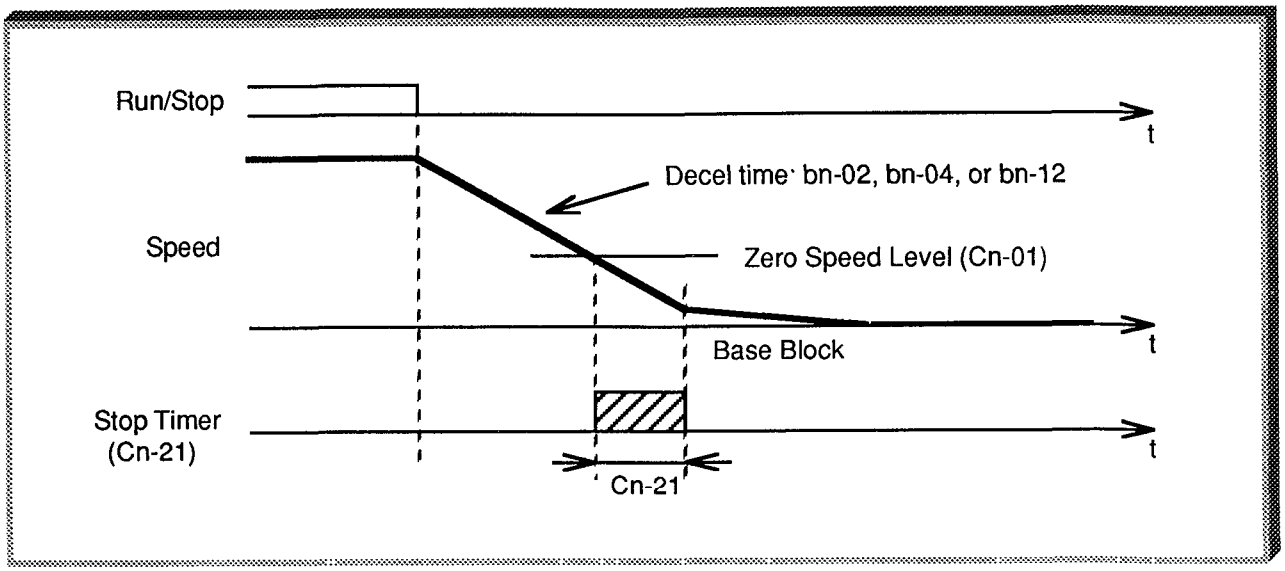


Table 5-4. Speed Reference Setting Constants (An-XX)

CONSTANT NUMBER	DATA NAME	INCREMENT	SETTING RANGE	FACTORY SETTING	USER SETTING	PAGE REF.
An-01	Speed Reference 1 (Main Speed Reference)	0.01 %	0.00 - 109.22	0.00	**	5-13, 5-14, 5-38 - 5-43
An-02	Speed Reference 2	0.01 %	0.00 - 109.22	0.00		5-38 - 5-40
An-03	Speed Reference 3	0.01 %	0.00 - 109.22	0.00		5-38 - 5-43
An-04	Speed Reference 4	0.01 %	0.00 - 109.22	0.00		5-38 - 5-42
An-05	Speed Reference 5	0.01 %	0.00 - 109 22	0.00		5-38 - 5-42
An-06	Speed Reference 6	0.01 %	0 00 - 109 22	0.00		5-38 - 5-42
An-07	Speed Reference 7	0.01 %	0.00 - 109.22	0.00		5-38 - 5-42
An-08	Speed Reference 8	0.01 %	0 00 - 109.22	0.00		5-38 - 5-42
An-09	Jog Speed Reference	0.01 %	0.00 - 109.22	10.00		5-20 - 5-21; 5-38 - 5-42

** An-01 setting changes whenever a new speed reference value is entered from the Digital Operator during Drive mode operation.

Table 5-5. Application Constants (bn-XX)

CONSTANT NUMBER	DATA NAME	INCREMENT	SETTING RANGE	FACTORY SETTING	USER SETTING	PAGE REF.
bn-01	Accel Time 1	0.1 s	0.0 - 3000 0	10.0		5-6
bn-02	Decel Time 1	0.1 s	0.0 - 3000.0	10.0		5-6
bn-03	Accel Time 2	0.1 s	0.0 - 3000.0	10.0		5-6
bn-04	Decel Time 2	0 1 s	0.0 - 3000.0	10.0		5-6
bn-05	ASR Proportional Gain (ASRP1)	0.1	0 0 - 300.0	20.0 With PG 10 0 w/o PG		5-8 - 5-9
bn-06	ASR Integral Time (ASRI)	1 ms	0 - 30000	1000		5-8 - 5-9
bn-07	FWD Side Torque Limit (TLF)	0.01 %	0.00 - 300.00	150.00		5-56 - 5-57
bn-08	REV Side Torque Limit (TLR)	0 01 %	0.00 - 300.00	150.00		5-56
bn-09	Regenerative Side Torque Limit (TLG)	0.01 %	0 00 - 300.00	150.00		5-56
bn-10	Rated Speed Adjustment (SADJ)	0.0001	0.5000 - 1 3000	1.0000		5-37
bn-11	Not Used	—	—	—	—	—
bn-12	Emergency Stop Time (TEMG)	0.1 s	0.0 - 3000.0	10.0		—

Table 5-5. Application Constants (bn-XX) - Continued

CONSTANT NUMBER	DATA NAME	INCREMENT	SETTING RANGE	FACTORY SETTING	USER SETTING	PAGE REF.
bn-13	Monitor No. at Power-Up	1	1 - 3	1		5-14
bn-14	Not Used	——	——	——	——	——
bn-15	Zero Speed Bias Adjustment (ZADJ)	0.01 %	-50.00 - (+)50.00	0.00		5-48
bn-16	Voltage Adjustment	0.001	0.800 - 1.200	1.000		——
bn-17	Multi-function Monitor Output 1 Selection (Term. 21-22)	1	3 - 5, 21 - 41, 44	23		5-28
bn-18	Multi-function Monitor Output 1 Gain (Term. 21-22)	0.001	0.000 - 10.000	1.000		5-28
bn-19	S-Curve Time 1	0.1 s	0.0 - 10.0	0.0		5-46
bn-20	Current Reference Gain (V/f test mode 2)	0.1	0.0 - 1.5	1.1		——
bn-21	Not Used	——	——	0	——	——
bn-22	AO (Option) CH1 Output Selection	1	3 - 5, 21 - 41	22		*(1)*
bn-23	AO (Option) CH1 Output Gain	0.001	0.000 - 10.000	1.000		*(1)*
bn-24	AO (Option) CH2 Output Selection	1	3 - 5, 21 - 41	23		*(1)*
bn-25	AO (Option) CH2 Output Gain	0.001	0.000 - 10.000	1.0000		*(1)*
bn-26	Multi-function Monitor Output 2 Selection (Term. 23-24)	1	3 - 5, 21 - 41, 44	2		5-28
bn-27	Multi-function Monitor Output 2 Gain (Term. 23-24)	0.001	0.000 - 10.000	1.000		5-28

(1) Refer to separate Option Instruction Sheet.

Table 5-6. Control Constants (Cn-XX)

CONSTANT NUMBER	DATA NAME	INCREMENT	SETTING RANGE	FACTORY SETTING	USER SETTING	PAGE REF.
Cn-01	Zero Speed Level	0.01 %	0.00 - 20.00	2.00		5-59, 5-65
Cn-02	Speed Coincidence Detection Level	0.01 %	0.00 - 100.00	100.00		5-47
Cn-03	Speed Coincidence Detection Width	0.01 %	0.00 - 100.00	2.00		5-47
Cn-04	Excessive Speed Deviation Level (for Speed Control mode)	0.01 %	0.00 - 130.00	10.00		5-49, 5-50
Cn-05	Speed Reference Upper Limit (SRMAX)	0.01 %	20.00 - 109.22	109.00		5-50
Cn-06	Min. Speed Reference	0.01 %	0.00 - 20.00	2.00		5-61 - 5-64
Cn-07	ASR Output Lag Time	1 ms	0 - 500	4		5-11
Cn-08	Initial Excitation Timer	0.1 s	0.0 - 10.0	0.0		5-16
Cn-09	Encoder (PG) Constant For Motor 1	ppr	0 - 6000	1024		5-51
Cn-10	Speed Limit Bias (for Torque Control mode) (EXSP)	0.01 %	0.00 - 109.22	0.00		5-53
Cn-11	Torque Compensation Value at BUS Fault	0.1 %	-200.0 - 200.2	0.0		—
Cn-12	Operator Display Mode	1	0 - 39999	0		5-13, 5-14
Cn-13	Feeder Resistance	0.1 %	0.0 - 5.0	0.0		—
Cn-14	Motor OL Detection Starting Current (OLI)	1 %	50 - 200	110		5-25, 5-50
Cn-15	Motor OL Operation Time (OLT)	1 s	1 - 120	60		5-25, 5-50
Cn-16	Overspeed Detection Level	1 %	50 - 130	120		5-35, 5-50
Cn-17	PUV Detection Level *(See Note 1)*	1 V	131 - 210 (230V rated) 262 - 420 (460V rated)	210 420		—
Cn-18	PG Disconnection Detection Time (for Speed Control mode)	0.01 s	0.00 - 2.00	1.00		5-51
Cn-19	Momentary Power Loss Ride-thru Time	0.01 s	0.00 - 2.00	*(See Note 2)*		5-22
Cn-20	No. of Auto-Restart Attempts	1	0 - 10	0		5-11
Cn-21	Stop Timer	0.1 s	0.0 - 10.0	1.0		5-66
Cn-22	ASR Proportional Gain 2 (ASRP2)	0.1	0.0 - 300.0	20 With PG 10 w/o PG		5-10
Cn-23	ASR Proportional Gain Selection Level	0.01 %	0.00 - 100.00	0		5-10
Cn-24	Zero Servo Gain	1	0 - 100	5		5-60

Table 5-6. Control Constants (Cn-XX) - Continued

CONSTANT NUMBER	DATA NAME	INCRE-MENT	SETTING RANGE	FACTORY SETTING	USER SETTING	PAGE REF.
Cn-25	Zero Servo Completion Width	1 pulse	0 - 16383	10		5-60
Cn-26	S-Curve Time 2	0.1 s	1.0 - 10.0	0.0		5-46
Cn-27	Torque Reference Delay Time	1 ms	0 - 10000	0		5-52
Cn-28	Motor Temperature Rise Detection Level	1 °C	0 - 200	80		5-34
Cn-29	Not Used	—	—	—	—	—
Cn-30	AI-14B (Option) CH1 Input Gain	0.1 %	-999.9 - 1000.0	100.0		*(3)*
Cn-31	AI-14B (Option) CH2 Input Gain	0.1 %	-999.9 - 1000.0	100.0		5-58 *(3)*
Cn-32	AI-14B (Option) CH3 Input Gain	0.1 %	-999.9 - 1000.0	100.0		5-58 *(3)*
Cn-33	Desired Torque Detection Level 1	0.01 %	0.00 - 300.00	100.00		5-34, 5-54 - 5-55
Cn-34	Desired Torque Detection Level 2	0.01 %	0.00 - 300.00	100.00		5-34, 5-54
Cn-35	Not Used	—	—	—	—	—
Cn-36	No. of Fault Retries For Excessive Slip (ES)	1	0 - 10	5		—
Cn-37	Starting Torque Compen-sation Integral Time (for elevator only)	1 ms	0 - 5000	0		—
Cn-38 to Cn-44	Not Used	—	—	—	—	—
Cn-45	Speed Loop Feed Forward Gain (for I-P control)	0.01	0.00 - 1.00	0.00		—
Cn-46	Drooping Compensation Gain	0.1 %	0.0 - 15.0	0.00		—
Cn-47	Drooping Compensation Lag Filter Time Constant	1 ms	0 - 2000	20		—
Cn-48	Torque Detection Time 1	1 ms	0 - 2000	0		—
Cn-49	Torque Detection Time 2	1 ms	0 - 2000	0		—
Cn-50 to Cn-51	Not Used	—	—	—	—	—
Cn-52	Carier Frequency Selection (Effective only when Sn-09 = **1** X X X)	1 kHz	2 - 12.5	Sn-01 dependent		5-21b

Table 5-6. Control Constants (Cn-XX) - Continued

CONSTANT NUMBER	DATA NAME	INCRE-MENT	SETTING RANGE	FACTORY SETTING	USER SETTING	PAGE REF.
Cn-53	Inverter Master Speed Reference Input Gain	0.1 %	-999.9 - 1000.0	100 0		—
Cn-54	Inverter Multi-function Analog Input Gain	0.1 5	-999.9 - 1000.0	100 0		—
Cn-55	Not Used	—	—	—	—	—
Cn-56	Torque Compensation Lag Filter Time Constant	1 ms	0 - 2000	0		—
Cn-57	Brake Delay Time (for elevator only)	1 ms	0 - 2000	0		—

NOTES:

1. PUV Detection Level is limited by the main circuit; contact MagneTek before changing the value.
2. Factory setting of Momentary Power Loss Ride-thru Time (Cn-19) is related to the VCD 703 capacity (Sn-01 setting). See Table A2-1.
3. Refer to separate option instruction sheet

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Table 5-7. Motor Constants (dn-XX)

	CONSTANT NUMBER	DATA NAME	INCRE-MENT	SETTING RANGE	DEFAULT VALUE *(SEE NOTE 1)*	USER SETTING
Motor #1	dn-01	Base Speed *(See Note 2)*	1 rpm	100 - 12000	1750	
	dn-02	Maximum Speed *(See Note 2)*	1 rpm	100 - 12000	1750	
	dn-03	No. of Motor Poles *(See Note 2)*	1	2 - 32	4	
	dn-04	No-load Voltage	1 V	50 - 240 (230V rated)	170	
				100 - 480 (460V rated)	340	
	dn-05	Motor Rated Secondary Current	0.01 A	0.00 - 655.35 *(See Note 3)*		
	dn-06	Rated Slip Frequency	0.01 Hz	0.00 - 10.00	1.00	
	dn-07	Exciting Current Reference	0 1 %	10.00 - 200.00	30.0	
	dn-08	Primary Resistance	0.1%	0.0 - 15.0	2.0	
	dn-09	Leakage Coefficient	0.01 %	0.00 - 50.00	20.00	
	dn-10	Motor Iron Loss	0.1 %	0.0 - 15.0	2.0	
	dn-11	Motor Mechanical Loss	0.1 %	0.0 - 10.0	0.5	
	dn-12	Secondary Circuit Time Constant	1 ms	0 - 10000	100	
	dn-13	Leakage Saturation Coefficient	0 01	1.00 - 2.00	1.20	
	dn-14	Rotor Heat Gain	0.01	0.00 - 2.00	0.00	
	dn-15	Rotor Heat Time Constant	1 min.	0 - 180	30	
	dn-16	Iron Core Saturation Comp. Coefficient 1 *(See Note 4)*	0.01	0.00 - 1.00	0.50	
	dn-17	Iron Core Saturation Comp. Coefficient 2 *(See Note 4)*	0.01	0.00 - 1.00	0.75	
	dn-18	Motor Overheat (OH1) Temperature *(See Note 5)*	1° C	50 - 200	120	
Motor #2	dn-21	Base Speed *(See Note 2)*	1 rpm	100 - 10000	1750	
	dn-22	Maximum Speed *(See Note 2)*	1 rpm	100 - 10000	1750	
	dn-23	No. of Motor Poles *(See Note 2)*	1	2 - 32	4	
	dn-24	No-load Voltage	1 V	50 - 240 (230V rated)	170	
				100 - 480 (460V rated)	340	
	dn-25	Motor Rated Secondary Current	0.01 A	0.00 - 655.35 *(See Note 3)*		
	dn-26	Rated Slip Frequency	0.01 Hz	0.00 - 10.00	1.00	
	dn-27	Exciting Current Reference	0.1 %	10.00 - 200.00	30.0	
	dn-28	Primary Resistance	0.1%	0.0 - 15.0	2.0	
	dn-29	Leakage Coefficient	0.01 %	0.00 - 50.00	20.00	
	dn-30	Motor Iron Loss	0.1 %	0.0 - 15.0	2.0	

Table 5-7. Motor Constants (dn-XX) - Continued

	CONSTANT NUMBER	DATA NAME	INCRE-MENT	SETTING RANGE	DEFAULT VALUE *(SEE NOTE 1)*	USER SETTING
Motor #2	dn-31	Motor Mechanical Loss	0.1 %	0.0 - 10.0	0.5	
	dn-32	Secondary Circuit Time Constant	1 ms	0 - 10000	100	
	dn-33	Leakage Saturation Coefficient	0.01	1.00 - 2.00	1.20	
	dn-34	Rotor Heat Gain	0.01	0.00 - 2.00	0.00	
	dn-35	Rotor Heat Time Constant	1 min.	0 - 180	30	
	dn-36	Iron Core Saturation Comp. Coefficient 1 *(See Note 4)*	0.01	0.00 - 1.00	0.50	
	dn-37	Iron Core Saturation Comp. Coefficient 2 *(See Note 4)*	0.01	0.00 - 1.00	0.75	
	dn-38	Motor Overheat (OH1) Temperature *(See Note 5)*	1° C	50 - 200	120	
	dn-39	PG Constant For Motor 2 *(See Note 6)*	ppr	0 - 6000	600	
	dn-40	CEMF Compensation	0.001	0.000 - 1.300	1.000	
	dn-41	Motor Cable Resistance	0.1 %	0.0 - 5.0	0.0	
	dn-42	Initial Excitation Timer	0.1 s	0.0 - 10.0	0	
	dn-45	AφR Time Constant	1 ms	0 - 10000	dn-32 dependent	
Auto Tuning *(8)*	dn-51	Motor Rated Output	0.01 kW	0.01 - 400.00	000.00	——
	dn-52	Motor Rated rpm	rpm	100 - 12000	00000	——
	dn-53	Maximum Motor RPM	rpm	100 - 12000	00000	——
	dn-54	Motor Poles	1	2 - 48	00	——
	dn-55	Motor Rated Voltage	1 V	50 - 600	000	——
	dn-56	Motor Rated Current	0.1 A	0.1 - 800.0	0.0	——
	dn-57	Motor Insulation Class *(See Note 7)*	1	0 - 4	0	
	dn-58	Inverter Input Power Supply Voltage	1 V	180 - 660	000	——

NOTES:

1. All dn-XX constants are factory set with parameter values unique to the vector control motor (VCM) provided in the VCD/VCM package; see Appendix 2. The default values listed in this table are those that will be present after Sn-02 has been set to " FFF " for use of a non-standard motor; each dn-XX constant must then be programmed with the appropriate value for that particular motor.
2. Setting conditions for dn-01 thru dn-03 and dn-21 thru dn-23:

$$0\ \text{Hz} \le \frac{[\text{Speed (in RPM) x No. of motor poles}]}{120} \le 400\ \text{Hz}.$$

3. Motor rated current value must be from 0% to 110% of VCD 703 Continuous Rated Current; see Table A1-1 for this 100% value.

(Table 5-7 Notes continued on next page)

Table 5-7 NOTES (Continued):

4. Setting range: 0.00 ≤ dn-16 (dn-36) ≤ dn-17 (dn-37) ≤ 1.00.
5. Motor overheat temperature setting MUST NOT exceed the overheat trip point of the motor's thermistor: Class E: 120° C; Class F: 155° C. Motor overload (OL1) operates at 90% of motor overheat temperature setting.
6. When the set value is 0, control without PG is enabled for the second motor.
7. Set dn-57 according to the chart below for the motor insulation class.

Insulation Class	dn-57 Setting Value
A (105°C)	0
E (120°C)	1
B (130°C)	2
F (155°C)	3
H (180°C)	4

8 These constants are for entering motor nameplate values BEFORE performing the Auto Tuning function. The settings are <u>not</u> saved when power is removed from the VCD 703.

Table 5-8. Order Constants (On-XX)

CONSTANT NUMBER	DATA NAME	DESCRIPTION DIGIT		DESCRIPTION DATA	FACTORY SETTING	USER SETTING	PAGE REF.
On-01	Control Status 1	X<u>X</u>XX	Operation Mode	000 Normal operation 001 Not Used 010 Simulation mode 011 Base test mode 100 V/f test mode 1 101 V/f test mode 2	0000		— vii
		<u>X</u>XXX	PG disconnection detection	0 Enabled 1 Disabled			—
On-02	Control Status 2	XXX<u>X</u>	Control mode 1 *(See Note 1)*	0 Vector control with PG 1 Simplified vector control without PG	0000 With PG 0001 w/o PG		—
		XX<u>X</u>X	Control mode 2	0 Control with thermistor 1 Control without thermistor			—
		X<u>X</u>XX	Control mode 3	0 Rotor heat model effective 1 Rotor heat model ineffective			—
		<u>X</u>XXX	Control mode 4 *(See Note 1)*	0 Adaptive control effective 1 Adaptive control ineffective			—
On-03	Control Status 3	XXX<u>X</u>	Phase shift during initial excitation	0 Phase fixed 1 According to rotor position	0010		—
		XX<u>X</u>X	Magnetic field forcing	0 Effective 1 Disabled			—
		X<u>X</u>XX	Overvoltage control function	0 Disabled 1 Enabled			5-36
		<u>X</u>XXX	DSP A/D automatic offset adjustment	0 Enabled 1 Disabled			—
On-04	Control Status 4	XXX<u>X</u>	Interlock Function	0 Enabled (w/o PG) 1 Disabled (w/o PG)	0000		—
		XX<u>X</u>X	Field weakening	0 By $1/\sqrt{N}$ 1 By 1/N (N: Speed)			—
		X<u>X</u>XX	Overspeed detection	0 Enable 1 Disable			—
		<u>X</u>XXX	Field weakening (w/o PG)	0 Weakening by $1/\sqrt{N}$ 1 Weakening by 1/N (N: Speed)			—

Table 5-8. Order Constants (On-XX) - Continued

CONSTANT NUMBER	DATA NAME	INCRE-MENT	SETTING RANGE	FACTORY SETTING	USER SETTING	PAGE REF.
On-05	Drive Low Freq. OL Gain	0.1	1.0 - 5.0	*(See Note 2)*		—
On-06	Drive Low Freq. OL Frequency	0.01 Hz	0.00 - 5.00	*(See Note 2)*		—
On-07	Regenerative Side Torque Limit at Low Frequency	0.01 %	0.00 - 300.00	50.00		—
On-08	Current Amplifier Characteristics	1	000 - 254	020		—
On-09	ASR Output Filter Time Constant	1 msec	0 - 500	0		—
On-10	CEMF Compensation	0.001	0.000 - 1.300	1.000		—
On-11	AΦR Time Constant *(See Note 1)*	1 msec	0 - 2000	*(See Note 3)*		—
On-12	AFR Gain (for PG-less) *(See Note 1)*	0.01	0 00 - 2.00	0.60		—
On-13	AFR Time Constant (for PG-less) *(See Note 1)*	1 msec	50 - 2000	100		—
On-14	Magnetic Flux Feedback Gain *(See Note 1)*	0.001	0.800 - 1.200	1.000		—
On-15	Current Feedback Gain *(See Note 1)*	0.001	0.800 - 1 200	1.000		—
On-16	NV-RAM Software No.	1	0 - 9999	*(See Note 4)*		—
On-17	DSP A/D Converter Phase U Gain	0.0001	0.9000 - 1.1000	*(See Note 5)*		—
On-18	DSP A/D Converter Phase U Offset	1	−819 - 819	*(See Note 5)*		—
On-19	DSP A/D Converter Phase W Gain	0.0001	0.9000 - 1.1000	*(See Note 5)*		—
On-20	DSP A/D Converter Phase W Offset	1	−819 - 819	*(See Note 5)*		—
On-21	ON-DELAY Compensation Gain	0.01	0.00 - 2.00	1.00		—
On-22	AO Output Offset (terminals 21 & 22)	0.001v	−5.000 - 5.000	0.000		—
On-23 thru On-25	Not Used	—	—	—	—	—
On-26	Curent Regulator Proportional Gain (Enabled when On-08 = 254)	0.01	0.00 - 5.00	2.20		—
On-27	Current Regulator Integral Time Constant (Enabled when On-08 = 254)	0.1 msec	0 0 - 50.0	1.0		—

Table 5-8. Order Constants (On-XX) - Continued

CONSTANT NUMBER	DATA NAME		INCRE-MENT	SETTING RANGE	FACTORY SETTING	USER SETTING	PAGE REF.
On-28 and On-29	Not Used		—	—	—	—	—
On-30	Control Status 5	XXXX Speed Control Mode		0 PI Control 1 I-P Control	0010		—
		XXXX Speed control card clock		0 10 MHz 1 5 MHz			—
		XXXX Not Used		—			—
On-31 thru On-33	Not Used		—	—	—	—	—
On-34	Inverter Master Speed Analog Input A/D Gain		0.0001	0.9000 - 1.1000	*(See Note 5)*	—	—
On-35	Inverter Master Speed Analog Input A/D Offset		1 (DEC)	-819 - 819	*(See Note 5)*	—	—
On-36	Inverter Multi-function Analog Input A/D Gain		0.0001	0.9000 - 1.1000	*(See Note 5)*	—	—
On-37	Inverter multi-function Analog Input A/D Offset		1 (DEC)	-819 - 819	*(See Note 5)*	—	—
On-38	Multi-function Output Monitor 1 D/A Gain		0.0001	0.8000 - 1.2000	*(See Note 5)*	—	—
On-39	Multi-function Output Monitor 2 D/A Offset		0.001 V	-5.000 - 5.000	*(See Note 5)*	—	—
On-40	Multi-function Output Monitor 2 D/A Gain		0.0001	0.8000 - 1.2000	*(See Note 5)*	—	—
On-41	Not Used		—	—	—	—	—
On-42	U-Phase Voltage Reference Offset		0.01 %	-10.00 - 10.00	*(See Note 5)*	—	—
On-43	Not Used		—	—	—	—	—
On-44	V-Phase Voltage Reference Offset		0.01 %	-10.00 - 10.00	*(See Note 5)*	—	—
On-45	Not Used		—	—	—	—	—
On-46	W-Phase Voltage Reference Offset		0.01 %	-10.00 - 10 00	*(See Note 5)*	—	—
On-47	Elapsed Time in Operation Offset		1 Hour	0 - 65535	0	—	—
On-58	2nd Motor Selection Code Offset		HEX	0000 - FFFF	0FFF	—	—

Table 5-8. Order Constants (On-XX) - Continued

CONSTANT NUMBER	DATA NAME	INCRE-MENT	SETTING RANGE	FACTORY SETTING	USER SETTING	PAGE REF.
On-59	Password Set	HEX	0000 - FFFF	0FFF	—	——
On-60	Password Set	HEX	0000 - FFFF	0FFF	—	——

NOTES:

1. Effective when high accuracy torque control option card (TRQ-A) is used.
2. Value determined by Sn-01. DO NOT CHANGE.
3. Value determined by Sn-02. DO NOT CHANGE.
4. Displays the lower 4 digits of the program number.
5. Value determined by particular control card.

Table 5-9. System Constants (Sn-XX)

CONSTANT NUMBER	DATA NAME	DIGIT	SET DATA	FUNCTION	FACTORY SETTING	USER SETTING	PAGE REF.
Sn-01	VCD 703 Capacity Selection	--	VCD 703 capacity selection		See App. 2, Table A2-1	*(See Note 1)*	—
Sn-02	Motor Selection	--	Code for VCM used with the VCD 703		See App. 2, Table A2-2	*(See Note 2)*	—
Sn-03	Operator Status	XXXX	0000 = Setting and reading of An-, bn-, Cn-, dn- and Sn- constants 1010 = Setting and reading of An-, bn-, Cn-, dn-, On- and Sn- constants 1001 = Setting and reading of An-, bn-, Cn-, dn-, On- and Sn- constants (during operation) 1110 = Constant initialization (reset) for 2-wire control operation 1111 = Constant initialization (reset) for 3-wire control operation		0000		5-44, 5-45
Sn-04	Operation Mode Selection 1	XXXX	0 1	Remote: Auto speed reference at external terminals 13 & 17, or 14 & 17, or option card Local: Main speed reference set by Digital Operator (An-01; Speed Reference 1)	0011		5-38, 5-40 - 5-43
		XXXX	0 1	Run/Stop by external input signals Run/Stop by means of Digital Operator keypad			5-30 (Data **01** description)
		XXXX	0 1	Ramp to stop at Stop command Coast to stop at Stop command			— *(See Note 3)*
		XXXX	—	Not Used			
Sn-05	Operation Mode Selection 2	XXXX	0 1	Stop command from either Digital Operator or external terminal Stop command from external terminal only	0000		—
		XXXX	0 1	Reverse Run possible Reverse Run prohibited			
		XXXX	0 1	Forward Run possible Forward Run prohibited			
		XXXX	—	Not Used			

Table 5-9. System Constants (Sn-XX) - Continued

CONSTANT NUMBER	DATA NAME	DIGIT	SET DATA	FUNCTION	FACTORY SETTING	USER SETTING	PAGE REF.
Sn-06	Operation Mode Selection 3 (SRMIN)	XXXX	—	Not Used	0000 With PG 1000 w/o PG		
		XXXX		Operation when speed ref. ≤ Cn-06 (Min. Speed Reference): 00 = Normal operation (Cn-06 ineffective) 01 = Zero speed operation 10 = Stop (by Sn-04 XXXX setting) 11 = Operation at lower limit (Cn-06)			5-61 - 5-64
Sn-07	Operation Mode Selection 4	XXXX	0	Speed search at auto-restart enabled	0000		5-28
			1	Speed search at auto-restart disabled			
		XXXX	0	ASR operation when speed ref. ≤ Cn-01: P-I control (normal mode)			5-65
			1	ASR operation when speed ref. ≤ Cn-01: P control			
		XXXX	0	Synchronous Restart (w/o PG) Enabled			
			1	Synchronous Restart (w/o PG) Disabled			
		XXXX	—	Not Used			
Sn-08	Operation Mode Selection 5	XXXX	0	Speed reference input from installed option card	0010		5-38
			1	Speed reference input at control terminals			
		XXXX	0	Operation commands from installed option card			—
			1	Operation commands at control terminals			
		XXXX	—	Not Used			
		XXXX	0	Minor fault detection circuit resets automatically			5-11
			1	Minor fault detection circuit holds until external Fault Reset command is input			
Sn-09	Operation Mode Selection 6	XXXX	0	Input voltage "High": 220/230V (230V rated) 440/460V (460V rated)	0000		—
			1	Input voltage "Low": 200V (230V rated) 400V (460V rated)			
		XXXX	—	Not Used			
		XXXX	0	"Low" carrier frequency: 2.08 kHz (for General Use)			5-21a
			1	Carrier frequency can be set in Cn-52 (NOTE: derating may be necessary)			

Table 5-9. System Constants (Sn-XX) - Continued

CONSTANT NUMBER	DATA NAME	DIGIT	SET DATA	FUNCTION	FACTORY SETTING	USER SETTING	PAGE REF.
Sn-10	Protective Characteristics 1 (System Protection)	XXXX		Stopping method at excessive speed deviation (dEu) detection: 00 = Ramp to stop (decel time per bn-02) 01 = Coast stop 10 = Emergency stop (decel time per bn-12) 11 = Continuous operation	0111		5-49, 5-50
		XXXX		Stopping method at overspeed (oS) detection: 00 = Ramp to stop (decel time per bn-02) 01 = Coast stop 10 = Emergency stop (decel time per bn-12) 11 = Not Used			5-35, 5-50
Sn-11	Protective Characteristics 2	XXXX	0 1	Heatsink mounted braking resistor (option) not installed. Overheat protection disabled. Heatsink mounted braking resistor (option) installed. Overheat protection enabled.	0000		Separate Option Instruction Sheet
		XXXX	0 1	Fault contact status during auto restart: remains open Fault contact status during auto restart: closes			5-11, 5-12
		XXXX	0 1	Operation stops when momentary power loss is detected Operation continues during momentary power loss			5-11, 5-22
		XXXX	0 1	Undervoltage (PUV) Detection Level = 80% (210V for 230V rated; 420V for 460V rated) Undervoltage Detection Level is set by Cn-17			—
Sn-12	Protective Characteristics 3 (External Fault (Term. 3) Function Selection)	XXXX	0 1	External fault signal: N O. contact input External fault signal: N.C. contact input	0100		5-17, 5-50
		XXXX	0 1	External fault signal always detected External fault signal not detected during stop			
		XXXX		Stopping method when external fault is detected: 00 = Ramp to stop (decel time per bn-02) 01 = Coast stop 10 = Emergency stop (decel time per bn-12) 11 = Continuous operation			5-50

Table 5-9. System Constants (Sn-XX) - Continued

CONSTANT NUMBER	DATA NAME	DIGIT	SET DATA	FUNCTION	FACTORY SETTING	USER SETTING	PAGE REF.
Sn-13	Protective Characteristics 4 (Inverter Protection)	XXXX		Stopping method when inverter overload (oL2) is detected: 00 = Ramp to stop (decel time per bn-02) 01 = Coast stop 10 = Emergency stop (decel time per bn-12) 11 = Continuous operation	0101		5-50
		XXXX		Stopping method when inverter cooling fan (FAN) fault is detected: 00 = Ramp to stop (decel time per bn-02) 01 = Coast stop 10 = Emergency stop (decel time per bn-12) 11 = Continuous operation			
Sn-14	Protective Characteristics 5 (Motor Protection)	XXXX		Stopping method when motor overload (oL1) is detected: 00 = Ramp to stop (decel time per bn-02) 01 = Coast to stop 10 = Emergency stop (decel time per bn-12) 11 = Continuous operation	1101		5-25, 5-50
		XXXX		Stopping method when motor overheat (oH1) is detected: 0 = Emergency stop (decel time per bn-12) 1 = Coast stop			5-50
		XXXX		Stopping method when motor thermistor disconnection (THM) is detected: 0 = Emergency stop (decel time per bn-12) 1 = Coast stop			5-50
Sn-15 ✤	Multi-function Input Terminal Func. Selection	--	00 – 74	Selects terminal 5 function	03 (00) *		5-6, 5-7, 5-10 - 5-11, 5-15, 5-18, 5-29 - 5-32, 5-38, 5-40 - 5-43, 5-44, 5-46, 5-54, 5-59
Sn-16 ✤	Multi-function Input Terminal Func. Selection	--	00 – 74	Selects terminal 6 function	04 (03) *		
Sn-17 ✤	Multi-function Input Terminal Func. Selection	--	00 – 74	Selects terminal 7 function	06 (04) *		
Sn-18 ✤	Multi-function Input Terminal Func. Selection	--	00 – 74	Selects terminal 8 function	08 (06) *		
Sn-19	Multi-function Analog Input	——	00 – 04	Selects terminal 16 function	00		5-26 - 5-27, 5-38, 5-40 - 5-43, 5-57

✤ Settings of these four constants MUST be in ascending value.

* ( ) are constant settings after 3-wire Reset Code has been entered (see paragraph 5.21).

Table 5-9. System Constants (Sn-XX) - Continued

CONSTANT NUMBER	DATA NAME	DIGIT	SET DATA	FUNCTION	FACTORY SETTING	USER SETTING	PAGE REF.
Sn-20	Multi-function Output 1	——	00 – 36	Selects multi-function contact (terminals 9 & 10) function	00		5-33 - 5-34, 5-47, 5-54, 5-60
Sn-21	Multi-function Output 2	——	00 – 36	Selects multi-function open collector (terminal 25) function	01		
Sn-22	Multi-function Output 3	––	00 – 36	Selects multi-function open collector (terminal 26) function	02		
Sn-23	Multi-function Output 4	——	00 – 36	Selects multi-function open collector (terminal 28) function	06		
Sn-24	Multi-function Output 5	——	00 – 36	Selects multi-function open collector (terminal 29) function	0d		
Sn-25	Analog Reference Card (AI-14B) (Option) Input Function Selection	XXXX	——	Selects VCD 703 control mode and function of the option's 3-channel input	0000		5-48, 5-49, 5-52 - 5-54 5-58; also Separate Option Instruction Sheet
Sn-26	Digital Reference Card (DI-16) (Option) Input Function Selection	XXXX	Selects format of speed reference data at the option's input terminals: 0001 = BCD input, 0.1% accuracy (–109.2 to +109.2) 0010 = BCD input, 0.01% accuracy (–109.20 to +109.20) 0111 = Binary input (–32768 to +32768, 30000/100%)		0001		Separate Option Instruction Sheet
Sn-27	Digital Output Card (DO-08) (Option) Function Selection	XXXX	0000 OR 0001	Selects signal format of the option's digital output	0000		Separate Option Instruction Sheet
Sn-28	Analog Output Function Selection (Term. 21 & 22, and AO-08 or AO-12)	XXXX	0 1	Analog output +/– voltage according to sign Analog output voltage (absolute value)	0000		5-28; also Separate Option Instruction Sheet
	Terminal 3 Input Select	XXXX	0 1	External fault External base block			5-19
		XXXX	—	Not Used			
Sn-29	Not Used						
Sn-30	Transmission Function Selection 1	XXXX	——	Not Used	0000		—

Table 5-9. System Constants (Sn-XX) - Continued

CONSTANT NUMBER	DATA NAME	DIGIT	SET DATA	FUNCTION	FACTORY SETTING	USER SETTING	PAGE REF.
Sn-31	Transmission Function Selection 2	XXXX	——	Not Used	0000		—
Sn-32	Transmission Function Selection 3	XXXX	——	Not Used	0000		—
Sn-33	Transmission Function Selection 4	XXXX	0	8 words transferred from master controller to VCD 703	0000		—
			1	16 words transferred from master controller to VCD 703			
		XXXX	0	8 words transferred from VCD 703 to master controller			
			1	16 words transferred from VCD 703 to master controller			
		XXXX	0	Initial data receiving request from VCD 703 to master provided			
			1	Initial data receiving request from VCD 703 to master NOT provided			
		XXXX	0	Control data provided (master controller to VCD 703)			
			1	Control data NOT provided (master controller to VCD 703)			
Sn-34	Transmission Function Selection 5	XXXX	0	No speed monitor filter	0001		—
			1	Speed monitor filter set to 100 ms			
		XXXX	0	No. 8 control data from VCD 703 to master controller set to output voltage reference			
			1	No. 8 control data from VCD 703 to master controller set to output ASR output			
		XXXX	0	Auxiliary analog input (AI) function NOT active			
			1	Auxiliary analog input (AI) function active			
		XXXX	0	Inverter type code – F7 (new MAP)			
			1	Inverter type code – F8 (old MAP)			

Table 5-9. System Constants (Sn-XX) - Continued

CONSTANT NUMBER	DATA NAME	DIGIT	SET DATA	FUNCTION	FACTORY SETTING	USER SETTING	PAGE REF.
Sn-35	Not Used						
Sn-36	Not Used						
Sn-37	Tuning Mode Selection	XX	00	Normal operation	00		—
			01	Motor resistance (dn-08) tuning			
			02	Motor cable lead resistance (Cn-13) tuning			
			03	Motor constant tuning using nameplate motor kW			
			04	Motor constant tuning using dn-XX constants			2-6b, 5-7a
			0F	Motor constant tuning using nameplate HP			2-6c, 5-7a
Sn-38	Other Function Selection 2	XXXX	0	OL1 curve selection for vector duty motor (TENV or TEBC)	0000		5-25
			1	OL1 curve selection for general-purpose motor (TEFC)			
		XXXX	0	OL1 time constant set to 8 minutes			
			1	OL1 time constant set to 5 minutes			
		XXXX	——	Not Used			
Sn-39 to Sn-41	Not Used						
Sn-42	Other Function Selection 3	XXXX	0	Time unit set to 0.1 sec. unit (For bn-01 to bn-04; bn-12 & bn-19; Cn-22 & Cn-26)	0000		—
			1	Time unit set to 0.01 sec. unit			
		XXXX	——	Not Used			
Sn-43 to Sn-49	Not Used						
Sn-50	DI-08 Function	XXXX	——	See Option Instruction Sheet	1000		—

NOTES:

1. Sn-01 MUST NOT BE CHANGED from the factory setting.
2. Factory set. Sn-02 should only be changed if the original motor is being replaced with one of a different horsepower rating, which is still a suitable "match" for the VCD 703.
3. This selection is available in both torque and speed control modes.

Table 5-10. Monitor Displays (Un-XX)

CONSTANT NO	MONITOR ITEM	DISPLAY EXAMPLE	OUTPUT TO ANALOG MON. OPTION (AO-08 OR AO-12)
Un-01	Not Used		
Un-02	Drive output current (A)	***12.5A***	5V/continuous drive rated current (see Table A2-1)
Un-03	Drive output current (A)	***12.5A***	10V/motor rated current ***(see Note 1)***
Un-04	Voltage reference (V)	***460u***	10V/no-load voltage (dn-04)
Un-05	DC voltage (V P-N)	***Pn650***	10V/400V (230V rated) 10V/800V (460V rated)
Un-06	Not Used		
Un-07	Input terminal status	***CI I I*** (See paragraph 5 11)	N/A
Un-08	Output terminal status	***o I I*** (See paragraph 5 11)	N/A
Un-09	LED lamp check	***8.8.8.8.8.***	N/A
Un-10	Control Section Software No.	***0020*** (See paragraph 5 11)	N/A
Un-11	Optional Section Software No.	***1234*** (See paragraph 5.11)	N/A
Un-12	Digital Reference Card (DI-16) (Option) Input Lower 8 Bits Status	***IIII***	N/A
Un-13	Digital Reference Card (DI-16) (Option) Input Upper 8 Bits Plus SET and SIGN Status	***IIIII***	N/A
Un-14	Digital Output Card (DO-08) (Option) Output Terminal Status	***IIII***	N/A
Un-15	Motor Control Command 1		N/A
Un-16	Motor Control Command 2		N/A
Un-17	Internal Control Status 1	***IIII*** (See paragraph 5.11)	N/A
Un-18	Internal Control Status 2	***III I*** (See paragraph 5 11)	N/A
Un-19	Not Used		
Un-20	Not Used		

Table 5-10. Monitor Displays (Un-XX) - Continued

CONSTANT. NO	MONITOR ITEM	DISPLAY EXAMPLE	OUTPUT TO ANALOG MON. OPTION (AO-08 OR AO-12)
Un-21	Speed Reference (SFS Input) (%)		10V/100%
Un-22	Speed Reference (SFS Output) (%)		10V/100%
Un-23	Speed Feedback (Nfb) (%)	*5 0.0*	10V/100%
Un-24	External Torque Reference (%) (when in Torque Control mode)		10V/100%
Un-25	Torque Compensation (%)		10V/100%
Un-26	Torque Reference (%)		10V/100%
Un-27	Torque Feedback (%) (when High Accuracy Torque Control card is installed)		10V/100%
Un-28	Speed Controller Circuit (ASR) Input (%) (Speed Deviation)		10V/100%
Un-29	Speed Controller Circuit (ASR) Output (%) (after filter)		10V/100%
Un-30	Slip Frequency Reference (%)		10V/100%
Un-31	Primary Frequency Reference (%)		10V/100%
Un-32	Motor Temperature (°C)		10V/200°C
Un-33	Zero Servo Moving Pulse (pulse count) (x4)		10V/32767
Un-34	External Terminal 13 (or 14) Input Voltage (V) (Auto Speed Ref.)		10V/10V
Un-35	External Terminal 16 Input Voltage (V) (Analog Input)		10V/10V
Un-36	AI-14B (Option) CH1 Input Voltage (V)		10V/10V
Un-37	AI-14B (Option) CH2 Input Voltage (V)		10V/10V
Un-38	AI-14B (Option) CH3 Input Voltage (V)		10V/10V
Un-39	Magnetic Flux Feedback (Phase α) (%)		10V/100%
Un-40	Magnetic Flux Feedback (Phase β) (%)		10V/100%
Un-41	ACR Compensation (%)		10V/100%

Table 5-10. Monitor Displays (Un-XX) - Continued

CONSTANT. NO	MONITOR ITEM	DISPLAY EXAMPLE	OUTPUT TO ANALOG MON. OPTION (AO-08 OR AO-12)
Un-42	Magnetic Flux Feedback (only with TRQ-A card)	*5 0.0*	10V/100%
Un-43	Magnetic Flux Controller Output (only with TRQ-A card)		10V/100%
Un-44	Output Power (kW)		10V/100%
Un-49	Accumulated Operation Time (hours)	*1234*	N/A

NOTES:

1. Motor Rated Current = dn-05 x $\sqrt{1 - (\text{dn-07}/100)^2}$.

Section 6. TROUBLESHOOTING

6.1 GENERAL

A failure in the VCD 703 can fall into one of two categories.

A blinking "Alarm" indication is a warning that a VCD 703 trouble condition will soon occur, or that a problem in the external circuitry exists. The VCD 703 will continue to operate during an "Alarm" indication.

A steady "Fault" indication is displayed when the VCD 703's Fault relay has tripped (VCD 703 shutdown). The motor coasts to a stop, and a fault signal output is present at control circuit terminals 18 - 20.

Table 6-1. Failure Indication and Details

INDICATION (DISPLAY)	FAULT	DESCRIPTION
Uu	Momentary power loss	Low voltage has been detected (see "Undervoltage" specification, under "Protective Functions", in Appendix 1), but momentary power loss ride-thru is enabled, and momentary power loss ride-thru time (Cn-19 setting) has not been exceeded yet
Uu1	Power undervoltage fault (PUV)	Occurs two seconds after detection of low voltage (See "Undervoltage" specification, under "Protective Functions", in Appendix 1.)
Uu2	Control undervoltage fault (CUV)	Control circuit voltage is low during operation
Uu3	Undervoltage fault (MC-ANS fault)	Main circuit magnetic contactor (soft charge contactor) does not operate correctly
oC	Overcurrent (OC)	VCD 703 output current exceeds 120% of transistor rated current, or the ground current exceeds 25% of VCD 703 rated current
ou	Overvoltage (OV)	Detection level Approx 400V for 230V rated unit, Approx 800V for 460V rated unit
FAn	Cooling fan failure (FAN)	Cooling fan stopped while power is on Stop mode selection possible (Sn-13)
FU	Fuse blown	DC Bus fuse has cleared Check for short circuit in output
GF	Ground fault (GF)	Drive output ground current exceeded 50% of drive rated current
LC	Drive current limit	Drive output current exceeded drive rated current
oH1	Motor overheat (OH1)	Motor temperature has exceeded the allowable value (dn-18) Stop mode selection possible (Sn-14)
oH2	Heatsink overheated (OH2)	Fin temperature exceeds 90° C (194° F) ± 5°
oL1	Motor overload (OL1)	Protects the motor Motor thermal overload protection has tripped Cn-14, Cn-15 has been exceeded (initial value 150% for 60 sec), or motor exceeded 90% of the motor overheat level (dn-18) Stop mode selection possible (Sn-14)

Table 6-1. Failure Indication and Details - Continued

INDICATION (DISPLAY)	FAULT	DESCRIPTION
oL2	Drive overload (OL2)	Protects the VCD 703. Drive overload protection has tripped Stop mode selection possible (Sn-13)
rr	Braking transistor malfunction	Braking transistor failure
rH	Braking resistor unit overheated	Braking resistor unit temperature exceeds the allowable value (Built-in type only.)
rHn	Motor thermistor disconnection (THM)	Motor temperature detection thermistor is disconnected. Stop mode selection possible (Sn-14)
LF	Open phase fault	Problem in VCD 703-to-motor wiring
EF	Fwd Run and Rev Run commands are both applied to the VCD 703	VCD 703 is in "temporary" Ramp to Stop condition, one input command must be removed to resume operation
EF3	Ext. fault signal at term 3	A fault condition has occurred in the external circuit(s) monitored by the contact providing input to the indicated terminal. Stop mode selection possible (EF3. Sn-12, EF5 - EF8. Sn-15 - Sn-18)
EF5	Ext. fault signal at term. 5	
EF6	Ext fault signal at term 6	
EF7	Ext. fault signal at term 7	
EF8	Ext. fault signal at term 8	
ES	Speed estimation fault	A speed estimation fault occurred during PG-less operation.
SuE	Zero servo control error	Rotation position was shifted by more than 536,870,912/Cn-09 revolutions during zero-servo operation
PGo	PG disconnect (PGO)	PG cables are disconnected.
oS	Overspeed (OS)	Motor speed exceeds overspeed level (Cn-16) Stop mode selection possible (Sn-10).
dEu	Excessive speed deviation (DEV)	Deviation between speed reference and speed feedback exceeds the deviation level (Cn-04) Stop mode selection possible (Sn-10).
CPF00	Control circuit fault 1; transmission error or control function hardware fault (including internal RAM, external RAM or PROM)	Transmission between VCD 703 and Remote Operator is not established within 5 seconds after the power supply is turned on. (Displayed on the Remote Operator) Check operator connection
CPF01	Control circuit fault 2, Digital Operator transmission error	Transmission error occurs 2 seconds or more after transmission has first been established between VCD 703 and Digital Operator Check operator connection
CPF02	Control circuit failure	VCD 703 failure
CPF03	NV-RAM (S-RAM) fault	
CPF04	Constant destruction	
CPF05	A/D converter failure in CPU	
CPF06	Optional connection failure	VCD 703 failure. Check option connection
CPF07	A/D converter fault	Control card hardware was damaged.
CPF10	DSP hardware fault	VCD 703 failure

Table 6-1. Failure Indication and Details - Continued

INDICATION (DISPLAY)	FAULT	DESCRIPTION
CPF20	A/D converter fault in Analog Speed Reference card	Option card (AI-14B) A/D converter malfunctions.
CPF24	A/D converter fault in High Accuracy Torque Control card	Option card (TRQ-A) A/D converter malfunctions.
oP	Digital Monitor unit fault	Digital Monitor is mounted during Program mode, or during operation by the Digital Operator.
oP I	Torque control mode fault	Torque control selected by multifinction input selection (Sn-15 - Sn-18: Data **71**), and torque reference is missing when input is "CLOSED".
oP2	Base test mode fault	Main circuit DC voltage (VPN) exceeds 20V at test.
oP3	Unapplicable option card	One or more option cards improperly installed.
oP4	Open loop fault	W/o PG mode selected, and TRQ-A option card not installed.
oP5	Motor capacity incorrect	Motor rated current is less than 10% of drive rated current.
oP6	Control mode selection error	Speed/torque control changeover function was selected from a multi-function terminal while torque control mode was selected in Sn-25.
oPE01	VCD 703 capacity selection fault (Sn-01)	Sn-01 has been changed from correct factory setting value. Refer to Table A2-1.
oPE02	Constant setting range fault	One or more An-XX, bn-XX, Cn-XX or Sn-XX values are not within allowable setting range.
oPE03	Multi-function input setting fault	Sn-15 to -18 (multi-function input) set values are not in ascending order, or data other than **F** and **FF** are overlapping.
oPE05	Option card fault	Sn-08 XXXX is set to zero (0) and option card is not installed.
oPE20	Torque control selection fault	Torque control function is selected simultaneously by multifunction input selection (Sn-15 - Sn-18) and by AI-14B input function selection (Sn-25).
Err	Constant write-in fault	VCD 703 failure.
CALL	SI-B transmission error	Control data was not received when power supply was turned on.
bUS	Transmission error	Control data was not received for 2 seconds after initial communication.
Abort	Auto tuning fault	Tuning of R_1 and R_f was not completed within the specified time.
Er–E1	Auto tuning fault	A setting of dn-51 thru dn-58 is out of acceptable range.
Er–52 ***Er–62*** ***Er–72*** ***Er–82***	Auto tuning fault	Motor did not accelerate in the specified time.

Table 6-1. Failure Indication and Details - Continued

INDICATION (DISPLAY)	FAULT	DESCRIPTION
Er–13 ***Er–53*** ***Er–63*** ***Er–73*** ***Er–83***	Auto tuning fault	Tuning was not completed within the constant range (lower limit exceeded).
Er–14 ***Er–54*** ***Er–64*** ***Er–74*** ***Er–84***	Auto tuning fault	Tuning was not completed within the constant range (upper limit exceeded).
Er–F5	Auto tuning fault	Auto tuning was attempted when there was no TRQ-A card installed.
Er–F6	Auto tuning fault	Incorrect PG phasing or incorrect motor phasing.
Er–F7	Auto tuning fault	Torque reference became excessively large (100%) during tuning
Er–58 ***Er–68*** ***Er–78*** ***Er–88***	Auto tuning fault	Auto tuning was not completed within the specified time.
Er–FF	Auto tuning fault	Undefined tuning mode was selected.
SE10	Motor changeover sequence fault 1	Motor changeover was commanded when drive was running.
SE11	Motor changeover sequence fault 2	Motor answer back signal was not returned within 1 second of motor changeover command.

6.2 DISPLAYING FAULT SEQUENCE

Whenever the Fault relay trips (VCD 703 shutdown), the display code of the fault that caused the trip (except for Illegal Constant or Control Function Hardware) is entered into a register in NV-RAM memory. This register retains, in sequence, that fault code and those of up to three immediately preceding the shutdown failure.

The contents of this register can be displayed when the VCD 703 is in the Drive mode.

A. After VCD 703 Fault Shutdown (With Power Still Applied).

Table 6-2. Displaying Fault Sequence After Fault Shutdown

STEP	OPERATION PROCEDURE	DIGITAL DISPLAY
1	Before a RESET command is entered, the fault that caused Fault trip (shutdown) is displayed	oC
2	Press ^ The display indicates that this is currently the first code in the memory register	1 oC
3	Continue pressing ^ to display the other codes in the memory register After the last register code is displayed, the sequence will return to the first code	2 ou 3 oH 1 oC

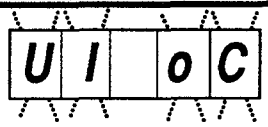
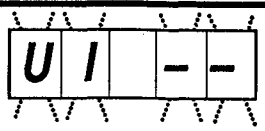
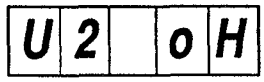
After the fault sequence has been examined, troubleshoot the most recent fault or enter a RESET command (from Digital Operator or external signal) to prepare the VCD 703 for restart of operation.

IMPORTANT: In 2-wire control, any RUN/STOP command and/or the Excitation command (multi-function input) must be removed before the RESET will be accepted.

B. At Power-Up.

NOTE: In Table 6-3, digital display A occurs if there was a Fault trip (shutdown) before turning off power, and digital display B occurs if there was no shutdown.

Table 6-3. Displaying Fault Sequence After Power-up

STEP	OPERATION PROCEDURE	DIGITAL DISPLAY A	DIGITAL DISPLAY B
1	Turn on power.	 Blinking for 5 seconds, then last selected monitor display.	 Blinking for 5 seconds, then last selected monitor display.
2	Press ^ while holding **DATA/ENTER** to select Previous Fault Display.		
3	Continue pressing ^ to display the other codes in the memory register. After the last code is displayed, the sequence will return to the first code.	 	 

After the fault sequence has been examined, refer to Table 6-1.

6.3 TROUBLESHOOTING FLOWCHARTS

If the VCD 703 malfunctions, locate the cause and take corrective action by following the flowcharts given in this section.

A. TROUBLESHOOTING MOTOR SYMPTOMS

B. TROUBLESHOOTING FOR FAULT CONDITIONS

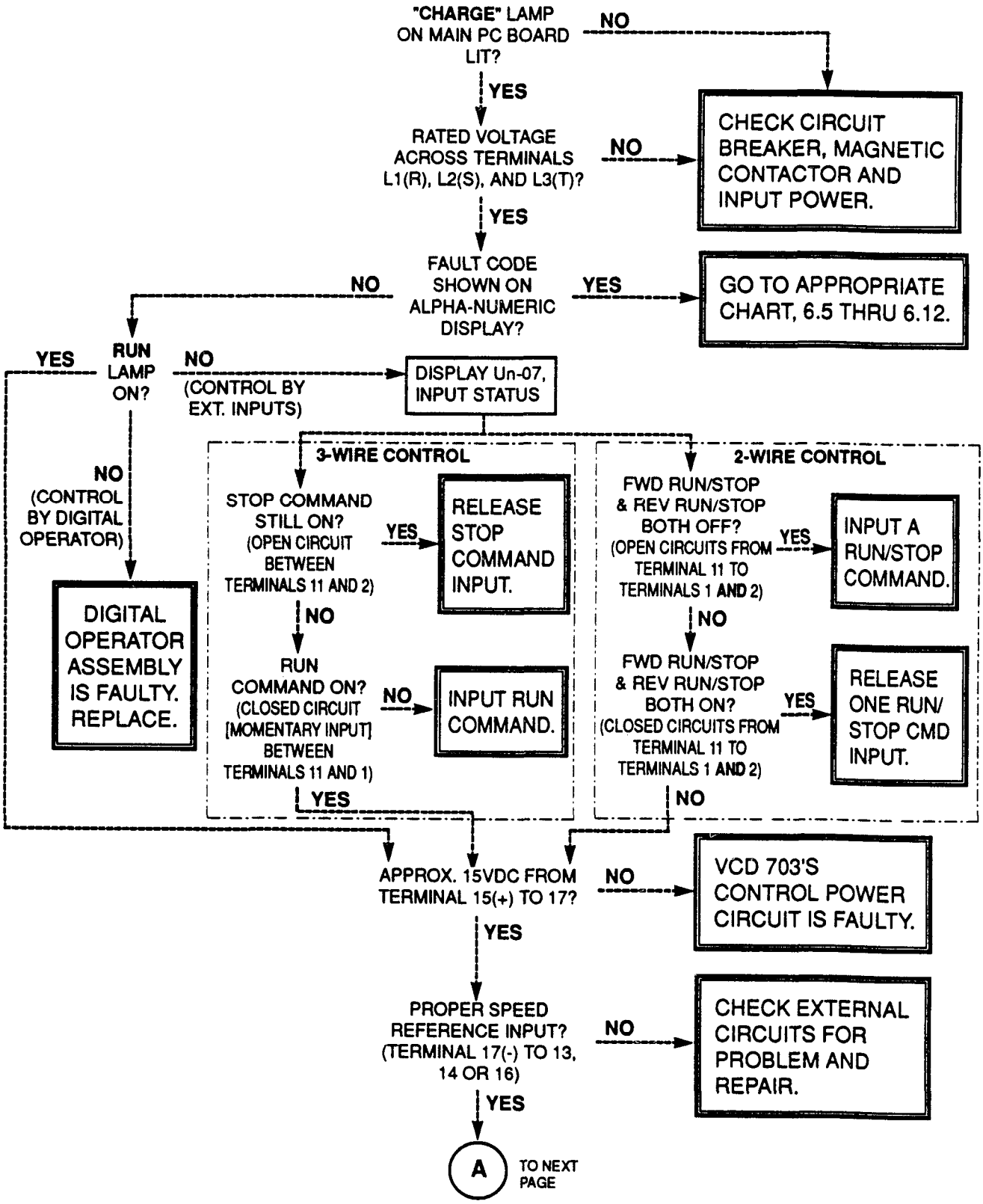
Oscilloscope chassis may be at voltages potentially hazardous to life if not properly grounded. If oscilloscope is used to measure high voltage waveforms, use only a dual channel oscilloscope in the differential mode with X100 probes. Always connect oscilloscope chassis to earth ground.

Voltages dangerous to life exist when equipment is open and energized. Do not work alone.

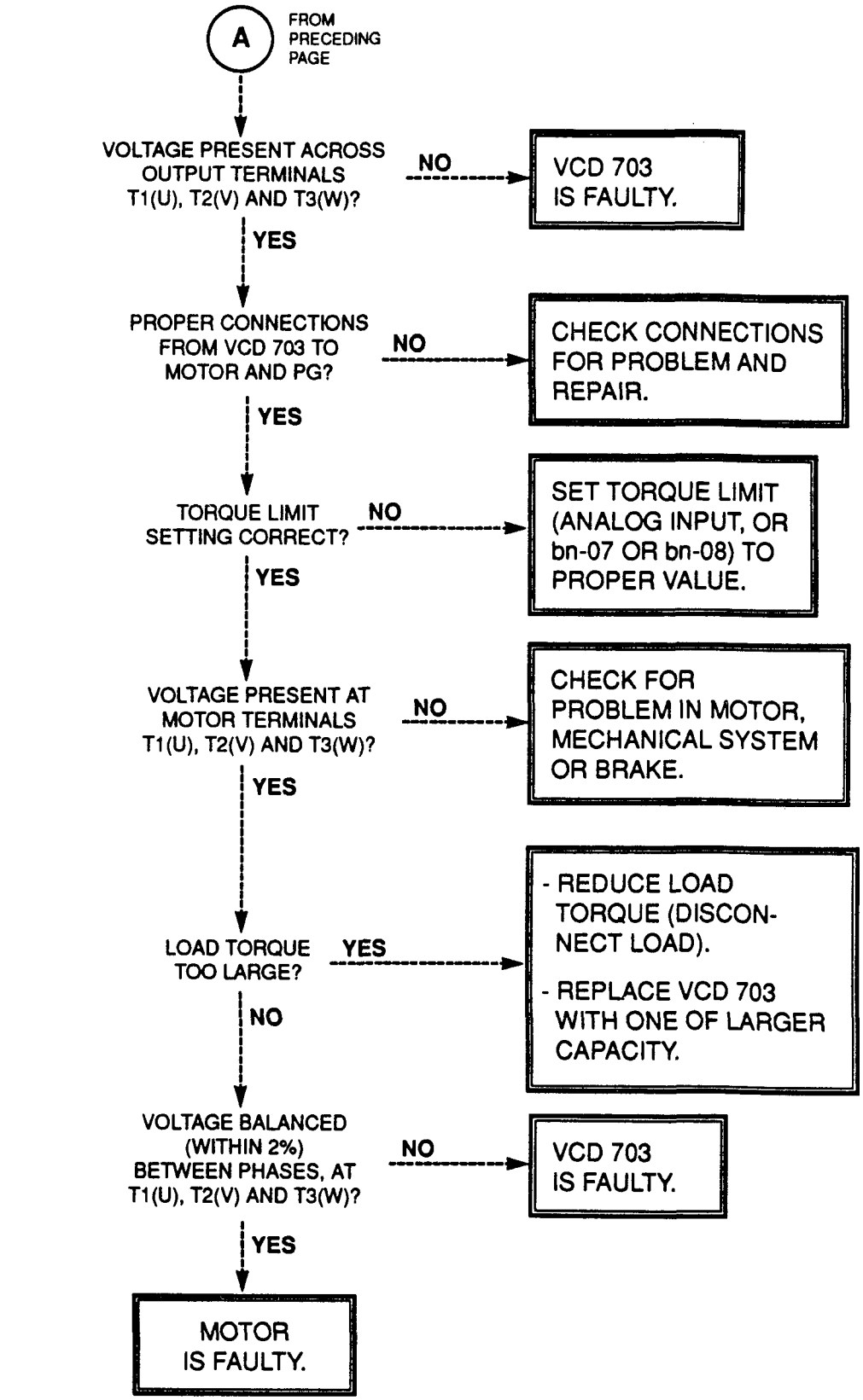
To prevent equipment damage always remove incoming three-phase power before test equipment is connected or removed. Never disconnect or connect the wiring while the power is applied.

TROUBLESHOOTING CHART 6.1

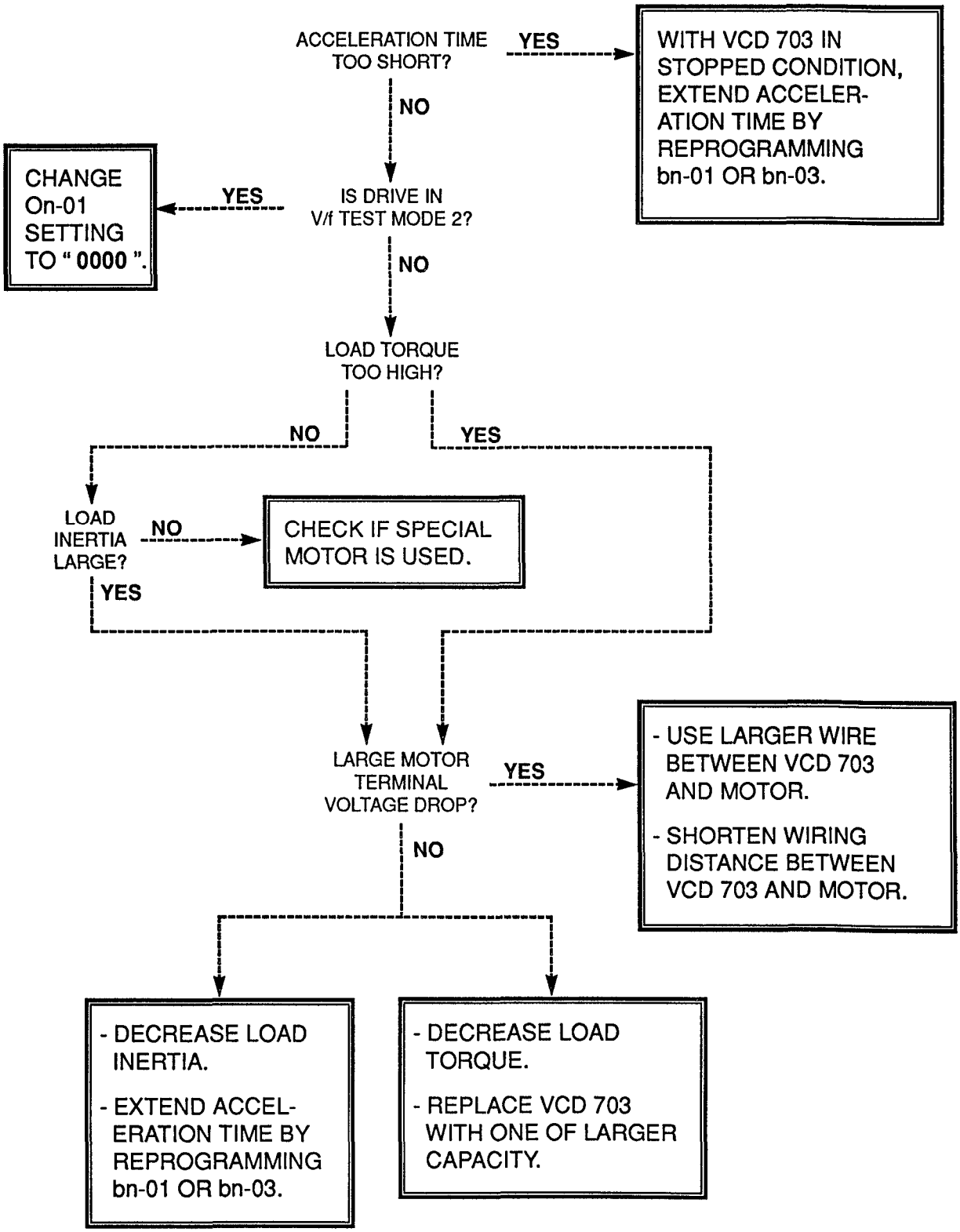
MOTOR DOES NOT ROTATE



TROUBLESHOOTING CHART 6.1 (Continued)

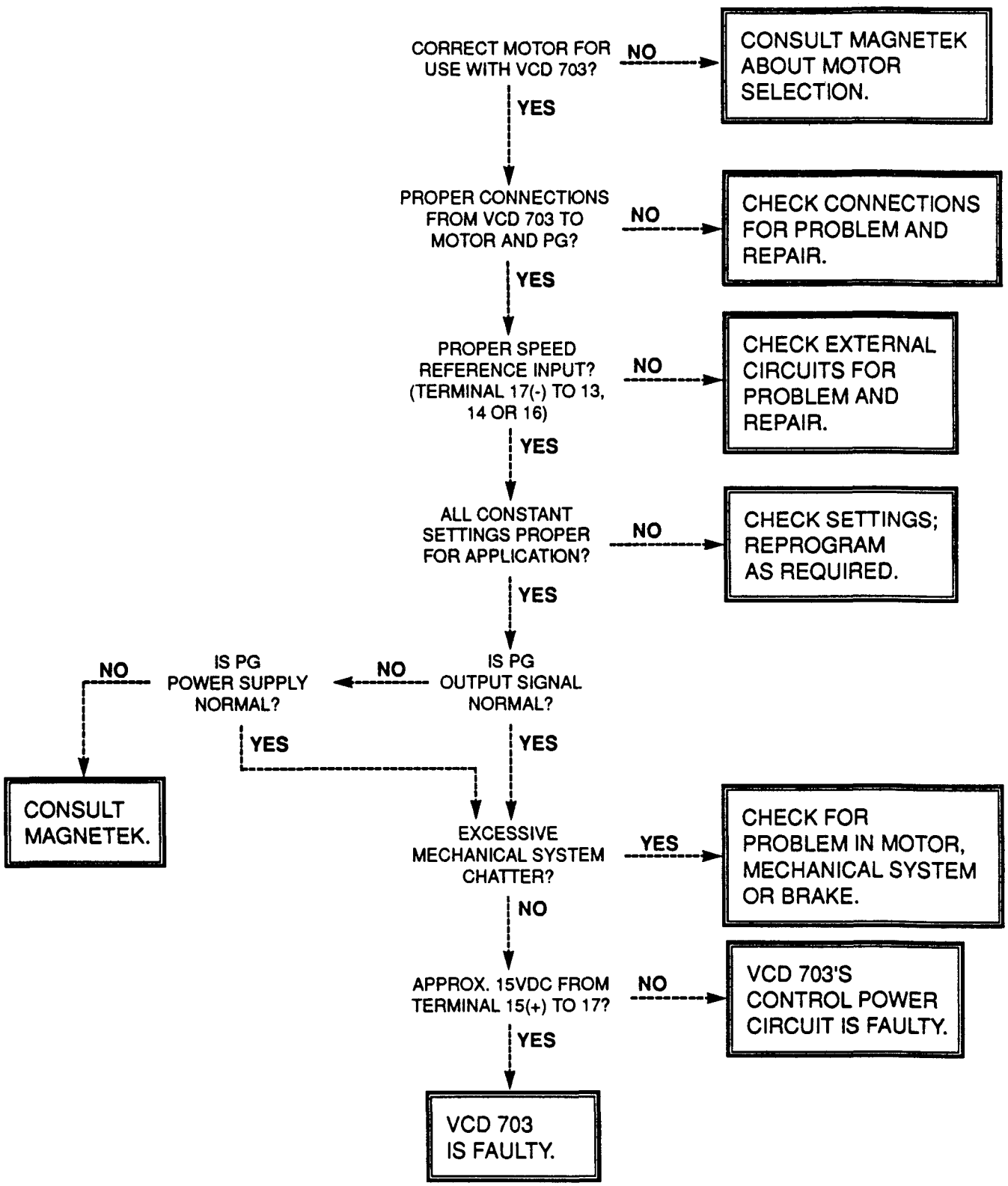


MOTOR STALLS DURING ACCELERATION



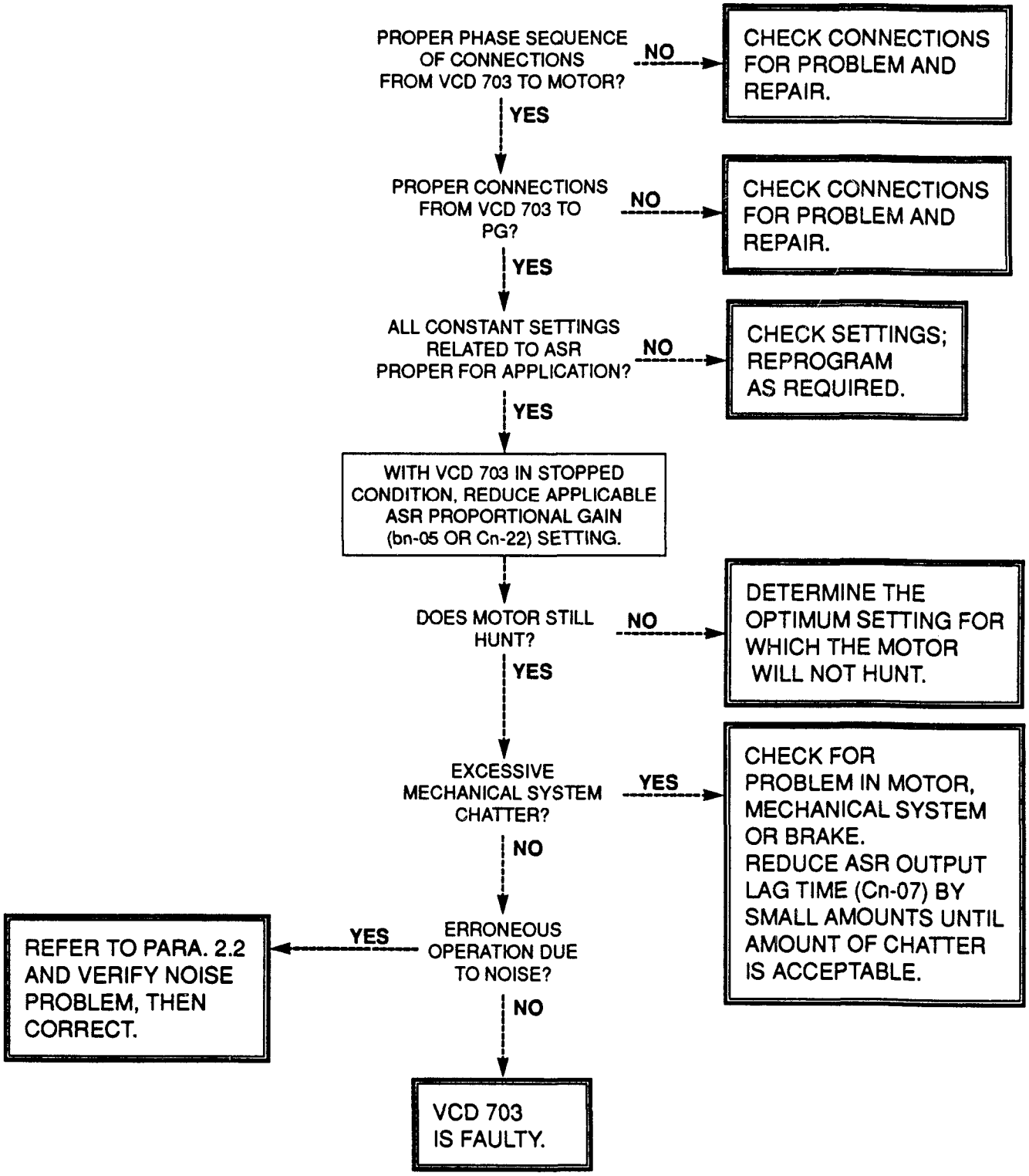
TROUBLESHOOTING CHART 6.3

MOTOR DOES NOT ROTATE AT SET SPEED



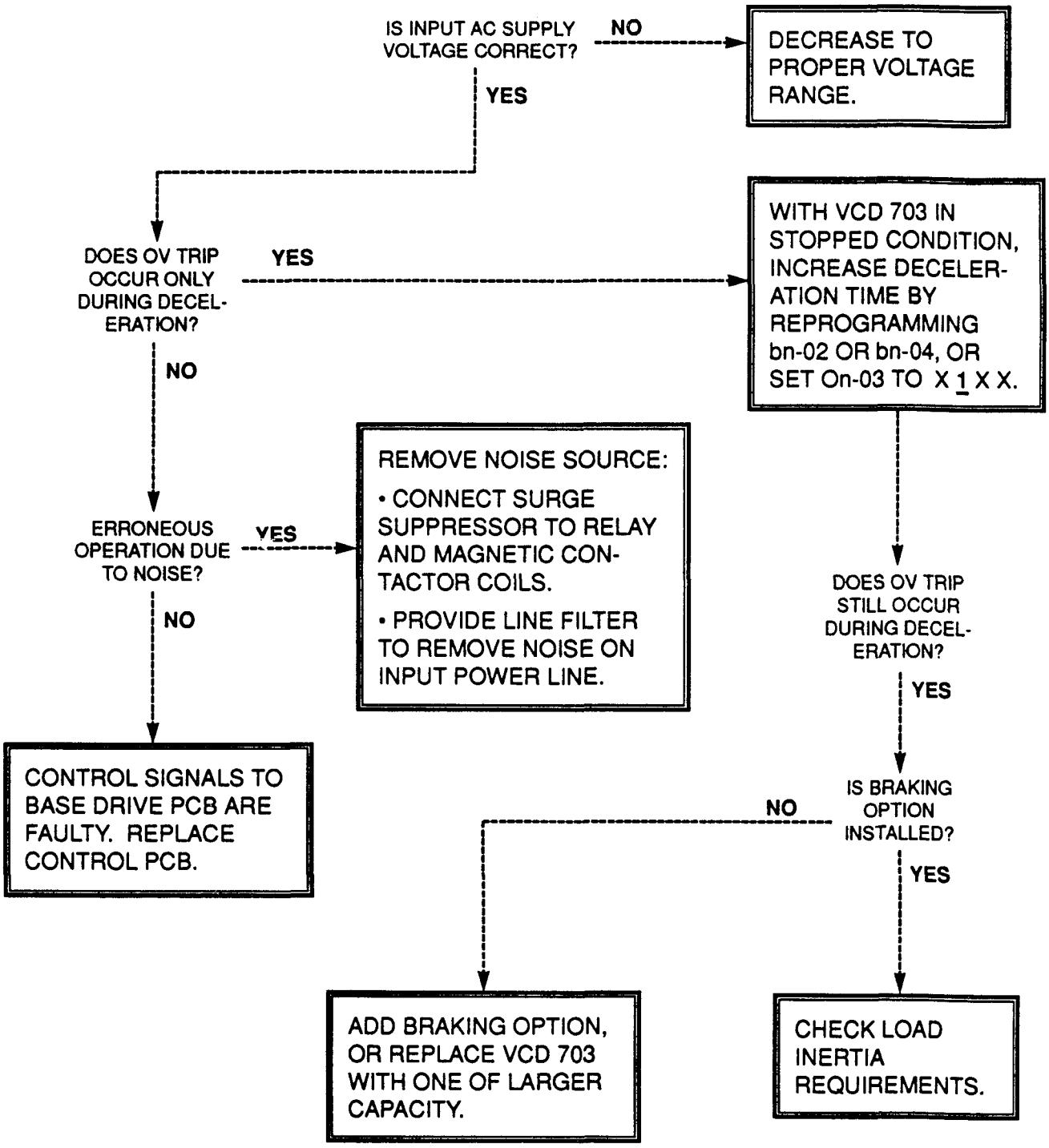
TROUBLESHOOTING CHART 6.4

MOTOR HUNTING

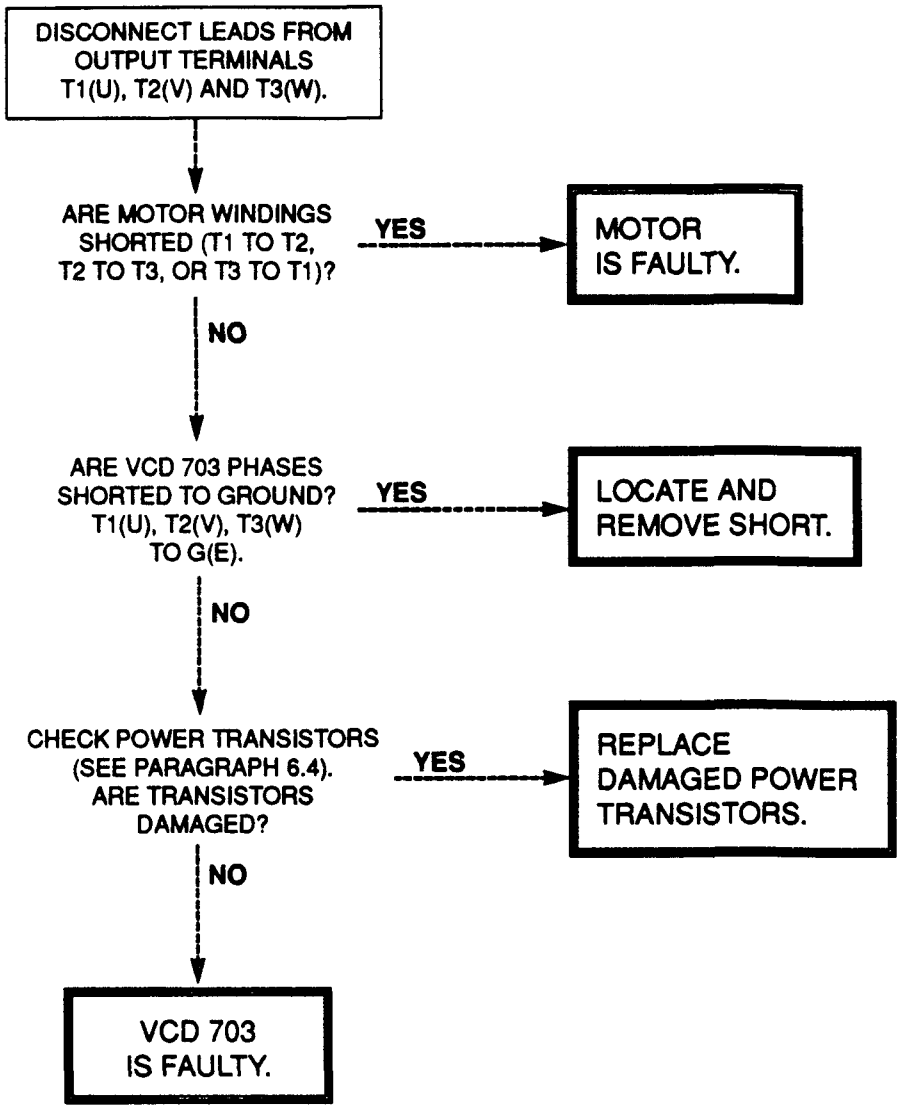


TROUBLESHOOTING CHART 6.5

OVERVOLTAGE (*ou*) FAULT INDICATION



BLOWN FUSE (*FU*) FAULT INDICATION



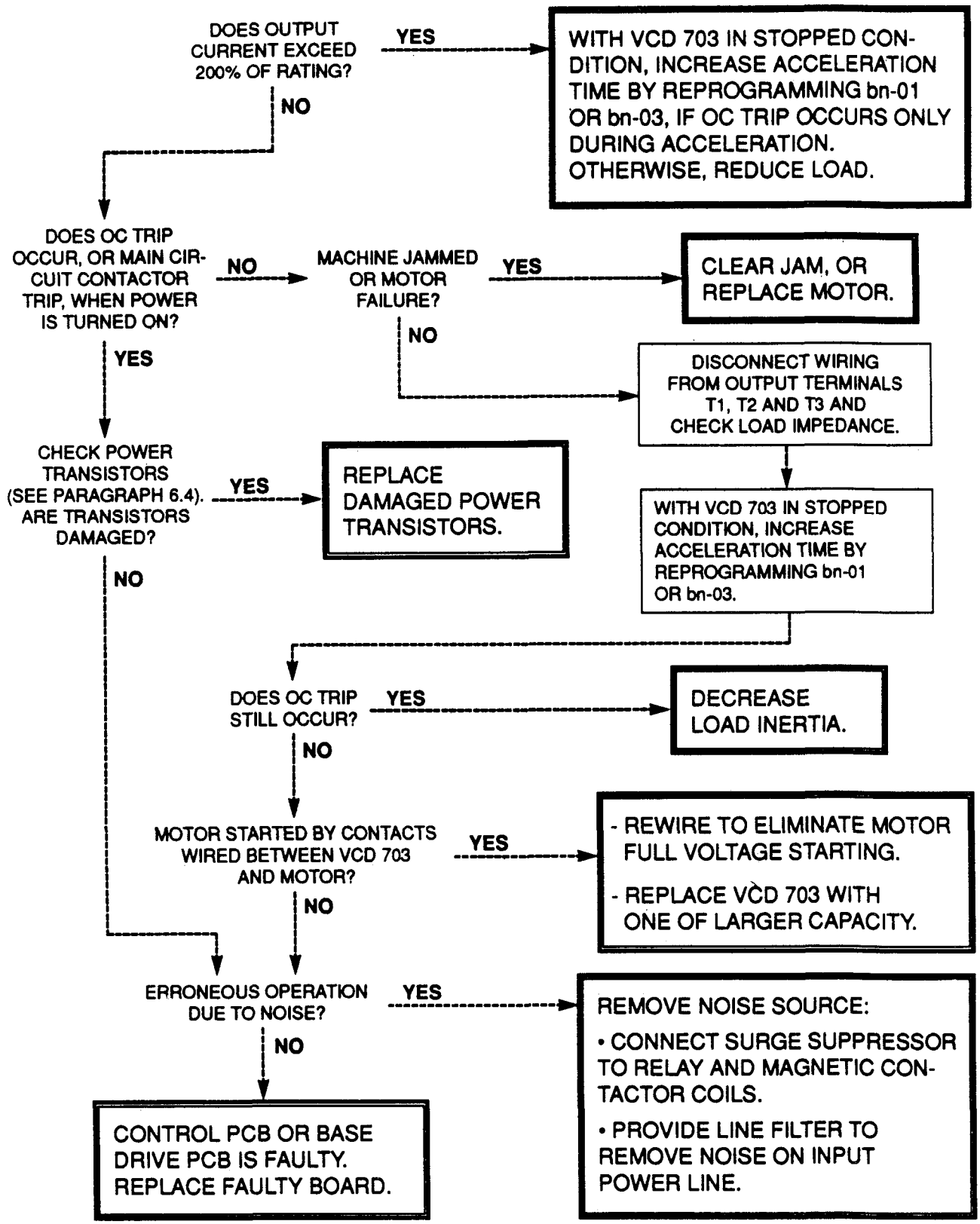
CAUTION

DO NOT REPLACE DC BUS FUSE WITHOUT

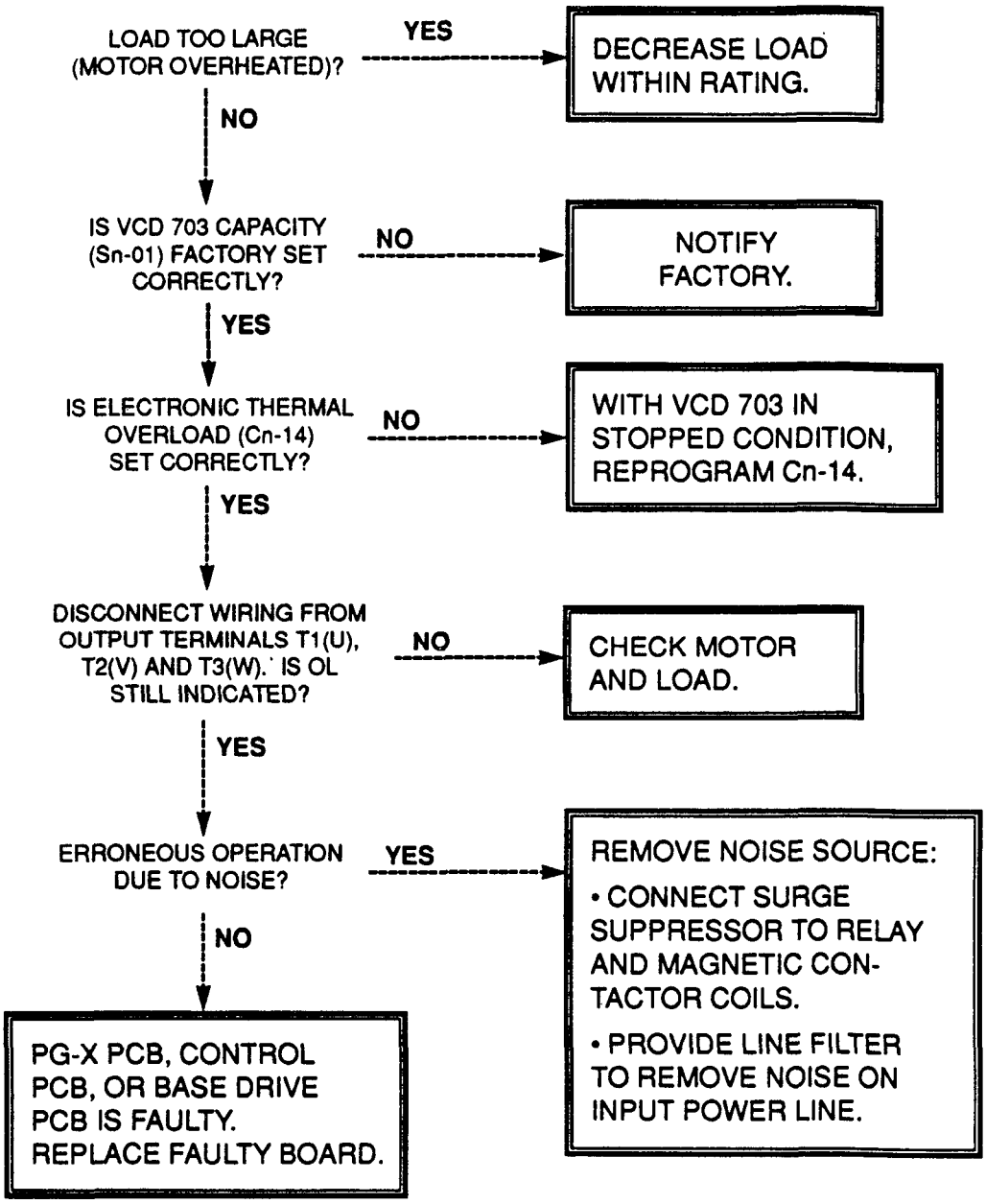
FIRST CHECKING OUTPUT TRANSISTORS.

TROUBLESHOOTING CHART 6.7

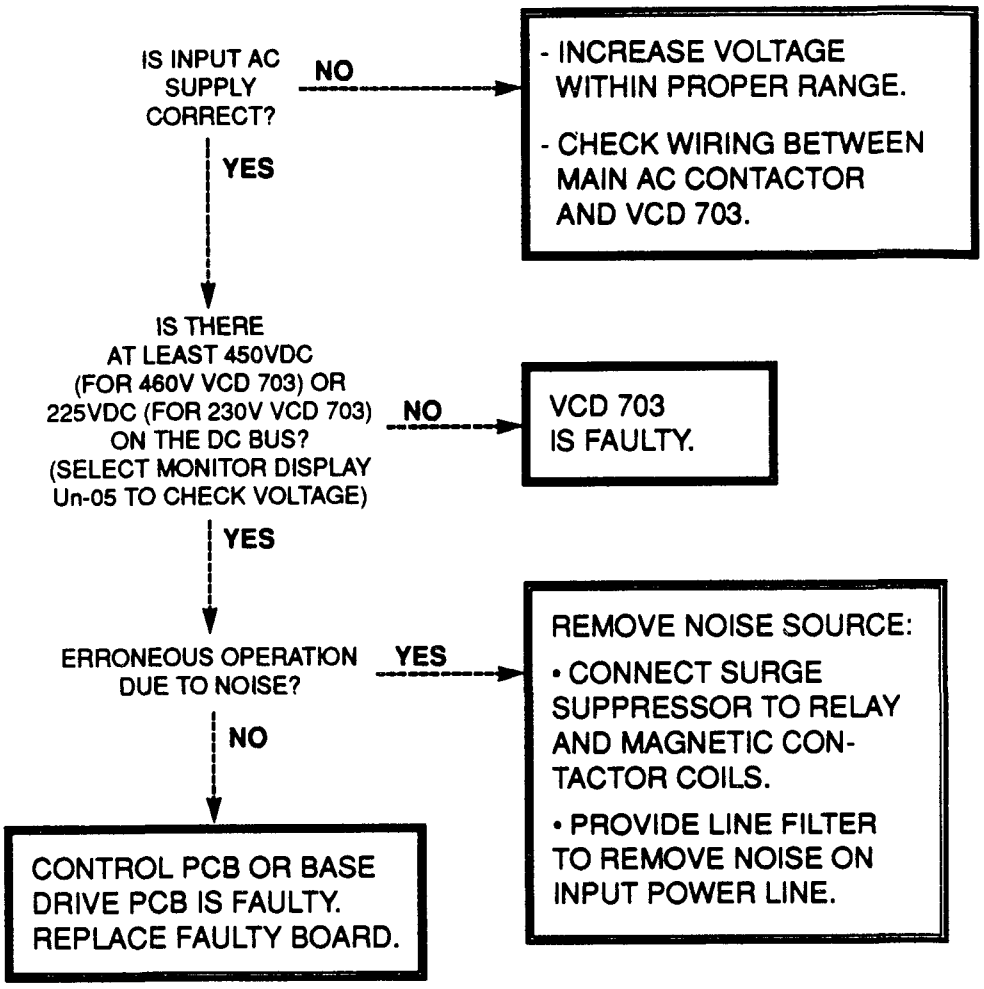
OVERCURRENT (*oC*) FAULT INDICATION



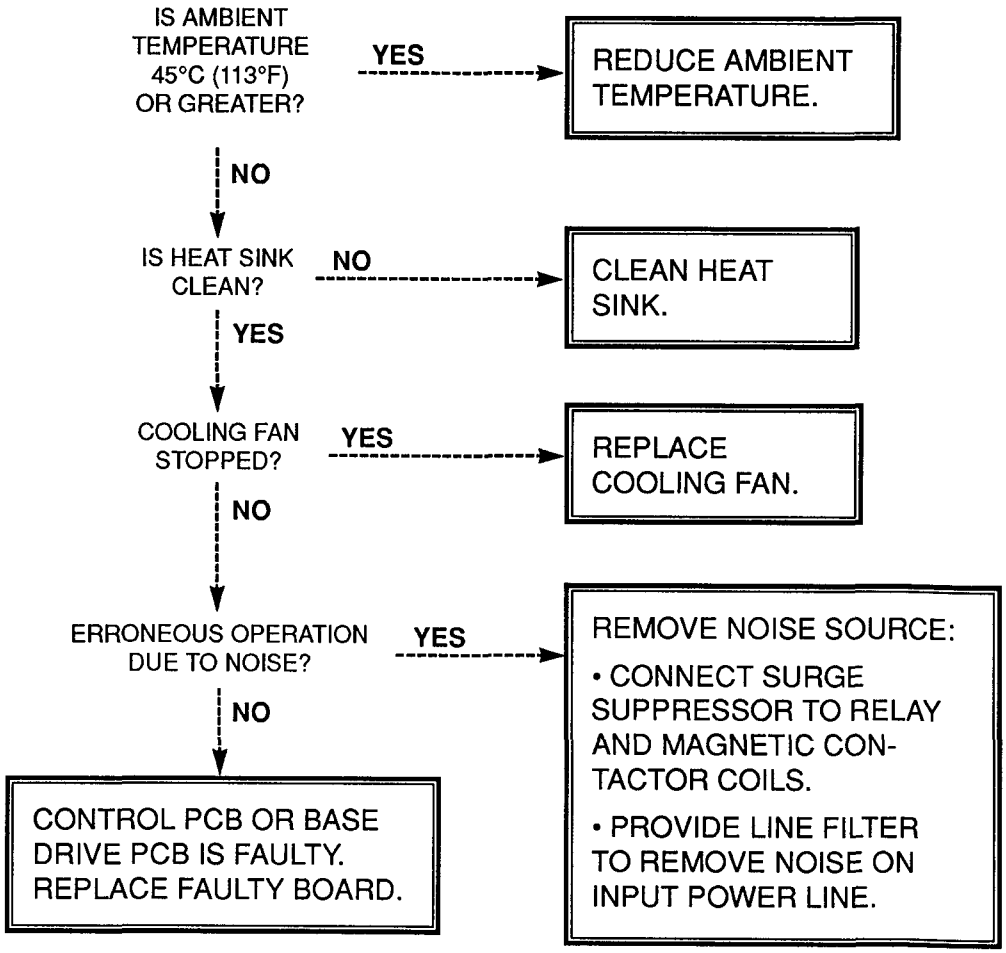
OVERLOAD (*oL*) FAULT INDICATION



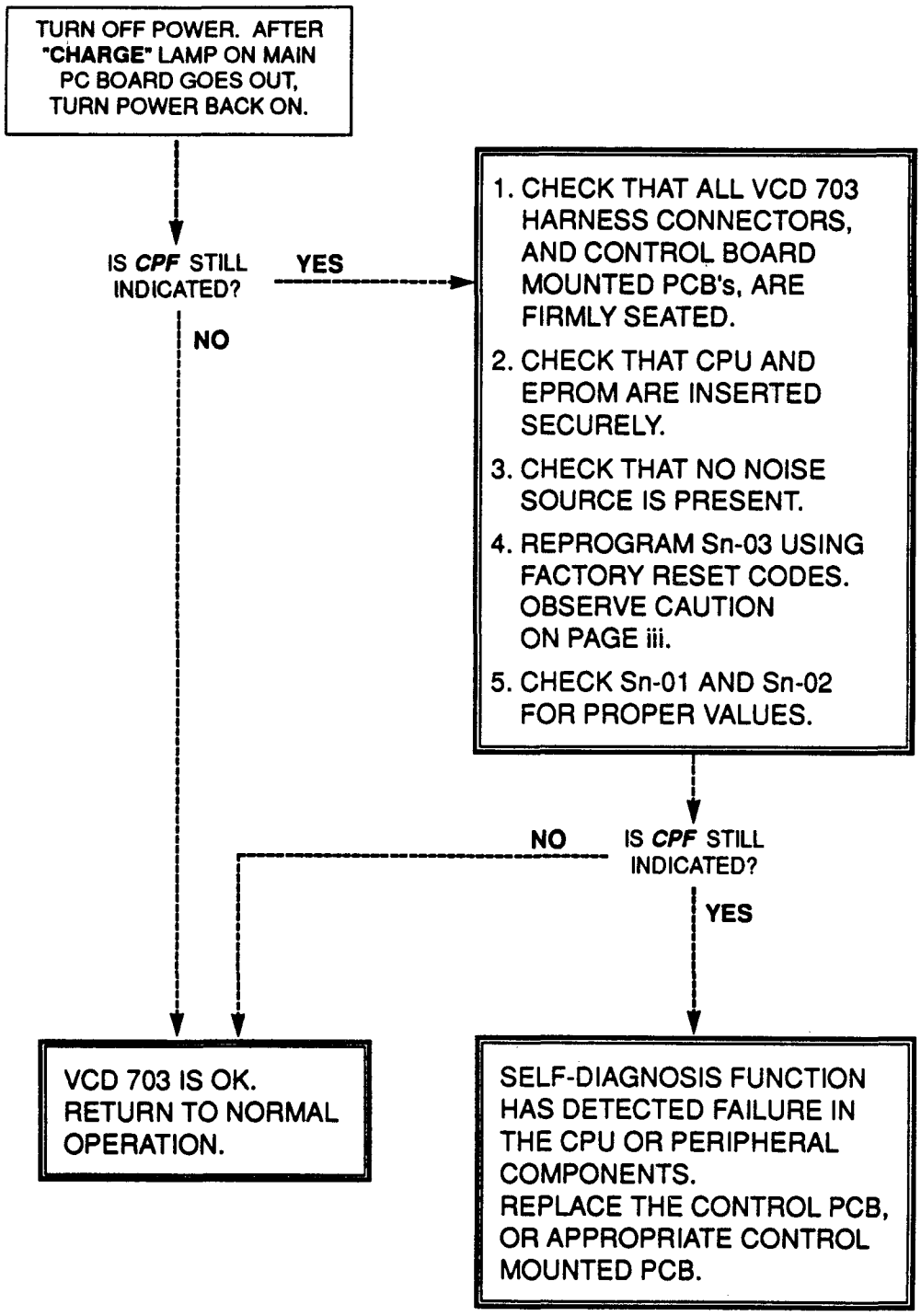
UNDERVOLTAGE (*Uu*) FAULT INDICATION



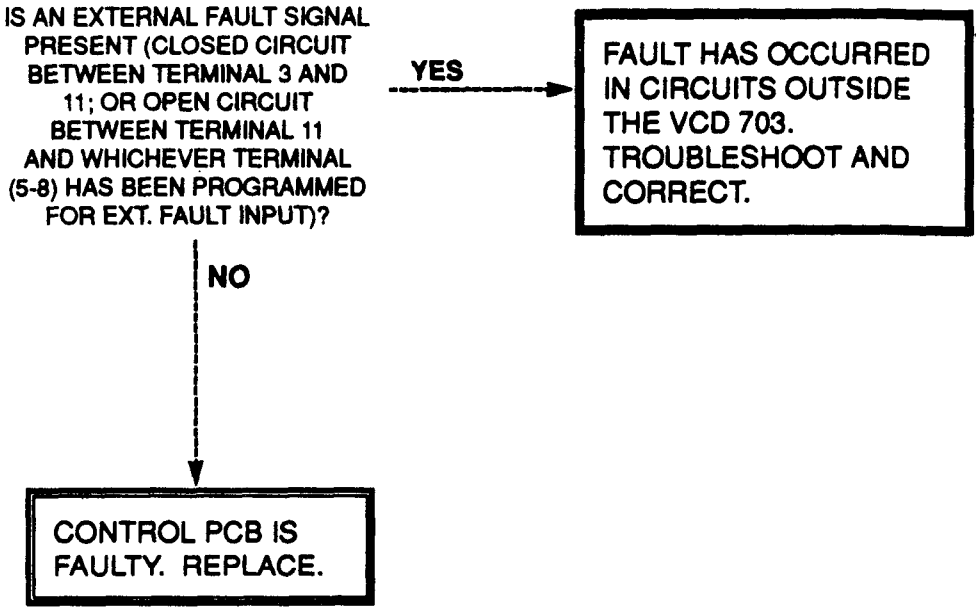
INVERTER OVERHEATED (*oH2*) FAULT INDICATION



CONTROL FUNCTION ERROR (*CPF_ _*) FAULT INDICATION

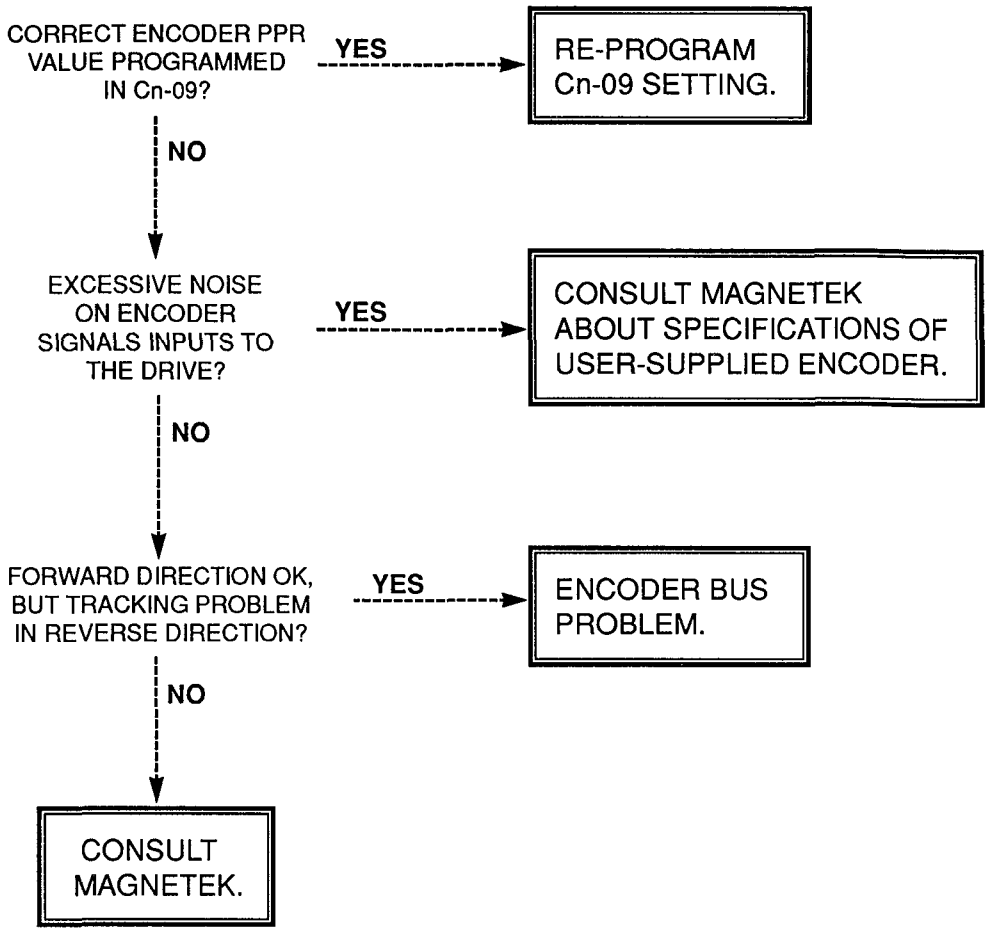


EXTERNAL FAULT (*EF_*) INDICATION

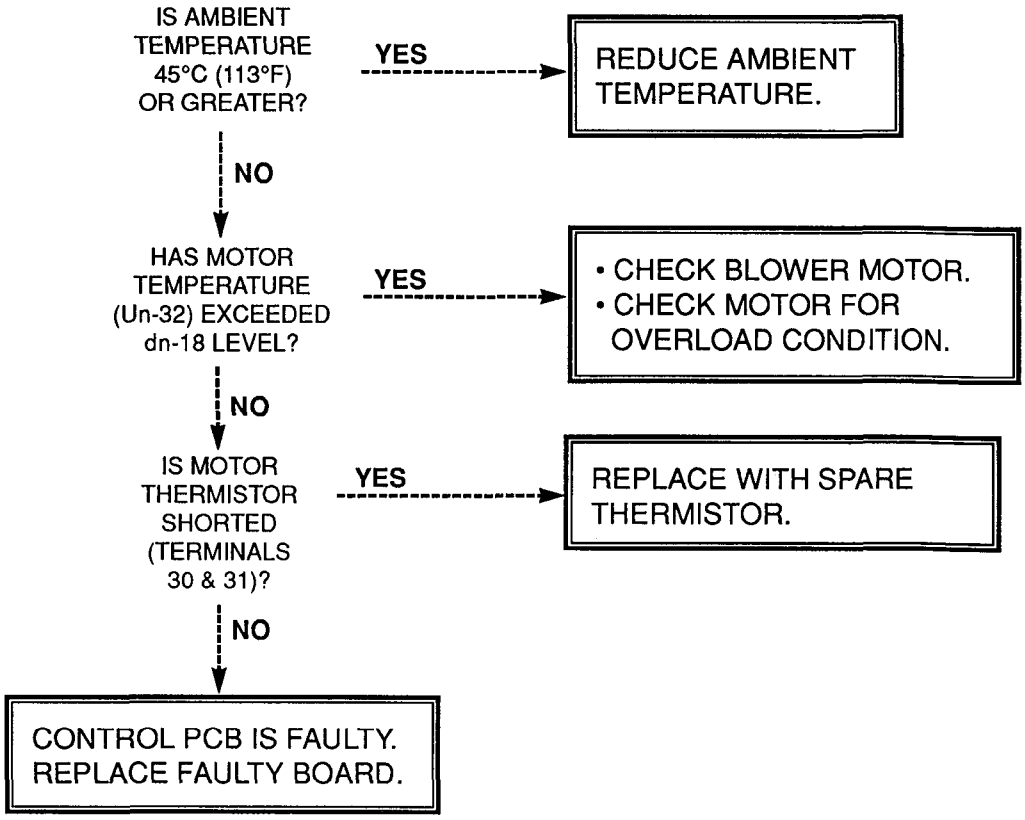


TROUBLESHOOTING CHART 6.13

OVERSPEED (*oS*) INDICATION



MOTOR OVERHEATED (*oH1*) FAULT INDICATION



NOTE

Factory reset code can be used to reset OH1 fault if Control PCB is bad. Make sure settings are recorded before using factory reset.

6.4 DIODE AND TRANSISTOR MODULE RESISTANCE TEST

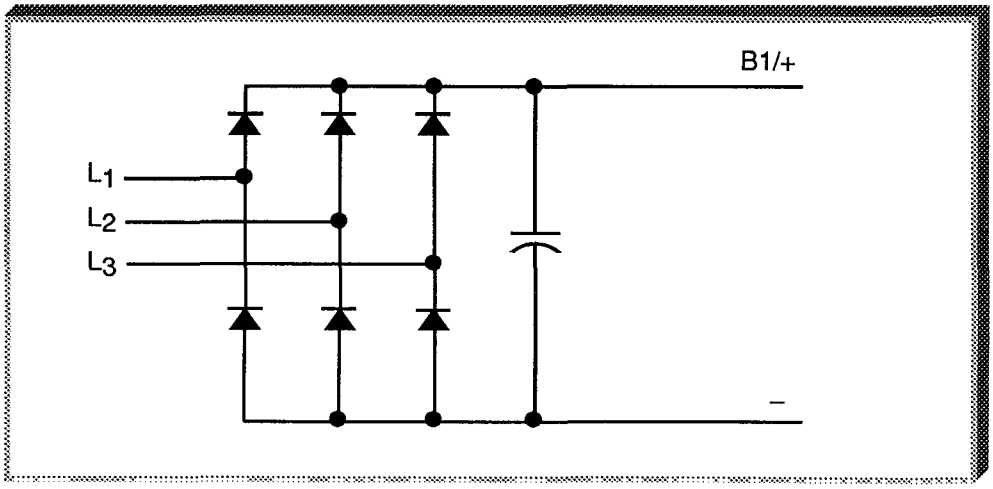
A. DIODE MODULE

Measure the resistance across the module terminals with a volt-ohm meter. Set the meter at the X1 range. The measured resistance should be within the values listed in Table 6-4.

Table 6-4. Diode Module Resistances

+ ON	– ON	NORMAL READING (OHMS)	ABNORMAL READING (OHMS)	+ ON	– ON	NORMAL READING (OHMS)	ABNORMAL READING (OHMS)
L1	B1/+			L1	–		
L2	B1/+			L2	–		LESS
L3	B1/+	2.5 to 50	0 or INFINITE	L3	–	INFINITE	THAN
–	L1	or		B1/+	L1		1M
–	L2	0 25 to 0 7		B1/+	L2		
–	L3	if using		B1/+	L3		
		→ scale					
				B1/+	–	MAGNITUDE OF CAP CHARGE TO INFINITE	0 or INFINITE

RESISTANCE TEST FOR 3Ø CONVERTER MODULES (BRIDGE RECT)



VOM RESISTANCE SCALE R x 1
+ IS THE POSITIVE POLARITY LEAD *
- IS THE NEGATIVE POLARITY LEAD

* THE VOM RED LEAD IS NOT NECESSARILY THE POSITIVE POTENTIAL IN THE RESISTANCE MODE FOR THESE TESTS THE + LEAD REFERS TO THE POSITIVE POTENTIAL MAKE SURE YOU KNOW WHICH POLARITY YOU HAVE ON YOUR VOM

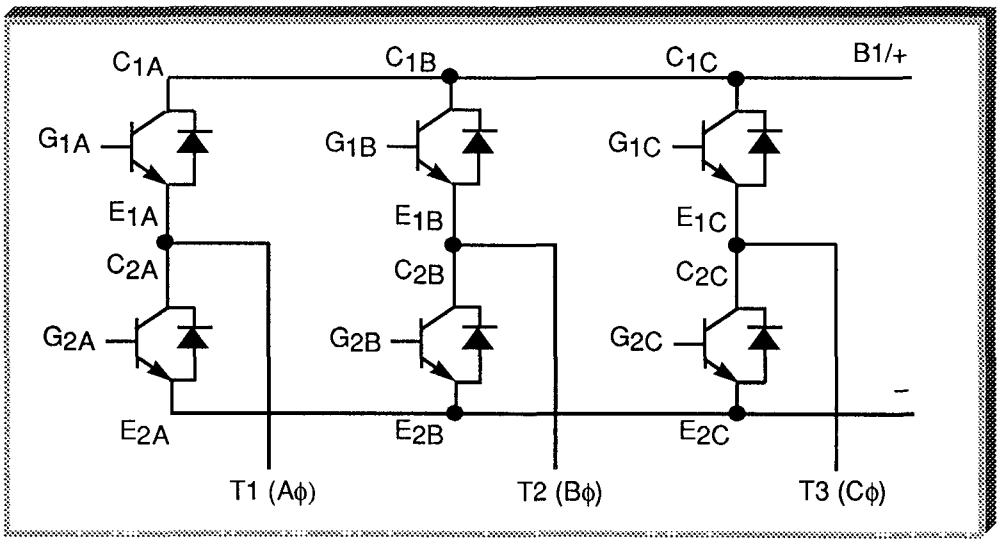
B. TRANSISTOR MODULE

Measure the resistance across the module terminals with a volt-ohm meter. Set the meter to the X1 range. The measured resistance should be within the values listed in Table 6-5.

Table 6-5. Transistor Module Resistances

+ ON	– ON	NORMAL READING (OHMS)	ABNORMAL READING (OHMS)	+ ON	– ON	NORMAL READING (OHMS)	ABNORMAL READING (OHMS)
B1/+	T1			G1A	T1		
B1/+	T2			G1B	T2		
B1/+	T3			G1C	T3		LESS
T1	–	INFINITE	0	G2A	–	INFINITE	THAN
T2	–			G2B	–		1M
T3	–			G2C	–		
T1	B1/+			T1	G1A		
T2	B1/+	2 5 to 50		T2	G1B		LESS
T3	B1/+	or	0 or INFINITE	T3	G1C	INFINITE	THAN
–	T1	0.3 to 0 7		–	G2A		1M
–	T2	if using		–	G2B		
–	T3	→ scale		–	G2C		

RESISTANCE TEST FOR 3Ø TRANSISTOR MODULES



VOM RESISTANCE SCALE R x 1
+ IS THE POSITIVE POLARITY LEAD *
- IS THE NEGATIVE POLARITY LEAD

* THE VOM RED LEAD IS NOT NECESSARILY THE POSITIVE POTENTIAL IN THE RESISTANCE MODE FOR THESE TESTS THE + LEAD REFERS TO THE POSITIVE POTENTIAL. MAKE SURE YOU KNOW WHICH POLARITY YOU HAVE ON YOUR VOM

Appendix 1. SPECIFICATIONS

Table A1-1. Specifications of VCD 703 and VCM

SECTION A. 208/230V

Drive (VCD 703)

General Use	Model VCD703-	A001	A003	A005	A7P5	A010	A015	A020	A025	A030	AL40	AL50
	Capacity HP	1	3	5	7 5	10	15	20	25	30	40	50
	Input Current A (Motor HP)	1	3	5	7.5	10	15	20	25	30	40	50
		5.3	11	18	26	35	53	70	88	106	143	211
	Continuous Rated Current A	4.8	9.6	16	24	32	48	64	80	96	130	160
Circuit Breaker (MCCB) Rating A		10	20	30	50	60	100	100	150	150	225	300
Low Noise Operation *(1)*	Model VCD703-	A001	A003	A005	A7P5	A010	A015	A020	A025	A030	AL40	AL50
	Capacity HP	1	3	5	7.5	10	15	20	25	30	40	50
	Continuous Rated Current *(6)* A	3 84	7.68	12 8	19 2	25 6	38 4	51 2	64	76 8	104	130
Rated Output Voltage		190V (with 230V input)										
Overload Current Rating		150% for one minute *(2)*										
Input Power	Voltage/Frequency	3-Phase 208V, 50Hz 208/230V, 60Hz										
	Allowable Fluctuation V	± 10%										
	Allowable Fluctuation F	± 5%										

Motor (VCM)

Capacity HP (KW)	1 (0.7)	3 (2.2)	5 (3 7)	7.5 (5 5)	10 (7 5)	15 (11)	20 (15)	25 (18 5)	30 (22)	40 (30)	50 (37)
Model VMA___	B001	003	005	7P5	010	015	020	025	030	040	050
Rated Speed rpm	1750 rpm (4-pole, 60Hz)										
Rated Voltage	3-phase 190 VAC										
Speed Control Range	1 1000 (1750 to 1 75 rpm continuous rating, 1 75 to 0 rpm. short time rating)										
Torque Characteristics	1 75 to 1750 rpm: constant torque 1750 to 2100 rpm constant horsepower										
Rated Current A	3 38	9.6	16 0	22 8	29 4	44 0	57 0	69 0	82 0	120	148
Rated Torque lb-ft	3	9	15	22 5	30	45	60	75	90	120	150
Rotor WK^2 $lb\text{-}ft^2$	0.074	0.183	0 264	0 543	0.680	1.253	1 617	3 260	4 050	5.96	7 5
Frame No.	143T	182T	184T	213T	215T	254T	256T	284T	286T	324T	326T

See notes on page A1-4.

Table A1-1. Specifications of VCD 703 and VCM (Continued)

SECTION B1. 380/415/460V; 1-60HP

Drive (VCD 703)

General Use	Model VCD703-	B001	B003	B005	B7P5	B010	B015	B020	B025	B030	B040	B050	BL60
	Capacity HP	1	3	5	7 5	10	15	20	25	30	40	50	60
	Input Motor HP	1	3	5	7.5	10	15	20	25	30	40	50	60
	Current A	2.82	5	9	13	18	26	35	44	53	70	88	106
	Continuous Rated Current A	2 56	4 8	8	12	16	24	32	40	48	64	80	96
Circuit Breaker (MCCB) Rating A		5	10	20	20	30	50	60	80	100	100	150	150
Low Noise Operation *(1)*	Model VCD703-	B001	B003	B005	B7P5	B010	B015	B020	B025	B030	B040	B050	BL60
	Capacity HP	1	3	5	7 5	10	15	20	25	30	40	50	60
	Continuous Rated Current *(6)* A	2 05	3.84	6 4	9 6	12 8	19 2	25 6	32	38.4	51 2	64	76
Rated Output Voltage		380V (with 460V input)											
Overload Current Rating		150% for one minute *(2)*											
Input Power	Voltage/Frequency	3-Phase 380/415/460V, 50/60Hz											
	Allowable Fluctuation V	± 10%											
	Allowable Fluctuation F	± 5%											

Motor (VCM)

Capacity HP (KW)	1 *(5)* (0 7)	3 (2 2)	5 (3 7)	7 5 (5 5)	10 (7 5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)
Model VMB___	001C	003	005	7P5	010	015	020	025	030	040	050	060
Rated Speed rpm	1750 rpm (4-pole, 60Hz)											
Rated Voltage	3-phase 380 VAC											
Speed Control Range	1:1000 (1750 to 1 75 rpm: continuous rating; 1 75 to 0 rpm short time rating)											
Torque Characteristics	1 75 to 1750 rpm constant torque 1750 to 2100 rpm constant horsepower											
Rated Current A	1.65	4 8	8	11 4	14.7	22	28 5	34 5	41	60	74	82
Rated Torque lb-ft	3	9	15	22 5	30	45	60	75	90	120	150	180
Rotor WK^2 lb-ft^2	0.074	0 183	0.264	0 543	0 680	1 253	1 617	3 260	4.050	5 960	7 500	9.340
Frame No.	143T	182T	184T	213T	215T	254T	256T	284T	286T	324T	326T	364T

See notes on page A1-4.

Table A1-1. Specifications of VCD 703 and VCM (Continued)

SECTION B2. 380/415/460V; 75-400HP

Drive (VCD 703)									
General Use	**Model VCD703-**		**BL75**	**BL100**	**BL150**	**BL200**	**B250**	**B300**	**B400**
	Capacity HP		75	100	150	200	250	300	400
	Input Current A	**Motor HP**	75	100	150	200	250	300	400
			141	211	246	330	375	496	663
	Continuous Rated Current A		128	165	224	300	340	450	600
Circuit Breaker (MCCB) Rating A			225	300	400	600	600	800	1000
Low Noise Operation *(1)*	**Model VCD703-**		**BL75**	**BL100**	**BL150**	**BL200**	N/A		
	Capacity HP		75	100	150	200			
	Continuous Rated Current A		102	132	179	240			
Rated Output Voltage			380V (with 460V input)						
Overload Current Rating			150% for one minute *(2)*						
Input Power	**Voltage/Frequency**		3-Phase 380/415/460V, 50/60Hz						
	Allowable Fluctuation	**V**	± 10%						
		F	± 5%						
Motor (VCM)									
Capacity	**HP (KW)**		**75** (55)	**100** (75)	**150** (110)	**200** (160)	**250** (185)	**300** (220)	**400** (300)
Model	**VMB___**		075	100	150	200	250	300	400
Rated Speed	**rpm**		1750 rpm (4-pole, 60Hz)						
Rated Voltage			3-phase 380 VAC						
Speed Control Range			1·1000 (1750 to 1 75 rpm: continuous rating, 1.75 to 0 rpm short time rating)						
Torque Characteristics			1 75 to 1750 rpm· constant torque. 1750 to 2100 rpm· constant horsepower						
Rated Current	**A**		103	142	206	272	338	398	525
Rated Torque	**lb-ft**		225	300	450	600	750	900	1200
Rotor WK^2	**$lb\text{-}ft^2$**		11.77	29	51	69.58	74 22	88.14	97 42
Frame No.			365T	405T	445T	447T	447T	449T	449T

See notes on page A1-4.

Table A1-1. Specifications of VCD 703 and VCM (Continued)

SECTION C. All VCD 703s			
Control Characteristics	Control Method		Digital flux vector, Sine-coded PWM
	Speed Control	Range	1:1000 operation possible even at stall
		Precision	Digital ref.: ± 0.01% (–10 to +40°C, +14 to +140°F) Analog ref.. ± 0 1% (25 ± 10°C, 77 ± 50°F)
	Speed Reference Setting Resolution		Digital Operator reference: 0.01 Hz (12 bits) Analog reference: 0 03 Hz/60Hz (11 bits)
	Auto Speed Reference Signal		±10 VDC (20k Ω), or 4 to 20 mA (250 Ω)
	Accel / Decel Time		0 to 3000 sec (resolution: 0.1 sec.) (Accel / Decel times set independently)
	Torque Limit		Setting range: 0 to 300%. Forward/Reverse set independently
	Selectable Functions		Multi-step speed operation (9 steps max.), S-curve accel/decel, zero speed control, servo lock, arbitrary torque detection, etc.
Protective Functions	Inverter		Overcurrent, overvoltage, cooling fin overheat, undervoltage, cooling fan failure, grounding, etc.
	Motor		Overload, overheat, overspeed
	System		Excessive speed deviation, open-phase detection, continuous operation during momentary power loss (immediate stop at end of programmed ride-thru time, 2 sec max) *(See Note 3)*
Environmental Conditions	Ambient Temperature		–10 to +45°C (+14 to +113°F)
	Storage Temperature *(See Note 4)*		–20 to +60°C (–4 to +140°F)
	Humidity		90% RH (no condensation)
	Vibration		1 G at less than 20 Hz, up to 0 2 G at 20 to 50 Hz.

SECTION D. All VCMs	
Rated speed	1750 rpm (4 poles)
Pulse Generator	1024 ppr
Thermistor	Standard
Load Connection	Direct coupling or belt drive
Insulation Type	Class F
Ambient Temperature	–20 to +40°C (–4 to +104°F)
Location	Indoor

NOTES:

(1) Low noise operation can be selected by setting of Sn-09 : **0**XXX = General Use (low carrier frequency ~ 2 08 kHz); **1**XXX = Low Noise Operation (carrier frequency can be set in Cn-52) See section 5.9a, "LOW NOISE OPERATION"

(2) 100% reference current is Continuous Rated Current for Low Noise Operation or General Use

(3) For all Models of VCD 703 rated 3HP or less (230V or 460V), the standard maximum ride-thru time is 1 sec (1000 msec). The maximum ride-thru time can be extended to 2 sec (2000 msec) by adding an optional external mounting capacitor unit. For units 5HP or larger (230V or 460V), the maximum ride-thru time is 2 sec (2000 msec)

(4) Temperature during shipping. Storing in this temperature for a long period may deteriorate main the main circuit capacitor.

(5) 1HP motor VMB001 is a 190/380V inverter-duty foot mount with C-Face.

(6) The value in this table is the rated curent with the maximum de-rating applied (80%). The actual de-rating may be less depending on the carrier frequency (see section 5 9a)

Appendix 2. VCD 703 CAPACITY (Sn-01) / MOTOR CONSTANTS (dn-XX)

System constant Sn-01 (VCD 703 Capacity Selection) is factory preset per the input voltage and output current ratings of the VCD 703. Table A2-1 identifies the set value, per Model Number. If the Control PCB is replaced, the new board MUST be set based on Table A2-1 criteria.

Table A2-1. VCD 703 Capacity

Voltage Rating	Model No. VCD703-	Sn-01 Factory Setting	Continuous Rated Current (A) *(See Note 1)*	Momentary Power Loss Ride-thru Time (Cn-19) Factory Setting *(See Note 2)*
	A001	01	4.8	1.00
	A003	03	9.6	1.00
	A005	04	16	2.00
2	A7P5	05	24	2.00
3	A010	06	32	2.00
0	A015	07	48	2.00
	A020	08	64	2.00
	A025	09	80	2.00
	A030	0A	96	2.00
	AL40	0b	128	2.00
	AL50	0C	160	2.00
	B001	21	2.56	1.00
	B003	23	4.8	1.00
	B005	24	8	2.00
	B7P5	25	12	2.00
	B010	26	16	2.00
	B015	27	24	2.00
4	B020	28	32	2.00
6	B025	29	40	2.00
0	B030	2A	48	2.00
	B040	2b	64	2.00
	B050	2C	80	2.00
	BL60	2d	96	2.00
	BL75	2E	128	2.00
	BL100	2F	165	2.00
	BL150	31	224	2.00
	BL200	33	300	2.00
	B250	34	340	2.00
	B300	35	450	2.00
	B400	36	600	2.00

NOTES:

1. The listed continuous output current value is for General Use; when Sn-09 is programmed to select Low Noise Operation, the continuous rated current is automatically reduced according to Cn-52 and the de-rating graphs in Section 5.9a.
2. Cn-19 is automatically set to this value when Sn-01 setting is entered.

System constant Sn-02 (Motor Selection) is factory preset for the VCM motor included in the VCD/VCM package. Any setting other than " FFF " automatically sets all motor constants (dn-XX) in the VCD 703; see Table A2-2 for set values.

When Sn-02 is set to " FFF ", the dn-XX constants revert to default values listed in Table 5-7. They must then be checked individually against the specifics of the motor being used, and changed as required. These settings should be recorded and saved; if the Control PCB is replaced, the setting values must be programmed into the dn-XX constants on the new board.

Table A2-2. dn-XX Factory Set Values

Vector Motor Rated Input	HP	Model No. VM____	Sn-02 Fact. Set	dn-__ Constant Set Value																
				01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
	1	B001C	002	1750	1750	4	175	3 01	1.69	50.0	5.3	8.77	1 9	3.9	188	1.20	0.00	30	0.50	0.75	155
	3	A003	003	1750	1750	4	175	8 03	1 57	51.6	5.1	8.77	6.7	0.4	139	1.20	0.00	30	0.50	0.75	155
	5	A005	004	1750	1750	4	175	13.34	1.37	56.1	4.0	8.39	6.6	0.3	140	1.20	0.00	30	0.50	0.75	155
	7.5	A7P5	005	1750	1750	4	175	19.94	1.83	37.4	3 3	8.05	3.4	0.6	143	1.20	0.00	30	0.50	0.75	155
	10	A010	006	1750	1750	4	175	26.24	1 67	33 5	2.7	6 62	3 2	0.7	171	1.20	0.00	30	0.50	0.75	155
190V	15	A015	007	1750	1750	4	175	39.07	1.33	28.4	3.3	5.84	1 4	1.0	212	1.20	0 00	30	0.50	0.75	155
	20	A020	008	1750	1750	4	175	52 11	1 17	24 7	2.9	5.86	1.4	0.8	268	1 20	0.00	30	0.50	0.75	155
	25	A025	009	1750	1750	4	180	63.32	1.03	29.1	2.1	5 84	1.5	1.0	264	1.20	0.00	30	0.50	0.75	155
	30	A030	00A	1750	1750	4	180	75.61	1.13	27.2	1 9	5 32	1.3	0.8	255	1.20	0.00	30	0.50	0.75	155
	40	AL40	00b	1750	1750	4	175	107.97	0.67	34.6	1.5	9.68	1.3	1.0	154	1.20	0.00	30	0.50	0.75	155
	50	AL50	00C	1750	1750	4	175	133.68	0.67	30.9	1.4	8 63	1 2	0.8	165	1.20	0 00	30	0.50	0.75	155
	3	A003	103	1750	1750	4	210	6 80	1.37	61.0	4.7	9.86	7 4	0 4	116	1.20	0.00	30	0.50	0.75	155
	5	A005	104	1750	1750	4	215	11.00	1.23	71.2	3.6	9.86	7.6	0.3	118	1.20	0.00	30	0 50	0.75	155
	7.5	A7P5	105	1750	1750	4	215	16 26	1 67	44 2	3 0	8 21	3.9	0.6	135	1.20	0.00	30	0.50	0.75	155
	10	A010	106	1750	1750	4	215	21.45	1.20	39.8	2.4	7.05	3.7	0.7	162	1.20	0.00	30	0.50	0.75	155
230V	15	A015	107	1750	1750	4	215	31.92	1 20	34.1	2 9	6 23	1 6	1 0	176	1.20	0.00	30	0 50	0.75	155
	20	A020	108	1750	1750	4	215	42.55	1 07	29 3	2 5	6.20	1.5	0.8	247	1.20	0.00	30	0.50	0.75	155
	25	A025	109	1750	1750	4	215	53.16	0.93	33.1	1 9	6.21	1.6	1.0	240	1.20	0.00	30	0.50	0.75	155
	30	A030	10A	1750	1750	4	215	63 54	1 00	30 5	1 8	5 73	1 4	0 8	263	1.20	0.00	30	0.50	0.75	155
	40	AL40	10b	1750	1750	4	215	85 36	0 60	28 1	1 3	6 52	1.6	1 0	230	1.20	0 00	30	0.50	0 75	155
	50	AL50	10C	1750	1750	4	215	109 04	0.60	36 7	1 2	8 90	1.4	0.8	163	1.20	0.00	30	0.50	0.75	155

NOTES:

** Consult MagneTek.

(1) Recommended motor winding for a MagneTek supplied motor is 190V for 230V drives, and 380V for 460V drives. Factory settings of Sn-02 for a VCD/VCM package will be based on the 190/380V rated input (motor) constant values.

(2) For definition and setting range of each dn-XX constant, refer to Table 5-7.

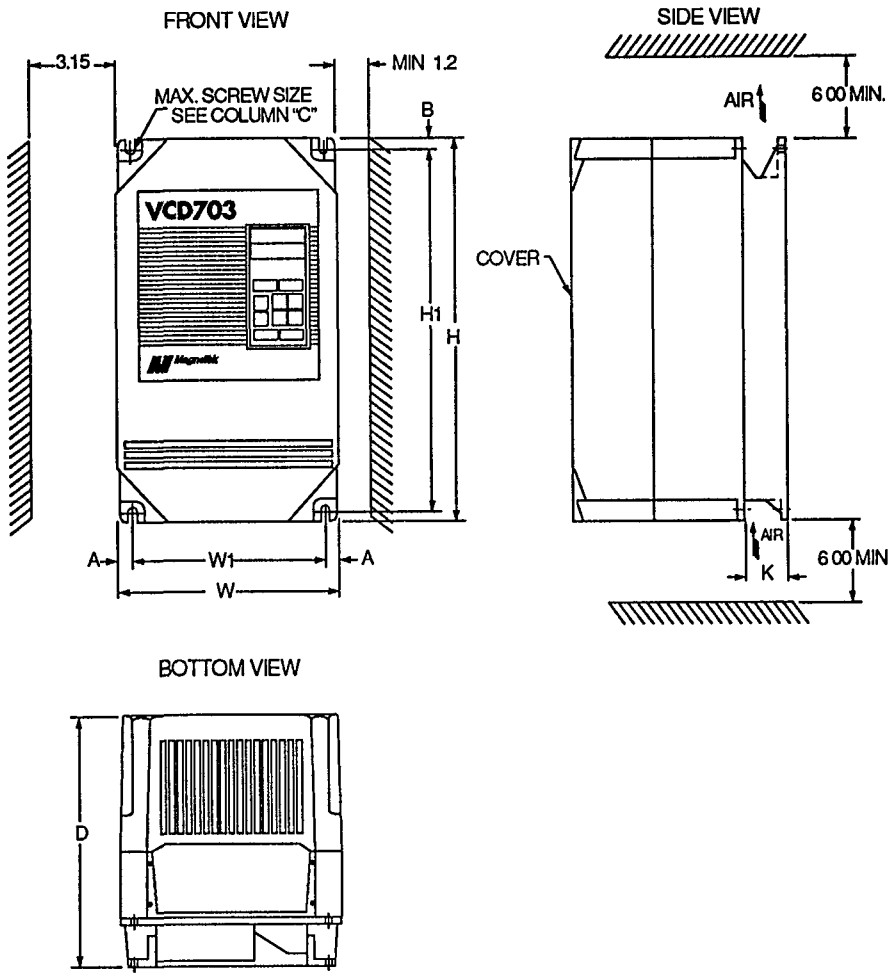
Table A2-2. dn-XX Factory Set Values - Continued

Vector Motor Rated Input	HP	Model No. VM____	Sn-02 Fact. Set	dn-__ Constant Set Value																
				01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
	1	B001C	002	1750	1750	4	350	1.50	1 69	50.0	5.3	8 77	1.9	3 9	188	1 20	0 00	30	0 50	0 75	155
	3	B003	003	1750	1750	4	350	4.02	1.30	51.6	5.1	8.77	6.7	0 4	139	1 20	0 00	30	0 50	0 75	155
	5	B005	004	1750	1750	4	355	6.58	1.37	57 7	3.9	8 39	6 7	0 3	140	1 20	0 00	30	0 50	0.75	155
	7.5	B7P5	005	1750	1750	4	350	9.97	1.83	37 4	3.3	8.05	3.4	0 6	143	1 20	0.00	30	0.50	0.75	155
	10	B010	006	1750	1750	4	355	12 94	1.46	37 2	3.2	6.62	2 2	1.8	257	1 20	0.00	30	0.48	0.72	155
	15	B015	007	1750	1750	4	350	19.54	1.33	28.4	3.3	5.84	1 4	1.0	212	1 20	0.00	30	0.50	0.75	155
	20	B020	008	1750	1750	4	355	25.69	1 17	25.4	2.8	5.86	1.4	0.8	268	1 20	0.00	30	0.50	0.75	155
	25	B025	009	1750	1750	4	360	31 66	1.03	29.1	2.1	5 84	1.5	1.0	264	1 20	0.00	30	0.50	0.75	155
	30	B030	00A	1750	1750	4	360	37.80	1 13	27 2	1 9	5.32	1.3	0 8	255	1.20	0 00	30	0 50	0 75	155
380V	40	B040	00b	1750	1750	4	355	53 23	0 67	35.6	1 4	9 68	1 3	1.0	154	1 20	0.00	30	0 50	0.75	155
	50	B050	00C	1750	1750	4	355	65 90	0.67	31.8	1.3	8 63	1.3	0.8	165	1 20	0 00	30	0 50	0.75	155
	60	BL60	00d	1750	1750	4	360	75.16	0.80	26 0	1 3	4.70	1 2	1 2	309	1.20	0 00	30	0 50	0 75	155
	75	BL75	00E	1750	1750	4	365	89 7	0 83	25 3	1 3	3 11	1 1	99	284	1 20	0 00	30	0 50	0.75	155
	100	BL100	00F	1750	1750	4	363	123.8	0.57	26 3	.87	3.81	1 0	49	231	1 20	0 00	30	0 50	0 75	155
	150	BL150	010	1750	1750	4	365	180 3	0.50	29.0	1.04	3 64	94	37	274	1 20	0 00	30	0.50	0.75	155
	200	BL200	011	1750	1750	4	365	245 2	0.53	25.8	1.06	3.34	.88	.27	301	1 20	0.00	30	0 50	0 75	155
	250	B250	Consult MagneTek																		
	300	B300																			
	400	B400																			
	3	B003	103	1750	1750	4	425	3 44	1 37	62 5	4 6	9 86	7.6	0 4	116	1.20	0 00	30	0 50	0 75	155
	5	B005	104	1750	1750	4	430	5.50	1 33	71.2	3.6	9 86	7 6	0.3	118	1 20	0.00	30	0.50	0 75	155
	7 5	B7P5	105	1750	1750	4	425	8.25	1.67	43.1	3 0	8.49	3 8	0 6	135	1.20	0 00	30	0 50	0 75	155
	10	B010	106	1750	1750	4	430	11 02	1.41	41 2	2 6	7.05	0 8	2 7	306	1 20	0.00	30	0 47	0 71	155
	15	B015	107	1750	1750	4	425	16 15	1.20	33 3	3.0	6 23	1 6	1 0	176	1.20	0.00	30	0.50	0 75	155
	20	B020	108	1750	1750	4	430	21.28	1 07	29 3	2 5	6.20	1.5	0 8	247	1.20	0 00	30	0.50	0 75	155
	25	B025	109	1750	1750	4	435	26 29	0 93	33 9	1.9	6 21	1 7	1 0	240	1 20	0 00	30	0 50	0 75	155
	30	B030	10A	1750	1750	4	435	31 41	1 00	31 2	1.7	5 73	1 5	0.8	263	1 20	0.00	30	0.50	0 75	155
460V	40	B040	10b	1750	1750	4	435	46.5	0.60	28 8	1 2	6 52	1 6	1 0	230	1 20	0 00	30	0 50	0.75	155
	50	B050	10C	1750	1750	4	435	55 89	0.74	37 6	1.2	8 86	1 4	0 8	827	1 20	0 00	30	0 50	0.75	155
	60	BL60	10d	1750	1750	4	440	61.60	0.70	27 3	2 8	6.18	1 7	10.0	679	1.20	0 00	30	0 50	0 75	155
	75	BL75	10E	1750	1750	4	440	77 5	0 96	25.7	1 6	3.22	0 0	2 5	827	1 20	0 00	30	0 50	0 75	155
	100	BL100	10F	1750	1750	4	440	102.2	0 50	30.4	80	3 85	1 23	49	234	1 20	0 00	30	0 50	0 75	155
	150	BL150	110	1750	1750	4	445	148 1	0.47	32 9	.94	3 72	1 03	.37	283	1 20	0 00	30	0.50	0 75	155
	200	BL200	111	1750	1750	4	440	203.5	0 47	26 57	98	3 39	93	27	284	1.20	0 00	30	0 50	0 75	155
	250	B250	Consult MagneTek																		
	300	B300																			
	400	B400																			

See notes on page A2-2.

Appendix 3. VCD 703 DRIVE & VCM MOTOR DIMENSIONS

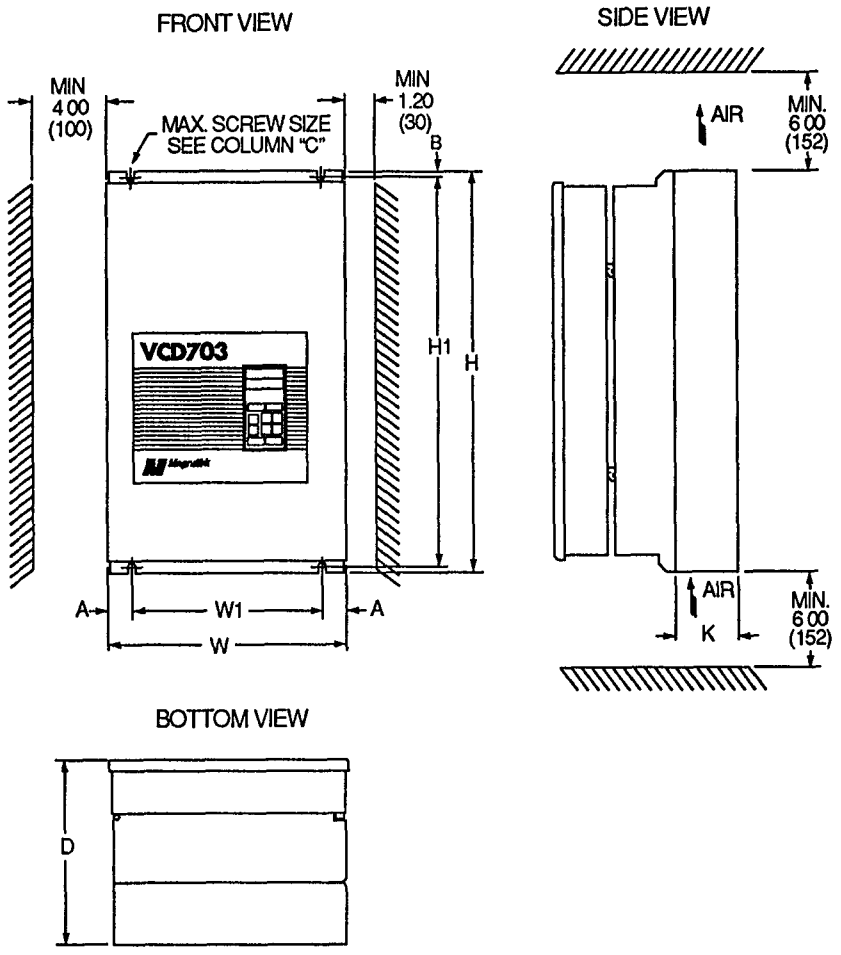
VCD 703 Standard Protected Chassis (Sheet 1 of 3)



INPUT	HP (kW)	ENCLOSURE DIMENSIONS IN INCHES (mm)							MTG HOLE DIMENSIONS IN INCHES (mm)		WEIGHT LBS. (KG) (1)
		H	W	D	A	B	C	K	H1	W1	
208 / 230V	1 (0.7)	11.97 (304)	8.05 (204)	7.48 (190)	.48 (12)	.39 (10)	1/4-20 (M6)	1.57 (40)	11.22 (285)	7.09 (180)	11 (5)
	3 (2.2) 5 (3.7)	11.97 (304)	8.05 (204)	8.86 (225)	.48 (12)	.39 (10)	1/4-20 (M6)	1.57 (40)	11.22 (285)	7.09 (180)	16 (7)
	7.5 (5.5) 10 (7.5)	13.94 (354)	8.05 (204)	10.04 (255)	.48 (12)	.39 (10)	1/4-20 (M6)	1.57 (40)	13.19 (335)	7.09 (180)	22 (10)
380 / 415 / 460V	1 (0.7) 3 (2.2)	13.94 (354)	8.05 (204)	8.66 (220)	.48 (12)	.39 (10)	1/4-20 (M6)	1.57 (40)	13.19 (335)	7.09 (180)	20 (9)
	5 (3.7) 7.5 (5.5) 10 (7.5)	13.94 (354)	8.05 (204)	10.04 (255)	.48 (12)	.39 (10)	1/4-20 (M6)	1 57 (40)	13.19 (335)	7.09 (180)	22 (10)

(1) Shipping weight will be greater due to packaging materials.

VCD 703 Standard Protected Chassis (Sheet 2 of 3)



INPUT	HP (kW)	ENCLOSURE DIMENSIONS IN INCHES (mm)							MTG HOLE DIM. IN INCHES (mm)		WEIGHT LBS. (KG) (1)
		H	W	D	A	B	C	K	H1	W1	
208 / 230V	15 (11)	19.69 (500)	9.84 (250)	10.04 (255)	.96 (25)	.30 (7.5)	1/4 (M6)	4.11 (104)	19.09 (485)	7.87 (200)	47 (21)
	20 (15)	21 65 (550)	12 80 (325)	9.65 (245)	96 (25)	30 (7 5)	1/4 (M6)	3 37 (86)	21 06 (535)	10 83 (275)	60 (27)
	25 (18)			10 04 (255)							71 (32)
	30 (22)										
	40 (30) Low Noise 50 (37) Low Noise	27 36 (695)	16 73 (425)	13 78 (350)	2 07 (52)	29 (7 4)	7/16 (M10)	4 30 (109)	26 78 (670)	12 60 (320)	141 (64)

(1) Shipping weight will be greater due to packaging materials.

(For dimensions of 380/415/460V 15HP and above, see page A3-2a)

VCD 703 Standard Protected Chassis (Sheet 3 of 3)

(See dimension views on page A3-2)

INPUT	HP (kW)	ENCLOSURE DIMENSIONS IN INCHES (mm)							MTG HOLE DIM. IN INCHES (mm)		WEIGHT LBS. (KG) (1)
		H	W	D	A	B	C	K	H1	W1	
380 / 415 / 460V	15 (11) 20 (15)	19 69 (500)	9 84 (250)	10 04 (255)	96 (25)	30 (7 5)	1/4 (M6)	2 58 (66)	19 09 (485)	7.87 (200)	49 (22)
	25 (18) 30 (22)	21.65 (550)	12 80 (325)	10 04 (255)	1 19 (30)	30 (7 5)	1/4 (M6)	3 37 (86)	21 06 (535)	10 43 (265)	71 (32)
	40 (30) 50 (37)	28 54 (725)	13 78 (350)	11 02 (280)	1 97 (50)	30 (7 5)	3/8 (M8)	4 14 (105)	27 76 (705)	9 84 (250)	100 (45)
	60 (45) Low Noise	36 42 (925)	19 69 (500)	11 02 (280)	1 97 (50)	50 (12 7)	7/16 (M10)	5 06 (129)	35 43 (900)	15 75 (400)	165 (75)
	75 (55) Low Noise	32 28 (820)	17 91 (455)	13 78 (350)	2 07 (52 5)	49 (12 5)	7/16 (M10)	5 06 (129)	31 30 (795)	13 78 (350)	192 (87)
	100 (75) Low Noise	32 28 (820)	17 91 (455)	13 78 (350)	2 07 (52 5)	49 (12 5)	7/16 (M10)	5 06 (129)	31 30 (795)	13 78 (350)	192 (87)
	150 (110) Low Noise	36 42 (925)	37 40 (950)	13 78 (350)	2 56 (65)	59 (15)	7/16 (M10)	5 06 (129)	35 24 (895)	17 52 (445)	293 (133)
	200 (160) Low Noise	36 42 (925)	22 64 (575)	15 75 (400)	2 56 (65)	.59 (15)	1/2 (M12)	5 06 (129)	35.24 (895)	17 52 (445)	324 (147)
	250 (185) 300 (220)	57 09 (1450)	37 40 (950)	17 12 (435)	3 94 (100)	.98 (25)	1/2 (M12)	4 05 (103)	55 12 (1400)	29 53 (750)	792 (360)
	400 (300)	63 00 (1600)	37 80 (960)	17 72 (450)	4 13 (105)	98 (25)	1/2 (M12)	4 05 (103)	61 02 (1550)	29 53 (750)	924 (420)

(1) Shipping weight will be greater due to packaging materials.

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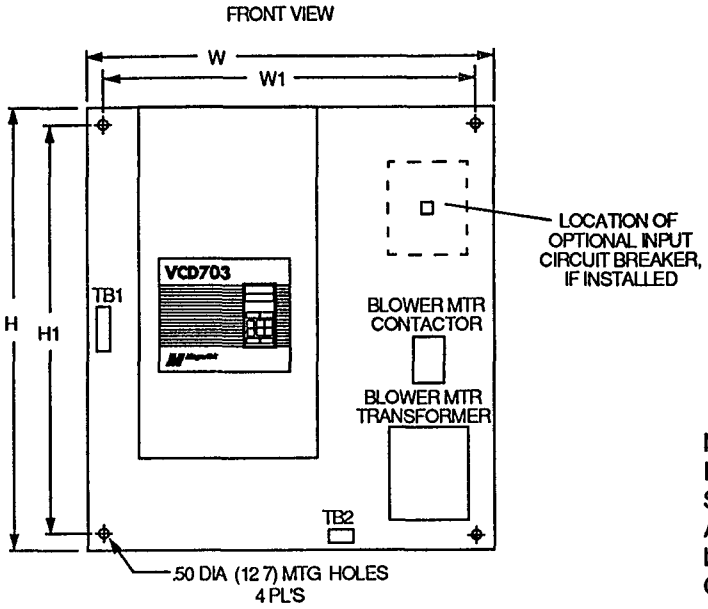
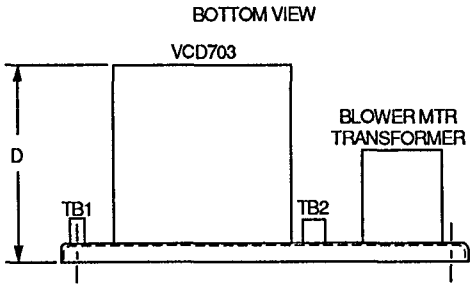
VCD 703 Factory Mounted on Open Panel



NOTE: ILLUSTRATION SHOWS APPROXIMATE LOCATION OF COMPONENTS.

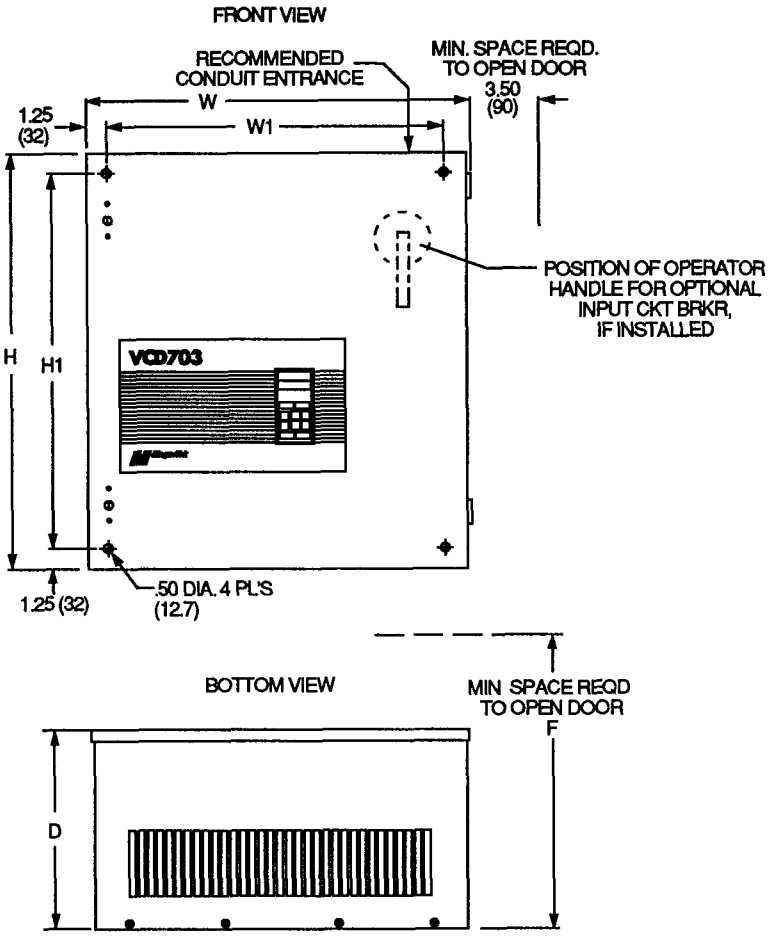


INPUT	HP (kW)	ENCLOSURE DIMENSIONS IN INCHES (mm)			MOUNTING HOLE DIMENSIONS IN INCHES (mm)		WEIGHT LBS. (KG) *(1)*
		H	W	D	H1	W1	
208 / 230V or 380 / 415 / 460V	1 (0.7) thru 10 (7.5)	14 00 (355)	18 50 (470)	11 00 (279)	12 00 (305)	16.50 (419)	42 (19)
	15 (11) thru 30 (22)	25 00 (635)	23 00 (584)	12 00 (305)	23 00 (584)	21.00 (533)	135 (61)
380 / 415 / 460V	40 (30) 60 (45)	32 00 (813)	23 00 (584)	12 00 (305)	30 00 (762)	21 00 (533)	170 (77)

(1) Shipping weight will be greater due to packaging materials.

VCD 703 Factory Mounted in NEMA 1 Wall Mount Enclosure

NOTE:
IN ORDER TO ACHIEVE ADEQUATE COOLING, THE ENCLOSURE MUST BE POSITIONED TO ALLOW A MINIMUM OF FREE AIR SPACE; TOP AND BOTTOM - 6 INCHES (150 MM), LEFT SIDE - 1 INCH (25MM).



INPUT	HP (kW)	ENCLOSURE DIMENSIONS IN INCHES (mm)				MOUNTING HOLE DIMENSIONS IN INCHES (mm)		WEIGHT LBS. (KG) (1)
		H	W	D	F	H1	W1	
208 / 230V or 380 / 415 / 460V	1 (0.7) (2) thru 10 (7.5)	14 5 (368)	19 0 (483)	11 1 (283)	32 0 (813)	12 0 (305)	16 5 (420)	60 (27)
	15 (11) thru 30 (22)	25 5 (648)	23 5 (597)	12 1 (308)	37 5 (953)	23 0 (585)	21 0 (534)	160 (72)
380 / 415 / 460V	40 (30) 60 (45)	32 5 (825)	23 5 (597)	12 1 (308)	37 5 (953)	30 0 (762)	21 0 (534)	200 (90)

(1) Shipping weight will be greater due to packaging materials.
(2) 1 HP is 460V only.

VCD 703 Factory Mounted In NEMA 1 Floor Mount Enclosure

INPUT	HP (kW)	ENCLOSURE DIMENSIONS IN INCHES (mm)			REF DWG
		H	W	D(1)	
208 / 230V or 380 / 415 / 460V	40 (30) 50 (37)	84 (2134)	37 75 (959)	26 (660)	S-5236
380 / 415 / 460V	75 (55) thru 200 (160)	84 (2134)	37 75 (959)	26 (660)	S-5236
	250 (185) 300 (220) 400 (300)	84 (2134)	73 25 (1861)	27 7 (704)	S-5274

See following pages for dimension drawings referenced on this page.

VCD Factory Mounted in NEMA 12 Wall Mount Enclosure

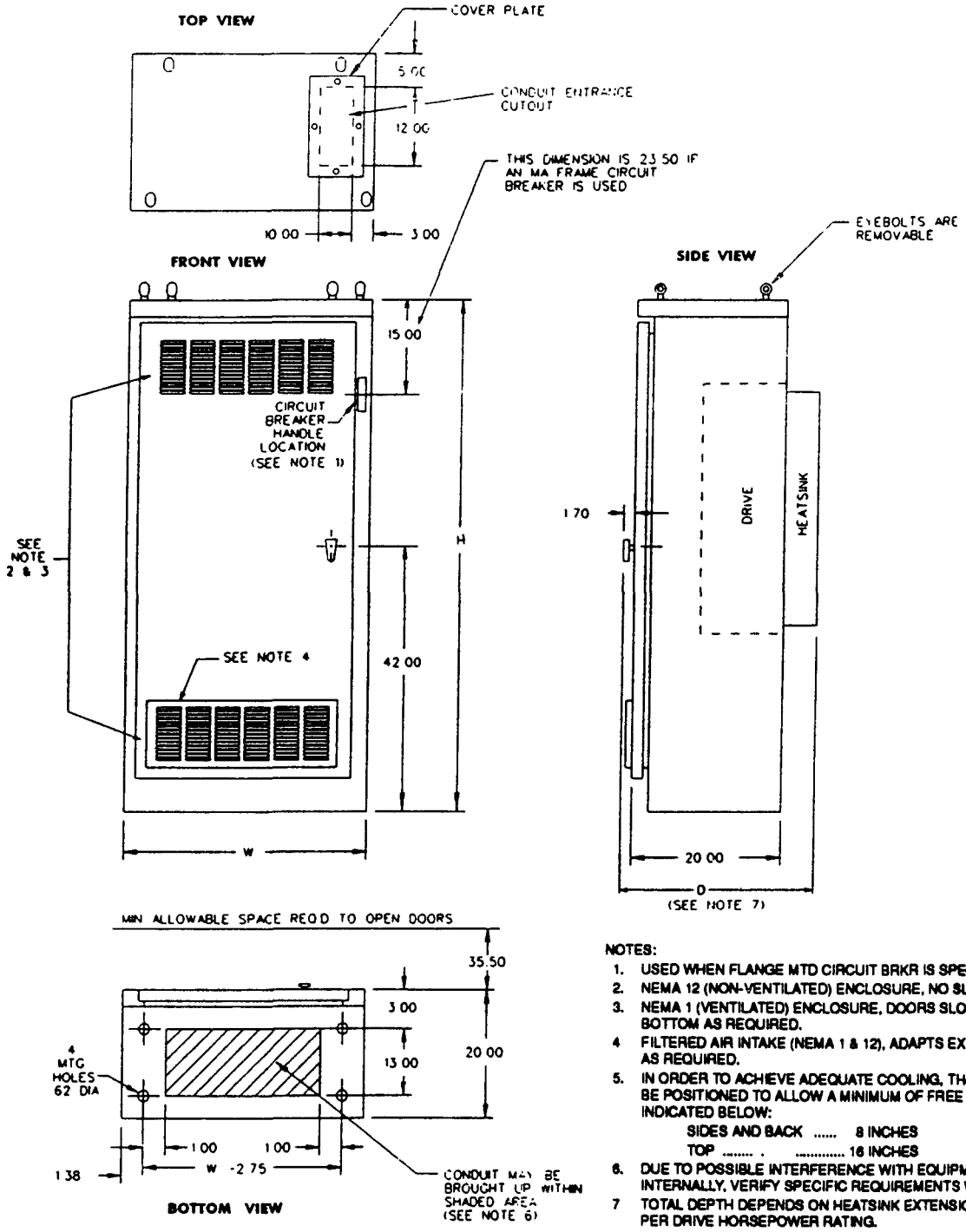
INPUT	HP (kW)	ENCLOSURE DIMENSIONS IN INCHES (mm)				MOUNTING HOLE DIMENSIONS IN INCHES (mm)		WEIGHT LBS. (KG) (3)	REF DWG
		H	W	D(2)	E	H1	W1		
208 / 230V	3 (2.2) 5 (3.7)	28 5 (724)	25 5 (648)	18 75 (476)	42 75 (1086)	27 (686)	22 5 (572)	75 (33.75)	S-5286
	7.5 (5.5)	34.5 (876)	25.5 (648)	18.75 (476)	42.75 (1086)	33 (838)	22.5 (572)	95 (42.75)	
	10 (7.5)	40.5 (1028)	31.5 (800)	18.75 (476)	48.75 (1086)	39 (991)	28.5 (724)	115 (51.75)	
	15 (11)	52.5 (1334)	37.5 (953)	18.75 (476)	54.75 (1391)	51 (1295)	34.5 (876)	200 (90)	
	20 (15) 30 (22)	40 5 (1028)	31 5 (800)	18 75 (476)	48 75 (1238)	39 (991)	28 5 (724)	200 (90)	S-5287
	50 (37)	39.5 (1003)	37.5 (953)	18.75 (476)	54.75 (1391)	51 (1295)	34.5 (876)	320 (144)	
380 / 415 / 460V	1 (0.7) 3 (2.2) 5 (3.7)	20 5 (724)	25 5 (648)	18 75 (476)	42 75 (1086)	27 (686)	22.5 (572)	75 (33 75)	S-5286
	10 (7.5)	44.5 (1130)	25.5 (648)	18.75 (476)	42.75 (1086)	43 (1092)	22.5 (572)	130 (58.5)	
	15 (11)	40.5 (1028)	31.5 (800)	18.75 (476)	48.75 (1238)	39 (991)	28.5 (724)	160 (72)	
	20 (15)	46.5 (1180)	37.5 (953)	18.75 (476)	54.75 (1391)	45 (1143)	34.5 (876)	190 (85.5)	
	30 (22)	40.5 (1028)	31.5 (800)	18.75 (476)	48.75 (1238)	39 (991)	28.5 (724)	190 (85.5)	S-5287
	40 (30) 60 (45)	52 5 (1334)	37 5 (953)	18 75 (476)	54 75 (1391)	51 (1295)	34 5 (876)	270 (121 5)	
	75 (55)							370 (166.5)	
	100 (75)							390 (175.5)	
	150 (110)							440 (198)	

VCD 703 Factory Mounted in NEMA 12 Floor Mount Enclosure

INPUT	HP (kW)	ENCLOSURE DIMENSIONS IN INCHES (mm)			REF DWG
		H	W	D(1)	
380 / 415 / 460V	200 (160)	84 (2134)	37.75 (959)	27.75 (705)	S-5236
	250 (185) 300 (220) 400 (300)	84 (2134)	73 25 (1861)	27 75 (705)	S-5274

(1) Depth dimension includes drive heat sink.
(2) When circuit breaker with through-the-door operator mechanism is present, add 2.38 to depth dimension for circuit breaker handle.
(3) Shipping wweight will be greater due to packaging materials.

VCD 703 Factory Mounted in NEMA 1 or NEMA 12 Enclosure

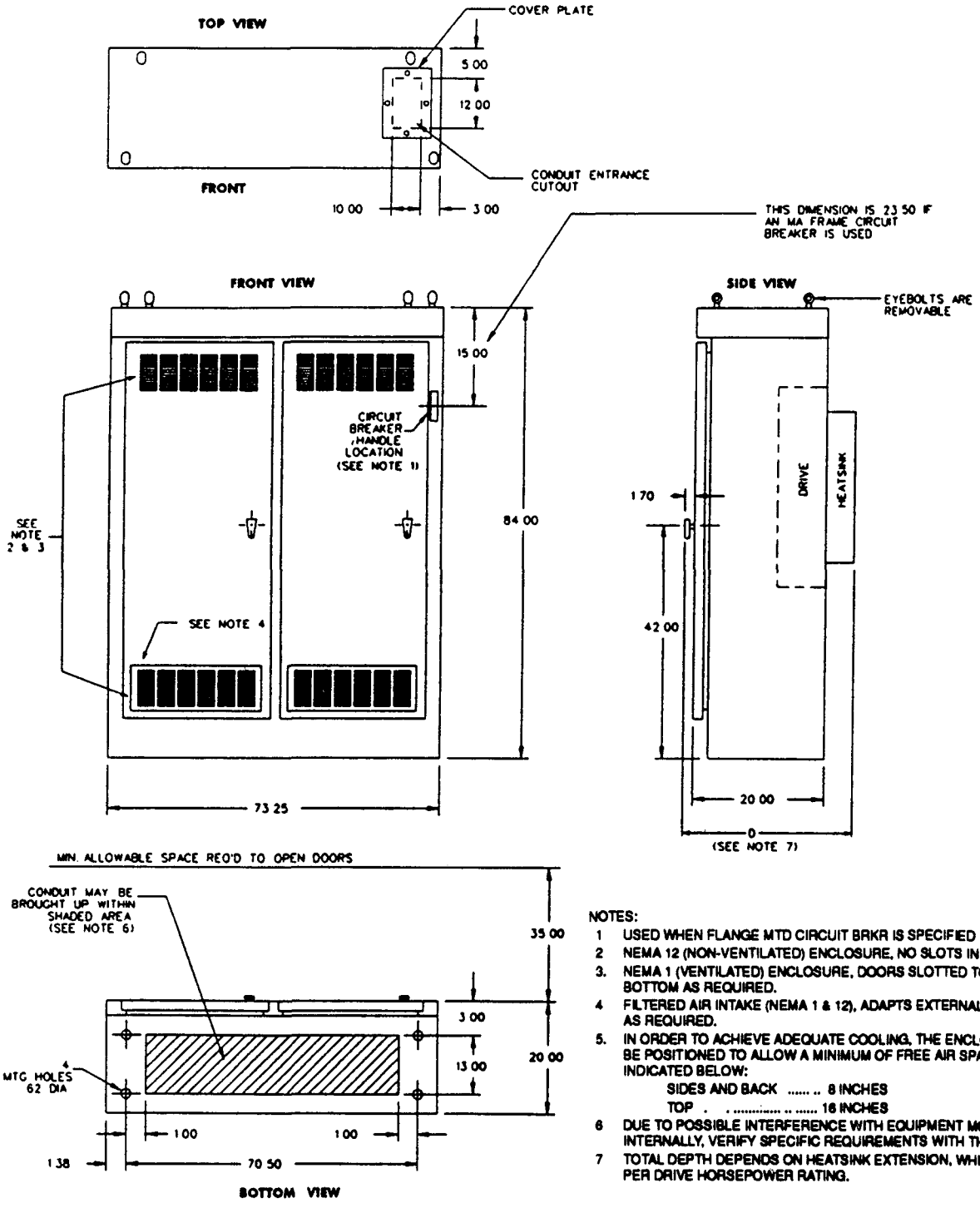


NOTES:

1. USED WHEN FLANGE MTD CIRCUIT BRKR IS SPECIFIED.
2. NEMA 12 (NON-VENTILATED) ENCLOSURE, NO SLOTS IN DOOR.
3. NEMA 1 (VENTILATED) ENCLOSURE, DOORS SLOTTED TOP AND BOTTOM AS REQUIRED.
4. FILTERED AIR INTAKE (NEMA 1 & 12), ADAPTS EXTERNALLY TO DOORS AS REQUIRED.
5. IN ORDER TO ACHIEVE ADEQUATE COOLING, THE ENCLOSURE MUST BE POSITIONED TO ALLOW A MINIMUM OF FREE AIR SPACE AS INDICATED BELOW:
   SIDES AND BACK ..... 8 INCHES
   TOP ..... 16 INCHES
6. DUE TO POSSIBLE INTERFERENCE WITH EQUIPMENT MOUNTED INTERNALLY, VERIFY SPECIFIC REQUIREMENTS WITH THE FACTORY
7. TOTAL DEPTH DEPENDS ON HEATSINK EXTENSION, WHICH VARIES PER DRIVE HORSEPOWER RATING.

REF: S-5236

VCD 703 Factory Mounted in NEMA 1 or NEMA 12 Enclosure

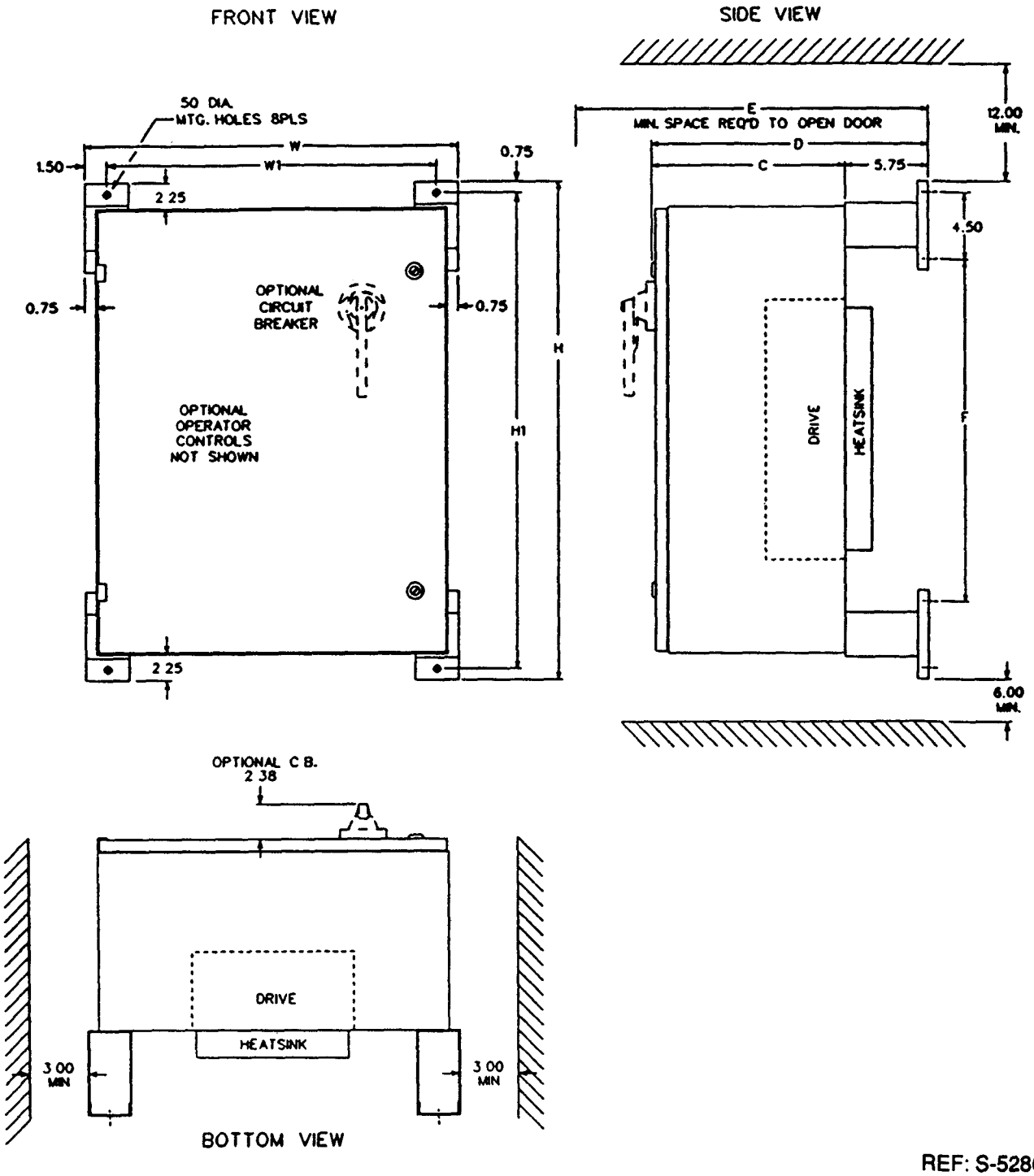


NOTES:

1. USED WHEN FLANGE MTD CIRCUIT BRKR IS SPECIFIED
2. NEMA 12 (NON-VENTILATED) ENCLOSURE, NO SLOTS IN DOOR.
3. NEMA 1 (VENTILATED) ENCLOSURE, DOORS SLOTTED TOP AND BOTTOM AS REQUIRED.
4. FILTERED AIR INTAKE (NEMA 1 & 12), ADAPTS EXTERNALLY TO DOORS AS REQUIRED.
5. IN ORDER TO ACHIEVE ADEQUATE COOLING, THE ENCLOSURE MUST BE POSITIONED TO ALLOW A MINIMUM OF FREE AIR SPACE AS INDICATED BELOW:
   SIDES AND BACK ..... 8 INCHES
   TOP . ..... 16 INCHES
6. DUE TO POSSIBLE INTERFERENCE WITH EQUIPMENT MOUNTED INTERNALLY, VERIFY SPECIFIC REQUIREMENTS WITH THE FACTORY
7. TOTAL DEPTH DEPENDS ON HEATSINK EXTENSION, WHICH VARIES PER DRIVE HORSEPOWER RATING.

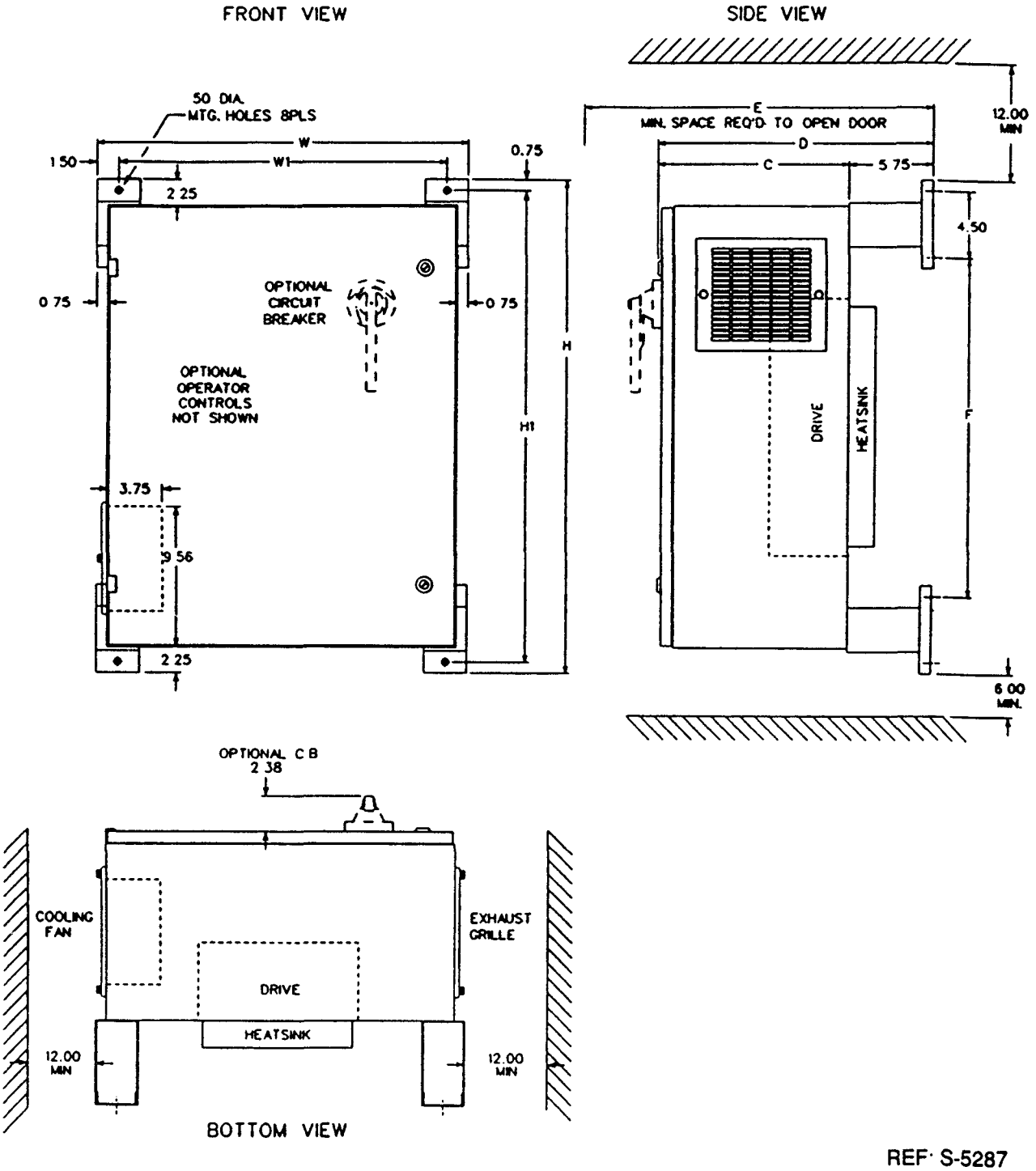
REF: S-5274

VCD 703 Factory Mounted in NEMA 12 Wall Mount Enclosure



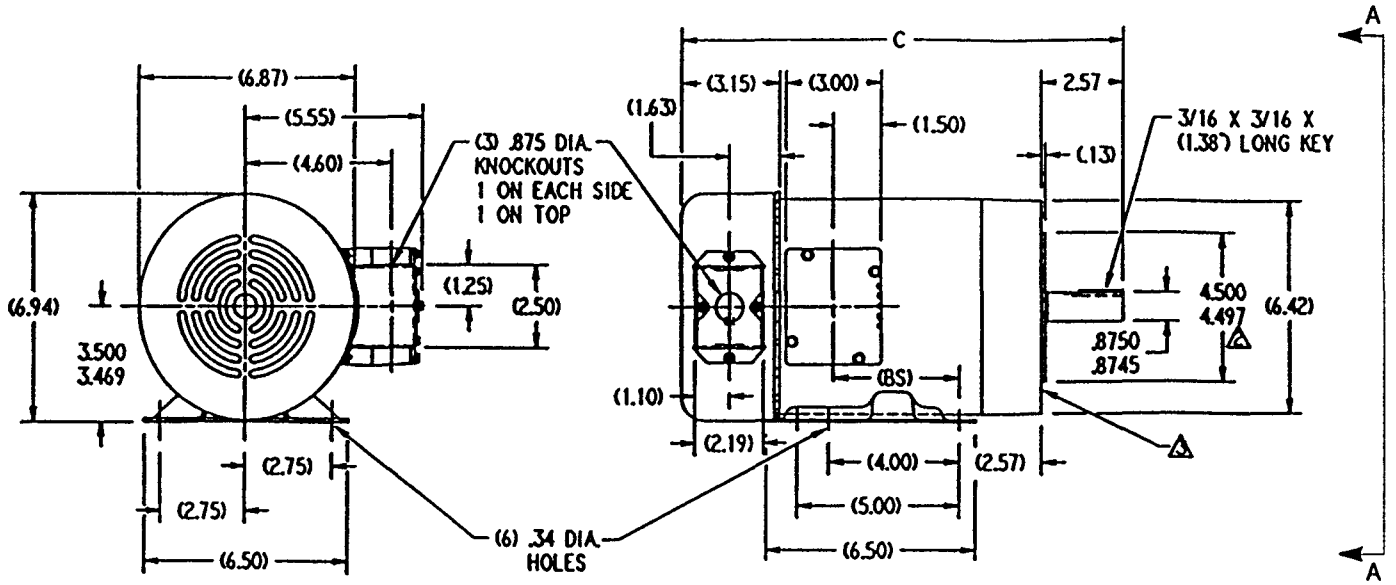
REF: S-5286

VCD 703 Factory Mounted in NEMA 12 Wall Mount Enclosure



REF: S-5287

VCM Motor, 1HP – Foot Mount & C-Face



"C"	("BS")
13.84	3.86

NOTES

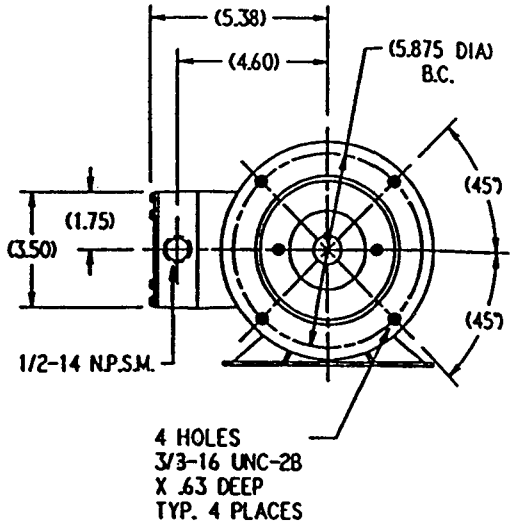
(1) ALL DIMENSIONS SHOWN IN PARENTHESIS ARE REFERENCE DIMENSIONS. ALL OTHER DIMENSIONS ARE TOLERANCED PER THE FOLLOWING CHART UNLESS OTHERWISE SPECIFIED.

"C" DIMENSION	= +/- 046
SHAFT EXTENSION	= +/- .034
LEAD LENGTHS	= +/- 1.00
EXTENDED THRU BOLTS	= +/- .050

△ RABBIT DIAMETER IS CONCENTRIC WITH SHAFT CENTERLINE WITHIN .004 T.I.R.

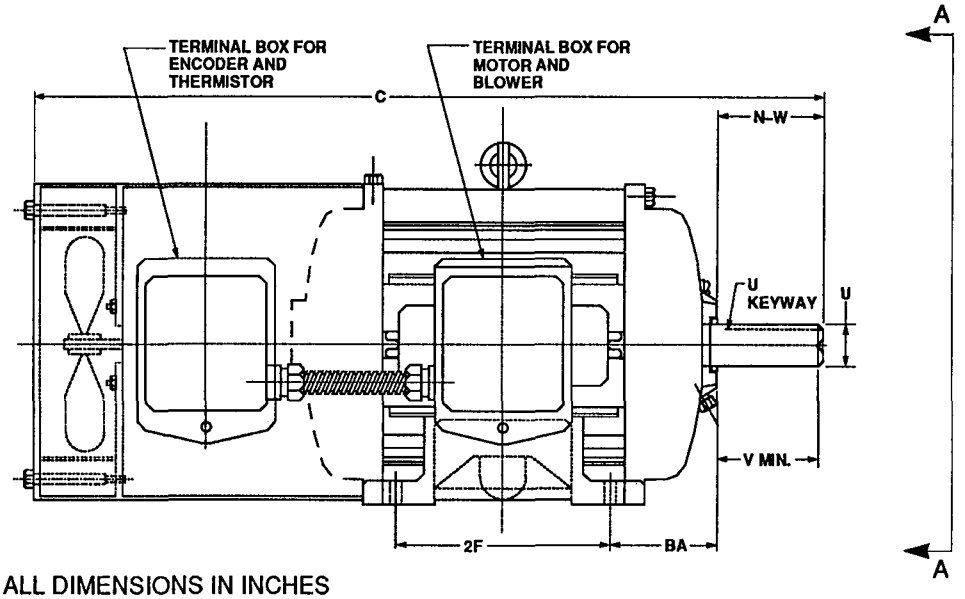
△ FACE OF MOUNTING FLANGE IS PERPENDICULAR TO SHAFT CENTERLINE WITHIN .004 T.I.R.

(4) SHAFT RUNOUT NOT TO EXCEED .002 T.I.R



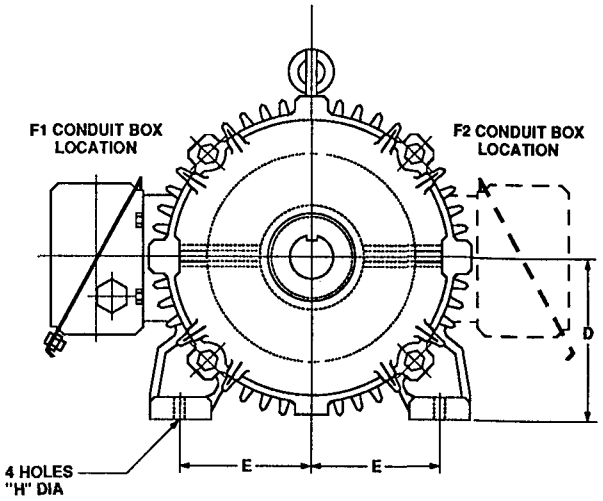
VIEW A–A

VCM Motor – Foot Mount



ALL DIMENSIONS IN INCHES

HP	FRAME	BA	C	D *	E	2F	H
1	See page A3-10						
3	182T	2.75	20 50	4 50	3 75	4 50	406
5	184T	2 75	21 50	4 50	3 75	5 50	406
7 5	213T	3 50	24 26	5 25	4 25	5 50	406
10	215T	3 50	25 76	5 25	4 25	7 00	406
15	254T	4 25	29 25	6 25	5 00	8 25	531
20	256T	4 25	31 00	6 25	5 00	10 00	531
25	284T	4 75	32 50	7 00	5 50	9 50	531
30	286T	4 75	34 00	7 00	5 50	11 00	531
40	324T	5 25	34 63	8 00	6 25	10 50	656
50	326T	5 25	36 13	8 00	6 25	12 00	656
60	364T	5 88	41 94	9 00	7 00	11 25	657
75	365T	5 88	42 94	9 00	7 00	12 25	657
100	405T	6 62	47 81	10 00	8 00	13 75	828
150	445T	7 50	53 85	11 00	9 00	16 50	828
200	447T	7 50	57 35	11 00	9 00	20 00	828
250	447T	7 50	57 35	11 00	9 00	20 00	828
300	449T	7 50	62 35	11 00	9 00	25 00	828
400	449T	7 50	62 35	11 00	9 00	25 00	828



VIEW A–A

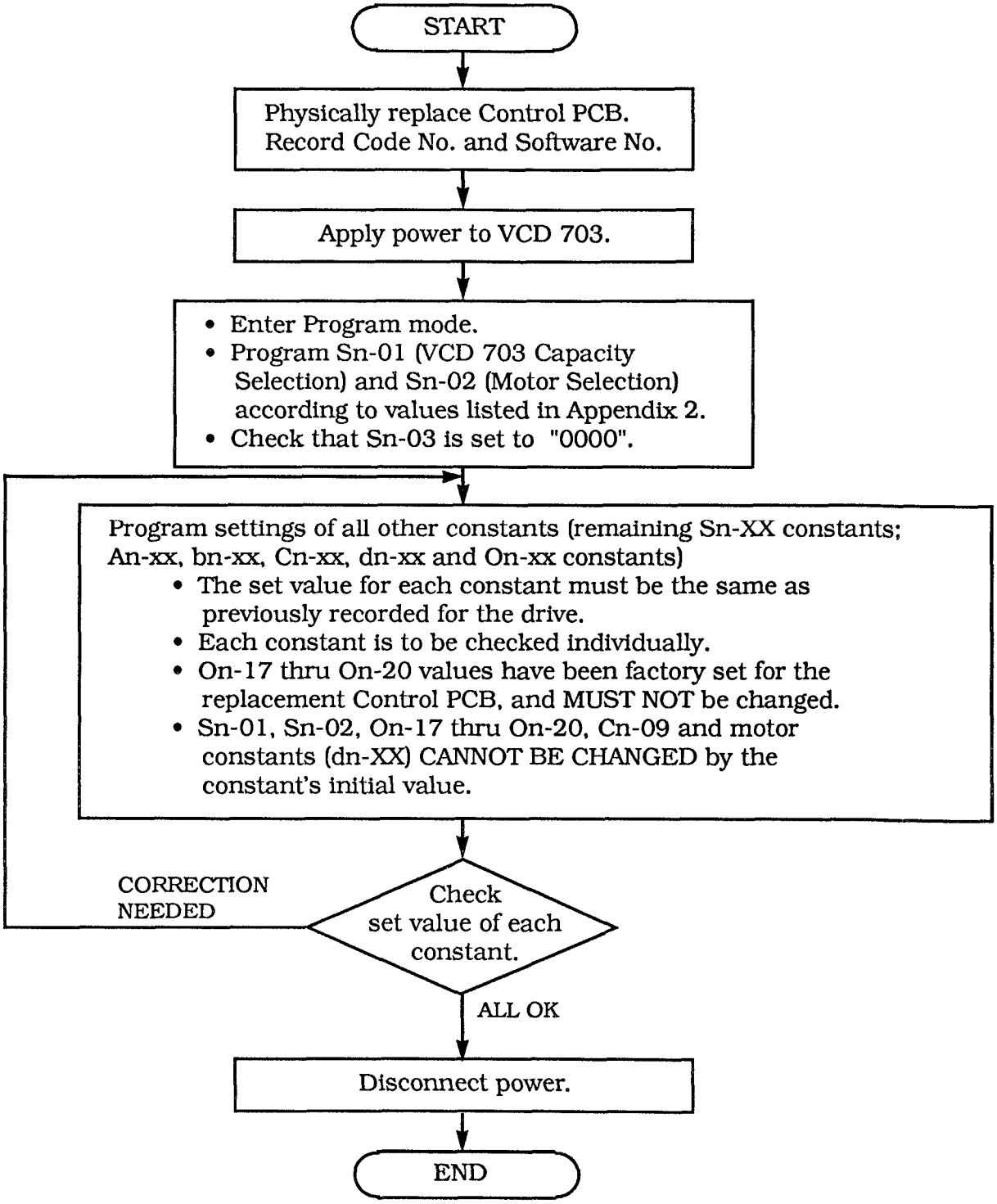
*** DIMENSION TOLERANCES**

DIM. D	TOL.	DIM. U	TOL.
UP TO 8.00	+ 00 – 03	UP TO 1.5000	+ 0000 – 0005
OVER 8 00	+ .00 – 06	OVER 1.5000	+ .000 – .001

FRAME	U *	V	N-W	U Keyway
180	1 1250	2 50	2 75	250 x 125
210	1 3750	3 12	3 38	312 x 156
250	1 625	3 75	4 00	375 x 188
280	1 875	4 38	4 62	500 x 250
320	2 125	5 00	5 25	500 x 250
360	2 375	5 75	5 88	625 x 312
400	2 875	7 00	7 25	750 x 375
440	3 375	8 25	8 50	875 x 437

Appendix 4. VCD 703 & VCM SPARE PARTS

PROCEDURE FOR INSTALLING REPLACEMENT CONTROL PCB:



VCD 703 Spares

VCD 703 - 208/230 VAC Rating - 1HP thru 10HP

Part No.	Transistor Module				Diode Module			Power PCB				Power Supply PCB	Control PCB	Fan		Fuses		
501848__																28	29	30
502078__	04	05	06	07	22	23	24											
502079__								43	44	45	46	64		19	66			
05P90-__													0378					
VCD703-																		
A001	Consult MagneTek												1	Consult MagneTek				
A003	1				1			1				1	1		1	1		
A005		1			1				1			1	1		1		1	
A7P5			3			1				1		1	1		1			1
A010				3			1				1	1	1	1				1

VCD 703 - 208/230 VAC Rating - 15HP thru 50HP

Part No.	Transistor Module				Diode Module			Gate Driver PCB			Control PCB	Fan	Fuses				
501739__					62												
501848__						16							31		59	90	
502078__	08	09	10														
502079__				88			12	47	48	87		19		74			
05P90-__											0378						
VCD703-																	
A015	3				1			1			1	1	1				
A020		3				3			1		1	1		1			
A025	Consult MagneTek										1	Consult MagneTek					
A030			6			3			1		1	1			1		
AL40	Consult MagneTek										1	Consult MagneTek					
AL50											1						

VCD 703 - 380/415/460 VAC Rating - 1HP thru 10HP

Part No.	Transistor Module				Diode Module			Power PCB				Power Supply PCB	Control PCB	Fan	Fuses	
502078	11	12	13	14	25	26									50	51
502079								51	52	53	54	65		66		
05P90-__													0378			
VCD703-																
B001	1				1			1				1	1	1	1	
B003		1			1				1			1	1	1	1	
B005			3			1				1		1	1	1		1
B7P5	Consult MagneTek												1	Consult MagneTek		
B010				3		1					1	1	1	1		1

IMPORTANT

Numbers represent total quantity used in one Drive To determine adequate inventory of spare parts, MagneTek suggests using listed value for quantities 2 and below If listed value is greater than 2, factory suggests 1/3 of total listed.

VCD 703 Spares

VCD 703 - 380/415/460 VAC Rating - 15HP thru 60HP

Part No.	Transistor Module				Diode Module				Gate Driver PCB				Control PCB	Fan		Fuses		
501848__					17	18												
502078__	15	16	17	18			27	28										
502079__									55	56	57	58		19	67	68	69	70
05P90-___													0378					
VCD703-																		
B015	3				1				1				1		1	1		
B020		3					1		1				1		1	1		
B030			3			1				1			1	1			1	
B040				6				3			1		1	2			1	
B050	Consult MagneTek												1	Consult MagneTek				

VCD 703 - 380/415/460 VAC Rating - 75HP thru 250HP

Part No.	Transistor Module			Diode Module		Gate Driver PCB				Control PCB	Fan	Fuse			
501739__															98
502079__	07	08	09	14	15	60	61	62	63		19	71	72	73	
05P90-___										0378					
VCD703-															
BL75	Consult MagneTek									1	Consult MagneTek				
BL100										1					
BL150										1					
BL200										1					

VCD 703 - 380/415/460 VAC Rating - 300HP, 400HP

Part No.	Transistor Module			Main Diode Ckt	Main Drive PCB		Sub Drive PCB			Control PCB	Fan Unit	Fuse		
502079__	10	11	13	15	16	17	25	26	28		29	81	82	83
05P90-___										0378				
VCD703-														
B250			12	6		1			3	1	3	12		
B300	12			6		1	3			1	3		12	
B400		12		9	1			3		1	3			12

IMPORTANT

Numbers represent total quantity used in one Drive. To determine adequate inventory of spare parts, MagneTek suggests using listed value for quantities 2 and below If listed value is greater than 2, factory suggests 1/3 of total listed

For all VCD 703 drives :

Encoder Feedback Card ..... Part No. **PG-X**

Connectors (for encoder cable)

Honda (male; CA2) . ... Part No **05P34-0793**
Honda (female; CA1) . Part No. **05P34-0581**
Honda cover ..... Part No **05P34-0582**

VCM Motor Spares

Blower Motor

180-210 Frames	1/15HP, 115V, 2 0A, 3000RPM	Part No **50207975**
250-320 Frames	1/15HP, 115V, 1 9A, 1550RPM	Part No **50207976**
360-440 Frames	1/3HP, 115V, 4.2A, 1075RPM	Part No **50207977**

Encoder (PG)

EPC (for 140-360 frame)	Part No **36554505**
EPC (for 400-440 frame)	Part No. **36554507**
BEI (for long lead runs)	Part No **50207979**

Thermistor

(for all frames)	Part No **50207978**

Appendix 5. DYNAMIC BRAKING CONNECTIONS

GENERAL. Dynamic braking (DB) enables the motor to be brought to a smooth and rapid stop. This is achieved by dissipating the regenerative energy of the AC motor across the resistive components of the Dynamic Braking option. For further details on dynamic braking operation, see the instruction sheet shipped with dynamic braking components.

The VCD 703 in 230V 3-10HP or 460V 1-20HP range has an integral braking transistor; all higher rated drives require the use of external Braking Units (also referred to as Braking Modules) which provide the braking transistor circuitry. In addition, to make use of the Dynamic Braking function requires adding a heat sink mount Braking Resistor (for 3% duty cycle; only available for the 230 3-5HP or 460V 3HP range) *or* external Braking Resistor Units (for 10% duty cycle).

Since the 3% Braking Resistor mounts directly to the drive's heat sink, any braking resistor overheating is sensed as a drive heatsink overtemperature fault. But for Braking Resistor Units, interconnection to external control circuitry is necessary to ensure that braking resistor overheating is communicated to the drive as a fault condition.

Available MagneTek dynamic braking components are listed in Table A5-1.

Table A5-1. VCD 703 DB Components

For 230V VCD 703s						For 380/460V VCD 703s					
DRIVE HP	BRAKING MODULE PART NO.	BRAKING MODULE QTY Reqd	HS RESISTOR (1) PART NO.	BRAKING UNIT PART NO.	BRAKING UNIT QTY Reqd	DRIVE HP	BRAKING MODULE PART NO.	BRAKING MODULE QTY Reqd	HS RESISTOR (1) PART NO.	BRAKING UNIT PART NO.	BRAKING UNIT QTY Reqd
--	--	—	--	--	—	1	N/A	—	50185530	5P41-0752	1
3	N/A	—	50185432	5P41-0744	1	3			50185532	5P41-0754	1
5			50185433	5P41-0745	1	5			N/A	5P41-0755	1
7.5			N/A	5P41-0746	1	7.5				5P41-0756	1
10				5P41-0747	1	10				5P41-0757	1
15	50185034	1		5P41-0748	1	15				5P41-0758	1
20	50185034	1		5P41-0749	1	20				5P41-0759	1
25	50185035	1		5P41-0750	1	25	50185234	1		5P41-0760	1
30	50185035	1		5P41-0751	1	30	50185234	1		5P41-0761	1
40	50185034	2		5P41-0749	2	40	50185234	1		5P41-0762	1
50	50185034	2		5P41-0749	2	50	50185235	1		5P41-0763	1
						60	50185235	1		5P41-0764	1
						75	50185234	2		5P41-0762	2
						100	50185235	2		5P41-0764	2
						150	50185234	3		5P41-0762	3
						200	50185235	4		5P41-0764	4
						250	50185235	5		5P41-0764	5
						300	50185235	5		5P41-0764	5
						400	50185235	6		5P41-0764	6

(1) When the heat sink mount Braking Resistor is used, DO NOT wire a Braking Unit to the drive.

INSTALLATION

This option should only be installed by a TECHNICALLY QUALIFIED INDIVIDUAL who is familiar with this type of equipment and the hazards involved.

WARNING

Hazardous voltage can cause severe injury or death. Lock all power sources feeding the drive in the "OFF" position.

CAUTION

Failure to follow these installation steps may cause equipment damage or personnel injury.

Preliminary Proecdures

1. Disconnect all electrical power to the drive.
2. Remove drive front cover.
3. Use a voltmeter to verify that voltage is disconnected from incoming power terminals.

Braking Resistor (Heat Sink Mount) Installation

1. Remove the drive from its mounting for access to the rear of the heat sink.
2. Mount the Braking Resistor on the back of the drive's heat sink, as shown in Figure A5-1.
3. Reinstall the drive in its mounting position.
4. Connect the leads from the Braking Resistor to drive terminals according to Figure A5-2.
5. Proceed to "ADJUSTMENTS" on page A5-7.

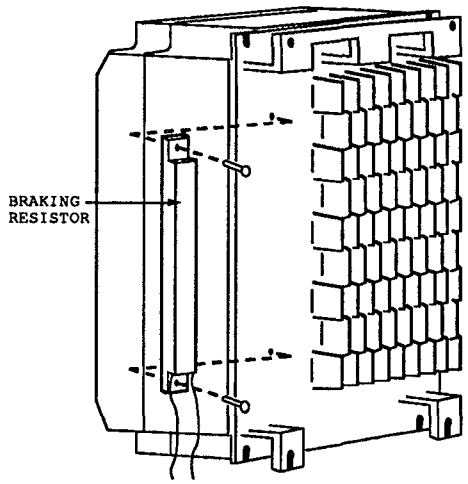


Figure A5-1. Mounting Braking Resistor on Heat Sink

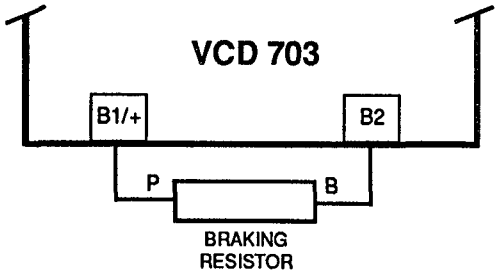


Figure A5-2. Lead Connections For Braking Resistor (Heat Sink Mounted)

Braking Resistor Unit Installation (for 230V 3-10HP, 460V 3-20HP drives)

IMPORTANT

Since the Braking Resistor Unit generates heat during dynamic braking operation, install it in a location away from other equipment which emits heat.

1. Mount the Braking Resistor Unit on a vertical surface, maintaining a minimum 1.18 inch (30 mm) clearance on each side and a minimum 5.91 inch (150 mm) clearance top and bottom.

2. Remove the Braking Resistor Unit front cover to access its terminal block. Connect the Braking Resistor Unit to the drive and to external control circuitry according to the chart at right and Figure A5-3.

Terminals	B, P	1, 2 *
Lead Size (AWG)	12-10	18-14 *
Lead Type	600V etheylene propylene rubber insulated, or equivalent	
Terminal Screw	M4	

* Power leads for the Braking Resistor Unit generate high levels of electrical noise; these signal leads must be grouped separately

3. Reinstall and secure Braking Resistor Unit front cover and drive front cover.

4. Proceed to "ADJUSTMENTS" on page A5-7.

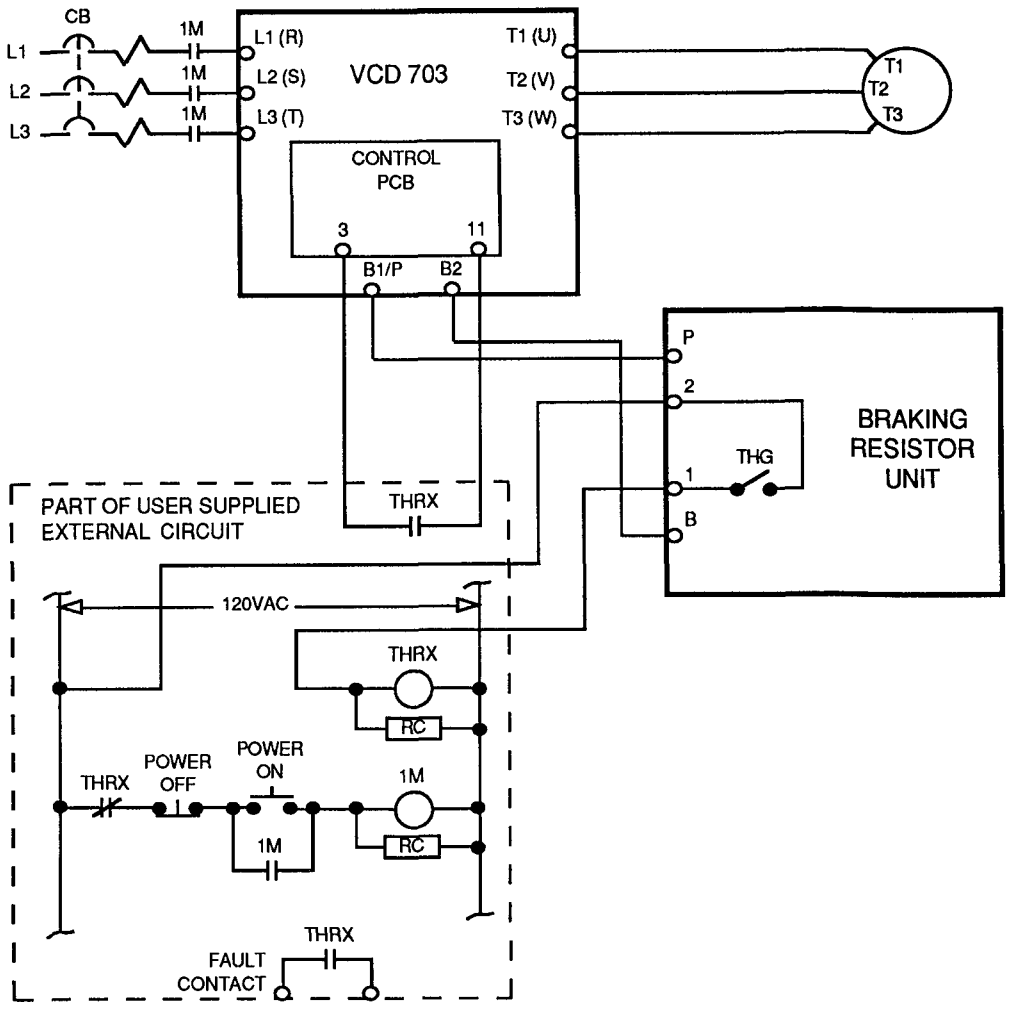


Figure A5-3. Wiring Braking Resistor Unit to Drive (230V 3-10HP, 460V 1-20HP)

Braking Unit(s) and Braking Resistor Unit(s) Installation (for 230V 15HP and above, 460V 25HP and above)

IMPORTANT

Since the Braking Resistor Unit generates heat during dynamic braking operation, install it in a location away from other equipment which emits heat.

Select mounting locations for the Braking Unit(s) and Braking Resistor Unit(s) so that wiring between the drive and the (Master) Braking Unit, and between each Braking Unit and its associated Braking Resistor Unit, is less than 33 feet (10 m).

1. Mount the Braking Unit(s) and Braking Resistor Unit(s) on vertical surfaces. A Braking Unit requires a minimum 1.18 inch (30 mm) clearance on each side and a minimum 3.94 inch (100 mm) clearance top and bottom; a Braking Resistor Unit requires a minimum 1.97 inch (50 mm) clearance in back (i.e. use mounting spacers) and a minimum 7.87 inch (200 mm) clearance in front.

2. Remove DB units' front covers to access their terminals.

3. For 380/460V drives only: In each Braking Unit, set the PCB nominal line voltage jumper plug to the correct setting for the installation; this is factory set at the "460V" position.

4. If multiple Braking Units are being installed, the unit closest to the drive should have the SLAVE/MASTER jumper on its PCB set to the "MASTER" position (factory setting); all others must have this jumper moved to the "SLAVE" position.

5. If a single Braking Unit and Braking Resistor Unit are being installed, connect them to the drive and external control circuitry according to the chart below and Figure A5-4.

   If two or more Braking Units and Braking Resistor Units are being installed, connect them to the drive and to external circuitry according to the chart below and Figure A5-5.

UNIT	TERMINALS	LEAD SIZE (AWG)	LEAD TYPE	TERMINAL SCREWS
Braking Resistor Unit	B, P	12-10	600V ethylene propylene rubber insulated or equivalent	M5
	1, 2 *	18-14 *		M4
Braking Unit	P, Po, N, B	12-10	600V etheylene propylene rubber insulated, or equivalent	M4
	1, 2 *	18-14 *		

* Power leads for the Braking Resistor Unit generate high levels ofelectrical noise; these signal leads must be grouped separately

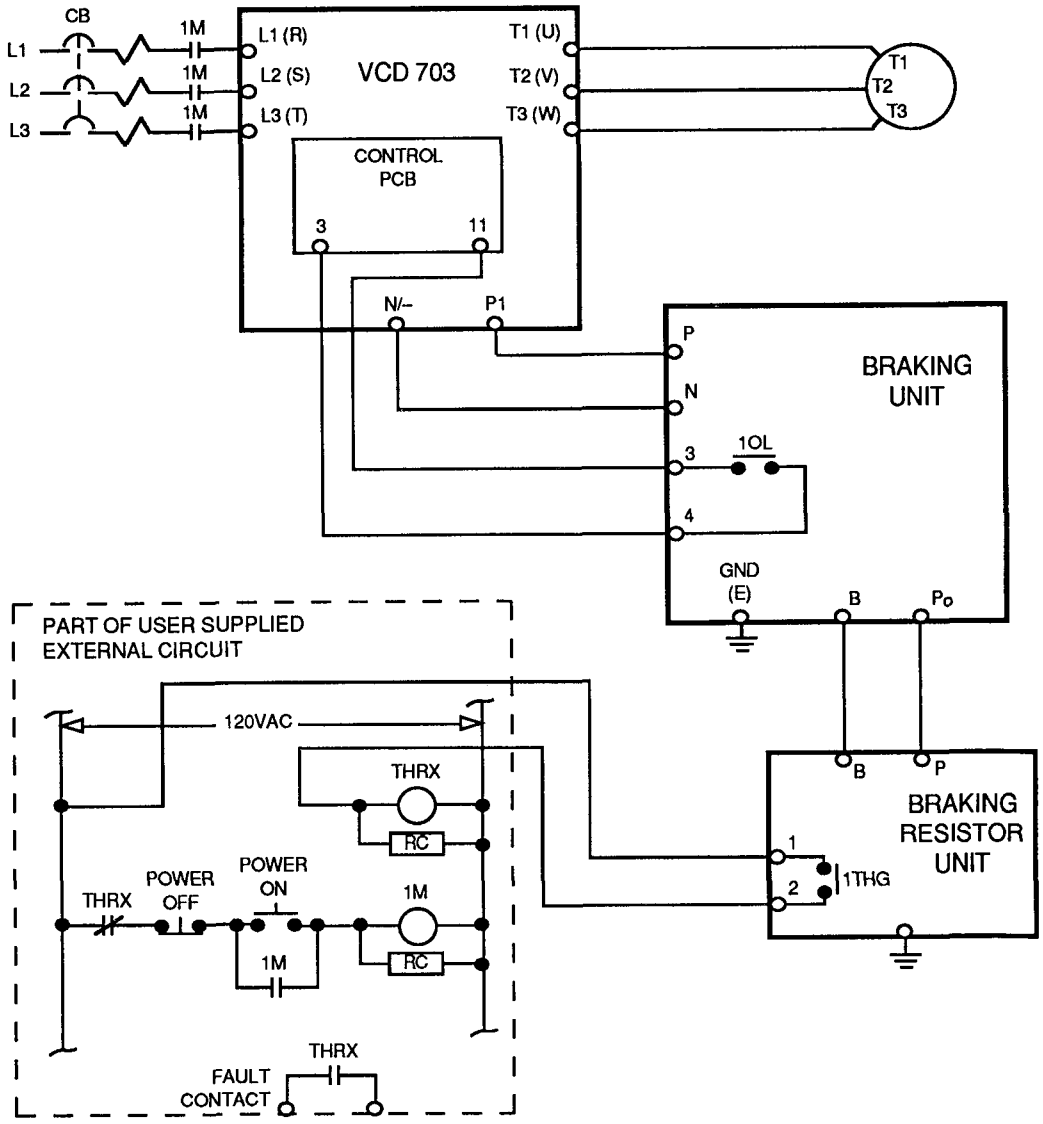


Figure A5-4. Wiring Single Braking Unit and Braking Resistor Unit to Drive (230V 15-30HP, 460V 25-60HP)

6. The Braking Unit and Braking Resistor Unit MUST BE GROUNDED. Observe the following precautions:

- Use grounding leads conforming to your National Electrical Code.
- If the installation requires the Braking Resistor Unit to be used without its enclosure (with grounding terminal), ground it by attaching a ground lead at one of the mounting screws.
- Grounding resistance of the Braking Unit should be 100 ohms or less.

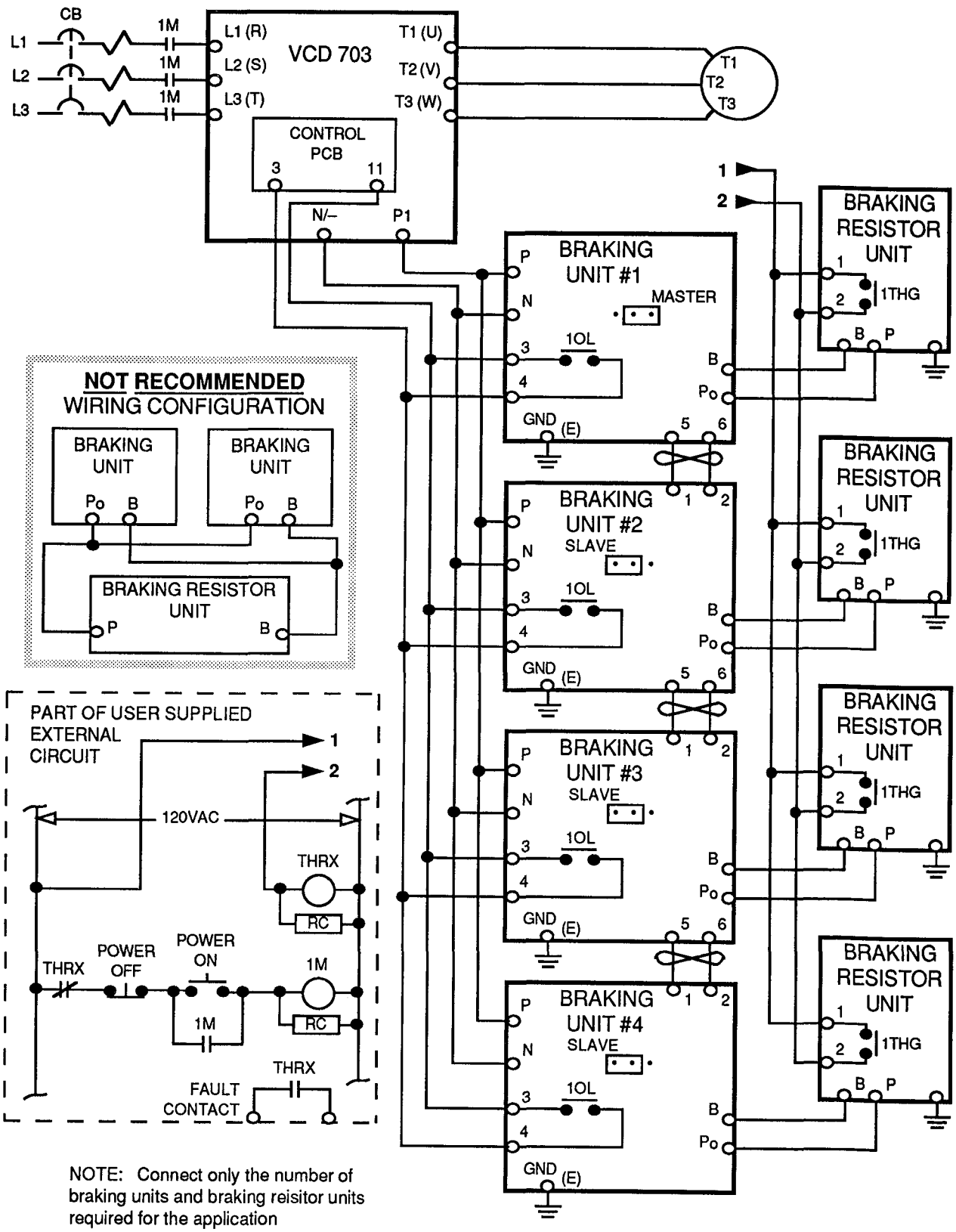


Figure A5-5. Wiring Multiple Braking Units and Braking Resistor Units to Drive (230V 40-50HP, 460V 75-400HP)

8. **IMPORTANT:** After wiring, test insulation resistance of each Braking Unit/Braking Resistor Unit with a 900V megger as follows:

a. Disconnect leads between the Braking Unit and the drive. If equipment with semiconductors is connected across terminals 1 & 2 of the Braking Unit, remove the wiring.

b. Connect common leads (jumpers) across Braking Unit terminals N, P, Po, and B, and across 3 & 4, as shown in Figure A5-6.

c. Measure the insulation resistance at points a, b, and c in Figure A5-6 with the megger.

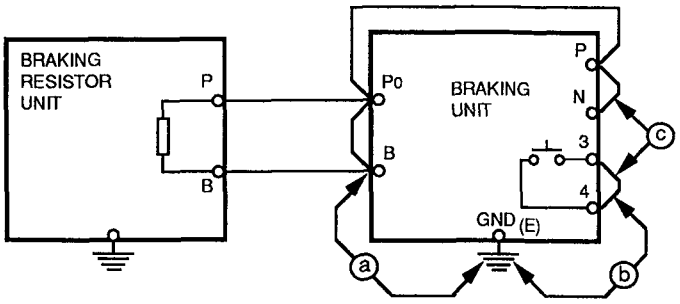


Figure A5-6. Megger Testing Set-up

ADJUSTMENTS

9. ALL drives: Program On-03 to ***X0XX***, to disable overvoltage control function. NOTE: This is the factory setting of this digit.

10. Only with Heat Sink Mount Resistor: Program Sn-11 to ***XXX1***, to enable overheat protection for the braking resistor.

OPERATION CHECK

11. During dynamic braking operation, verify that the "BRAKE" lamp inside the Braking Unit will be lit.

12. During dynamic braking operations, ensure that the required deceleration characteristic is obtained. If not, contact MagneTek for assistance.

13. Reinstall and secure covers on the DB units and the drive.

CAUTION

During normal operation, the Braking Unit and the Braking Resistor Unit must be kept closed, since high voltage is applied to the dynamic braking circuit.

VCD 703

MagneTek
Drives & Systems
16555 West Ryerson Road
New Berlin, WI 53151
(800) 541-0939, (414) 782-0200, FAX (414) 782-1283