SECTION 5 - POWER WIRING

The Delta driver and motors have three basic power wiring configurations. Each of the configurations is shown in the following power wiring diagrams (**Figures 5.4 through 5.6**). Each of the diagrams shows recommended circuit breaker, contactor and wire gauge.

5.1 CIRCUIT BREAKER

It is recommended that each driver be provided with a circuit breaker for protection of the driver and motor. All of the drives are suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 240 vac maximum when protected by a circuit breaker having an interrupting rating not less than 5000 rms symmetrical amperes, 240 volts maximum. Each of the driver wiring diagrams contains a chart of the recommended circuit breaker for each driver size.

The breaker is sized for the worst-case maximum power draw of the driver at the worst-case low line voltage. The charts contain specific vendor and size recommendations. Other types of circuit breakers or fuses may be used provided the continuous ratings are equivalent, the instantaneous rating is 10 to 15 times continuous and can support 3 times continuous for at least 3 seconds.

Lower rating protections devices may be used that are sized for the motor power rating. Contact the IIS factory for specific recommendations.

5.2 CONTACTOR

The DSD-1.5 through DSD-17.5 driver sizes has an internal power bus contactor. The DSD-35 through DSD-115 sizes requires an external power bus contactor. The driver-wiring diagram for the larger size drivers contains a chart of the recommended contactor for each driver size.

The contactor is sized for the worst-case maximum power draw of the driver at the worst-case low line voltage. The charts contain specific vendor and size recommendations. Other types of contactors may be used provided the continuous ratings are equivalent and the maximum instantaneous rating is 10 to 15 times continuous. The driver is equipped with a soft start circuit to limit the contactor inrush current.

The coil voltage should be the same rating as the incoming line. The maximum current draw for the coil cannot exceed 0.25 amps. The contactor coil must be fitted with a transient voltage protection device. An RC type suppression device is preferred.

5.3 WIRE SIZES

It is required that each driver be installed with the appropriate size wire for proper operation. Each of the driver wiring diagrams contains a chart of the recommended wire gauges and terminal connection tightening torques for each driver size.

The wire is sized for the worst-case maximum power draw of the driver at the worst-case low line voltage. The charts contain specific METRIC and AWG size recommendations for stranded wire. Use only copper wire rated for 60/75 degree C or greater. The driver terminals are specifically designed to handle the recommended wire gauge with lug or ferrule terminations. See wiring diagrams for more details.

5.4 TRANSFORMERS

Isolating the driver from the facility power line with a transformer is recommended but not required. A transformer may be required to step down or step up the facility power line to meet the driver voltage specifications in **Section 2**.

If a transformer is used, select a transformer with the following characteristics:

- Isolation type.
- Load regulation less than 10%.
- Ability to provide 3 times rated current for 3 to 5 seconds without saturation.
- Ability to drive load with a power factor of 0.85.
- Primary or secondary taps to provide -10%; nominal; +10%; supply voltage.

To achieve maximum performance from the driver, the power input to the driver should be as close to nominal driver input voltage rating as possible. The facility line voltage varies through wide ranges in many parts of the world and it is recommended to match the nominal facility voltage to the nominal input voltage rating of the driver with a transformer. This gives the system the maximum operating range with facility line voltage fluctuations.

If the line voltage is too low, intermittent under voltage alarms may occur. A high line voltage will result in excessive regeneration dumping or intermittent over voltage alarms.

Buck boost transformers may be used to optimally match the facility line voltage to the driver line voltage rating. Buck boost transformers can be used with or without an isolation transformer. If buck boost transformers are used in conjunction with an isolation transformer, it is best to put the buck boost transformers on the primary side of the isolation transformer.

As a general rule the transformer rating can be calculated using the following formulas:

For single phase transformer:

$$\text{Transformer Capacity (VA)} = \frac{\text{Rated Mechanical Output (Watts)}}{0.7}$$

Where: Rated Mechanical Output is from Delta Package rating.
0.7 = motor/drive efficiency and single phase full wave rectifier factor

Example: Select transformer for a Delta-200HRA motor/drive package

$$\text{Transformer Capacity (VA)} = \frac{200}{0.7} = 285\ \text{VA}$$

For three phase transformer:

$$\text{Transformer Capacity (Watts)} = \frac{\text{Rated Mechanical Output (Watts)}}{0.85}$$

Where: Rated Mechanical Output is from Delta Package rating.
0.85 is motor/drive efficiency and three phase rectifier factor

5.4 TRANSFORMERS (cont'd)

Example: Select transformer for a Delta-6500HRA motor/drive package

$$\text{Transformer Capacity (VA)} = \frac{6500}{0.85} = 7647 \text{ VA}$$

One transformer can supply multiple motor/driver packages. Simply add the rated mechanical output of the motor/driver packages together and use the above formulas. If one transformer is used to supply multiple drivers, be sure to protect each driver with the appropriate circuit breaker or fuse.

IIS offers a full line of transformers for various line voltage and frequencies, enclosed and open frame types. Contact IIS Application Engineering Department for full details.

5.5 BRANCH CIRCUIT PROTECTION FOR CONTROL VOLTAGE R0,S0

The DSD-35 through DSD-115 requires a separate control voltage supply (R0 S0) for proper operation. The R0 S0 circuit is fused internal to the driver and need not be externally fused except to protect the control voltage wiring external to the driver using branch circuit protection guidelines. The control voltage circuit of multiple drivers can be fed from a single branch circuit.

5.6 WIRING PRACTICES AND GROUNDING

All wiring must conform to accept standards such as NEMA and NEC codes. Signal and low voltage I/O wires must be physical separated from high voltage wires by at least 12 inches or separated by a suitable barrier such as steel conduit or wiring trough separator.

The driver must be adequately grounded for proper operation and to provide personnel safety. The proper grounding technique is shown in **Figure 5.1** below.

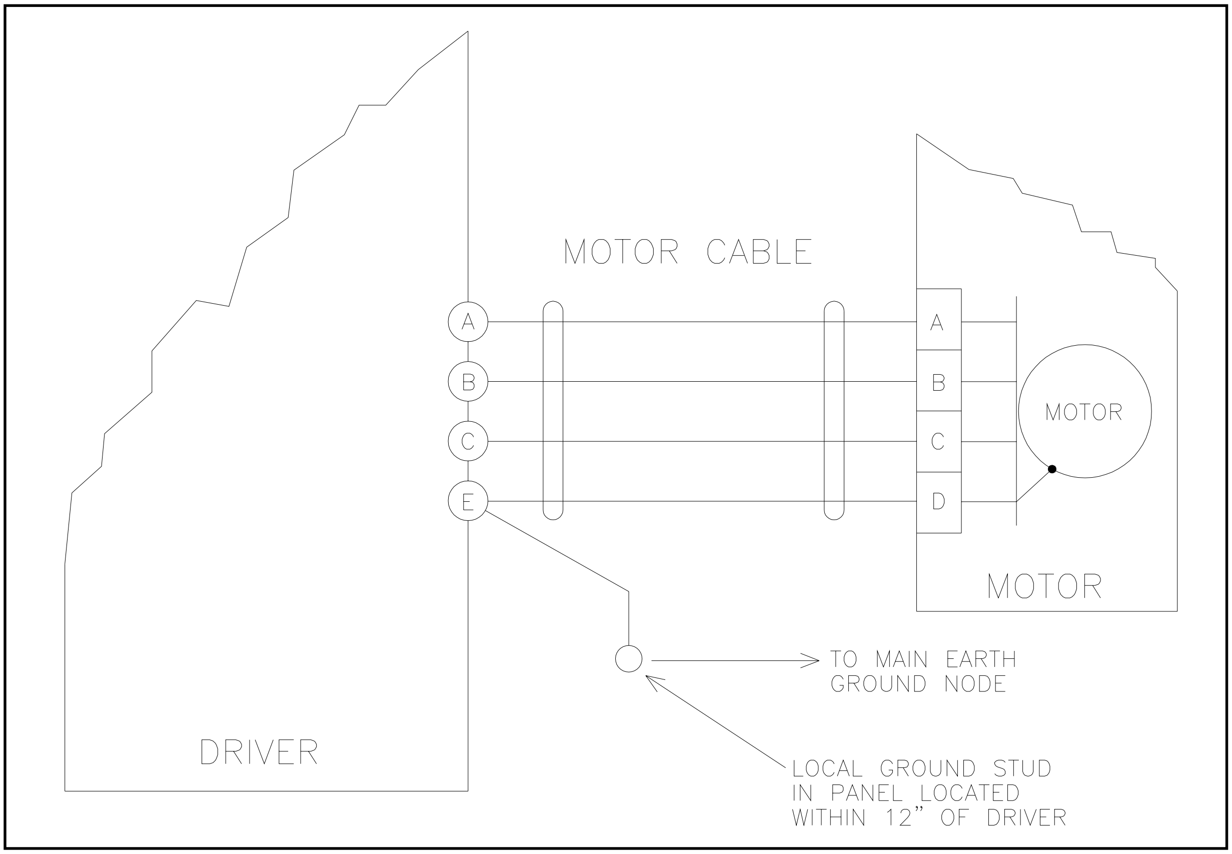


Figure 5.1 - Grounding Technique

> ****NOTE****
> **Multiple drivers can share a local ground stud if it is located within 12" of each drivers's (E) terminal. The ground symbol on each drive indicates that a connection must be made between the (E) terminal of the drive and earth ground.**

5.7 POWER SEQUENCING

The Delta drivers have provisions for power contactor sequencing. The power contactor is internal to the driver for the DSD-1.5, DSD-4.25, DSD-8.5 and DSD-17.5 sizes and external for the larger sizes. The sequencing of the power and control signals is shown in **Figures 5.2 and 5.3**.

If a mechanical brake or dynamic brake is used, the sequencing changes slightly. See **Sections 8 and 9** for details.

5.7 POWER SEQUENCING (cont'd)

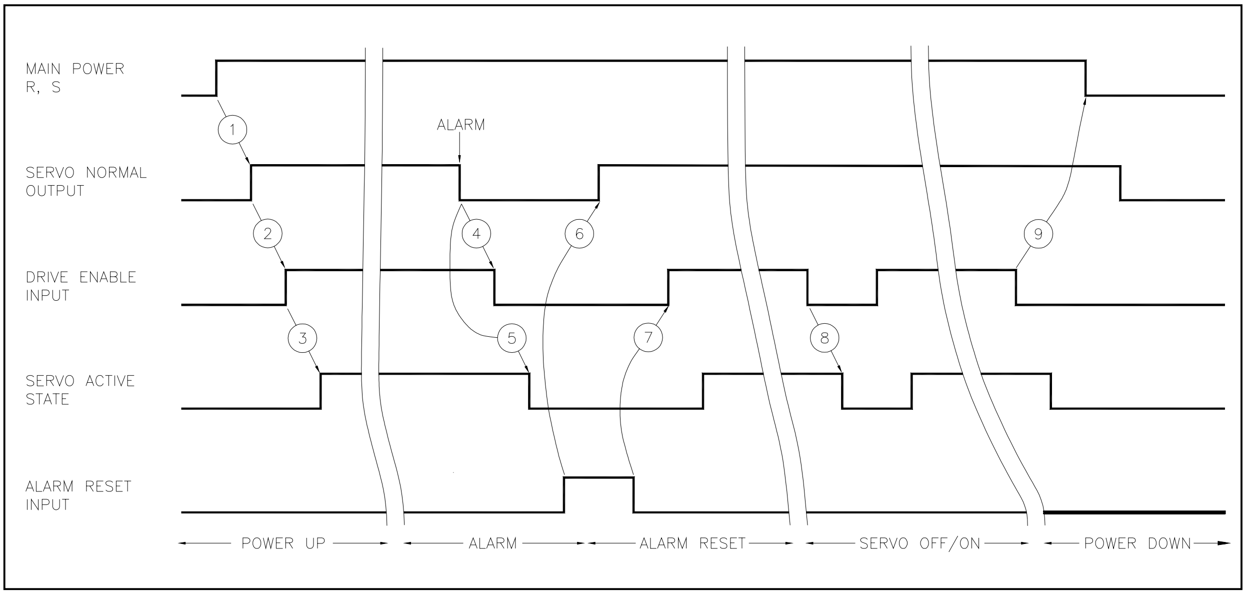


Figure 5.2 - Power and Control Signals for DSD-1.5 Through DSD-17.5 Drivers

1. At power application the driver initializes and does fault checks. If there are no faults, the SERVO NORMAL output will turn ON with a maximum delay of 2.5 seconds.
2. DRIVE ENABLE may be turned ON within 0.6 seconds of SERVO NORMAL.
3. The servo will become active within 800usec.
4. When an alarm is sensed, the SERVO NORMAL output is turned OFF and the DRIVE ENABLE must be turned OFF before alarm clearing can be accomplished.
5. The servo will become inactive within 800usec of the alarm.
6. ALARM RESET causes driver to check for clearing of the alarm condition and if all alarm states are clear, the SERVO NORMAL will turn ON within 30 ms.
7. ALARM RESET should be turned off before DRIVE ENABLE is turned ON.
8. The servo will become inactive within 800usec of DRIVE ENABLE being turned OFF.
9. DRIVE ENABLE should be turned off before the main power is removed to avoid an under voltage alarm, AL-03. Turning off main power while the DRIVE ENABLE is on will not damage the driver.

5.7 POWER SEQUENCING (cont'd)

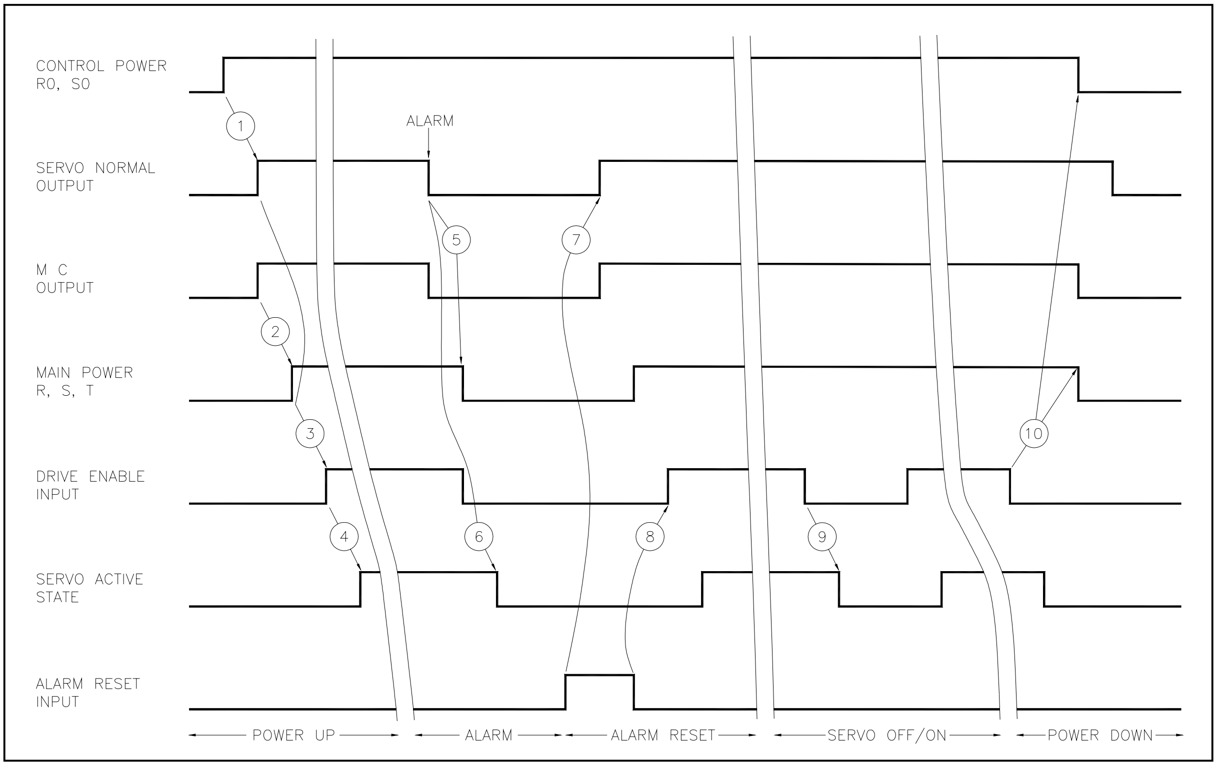
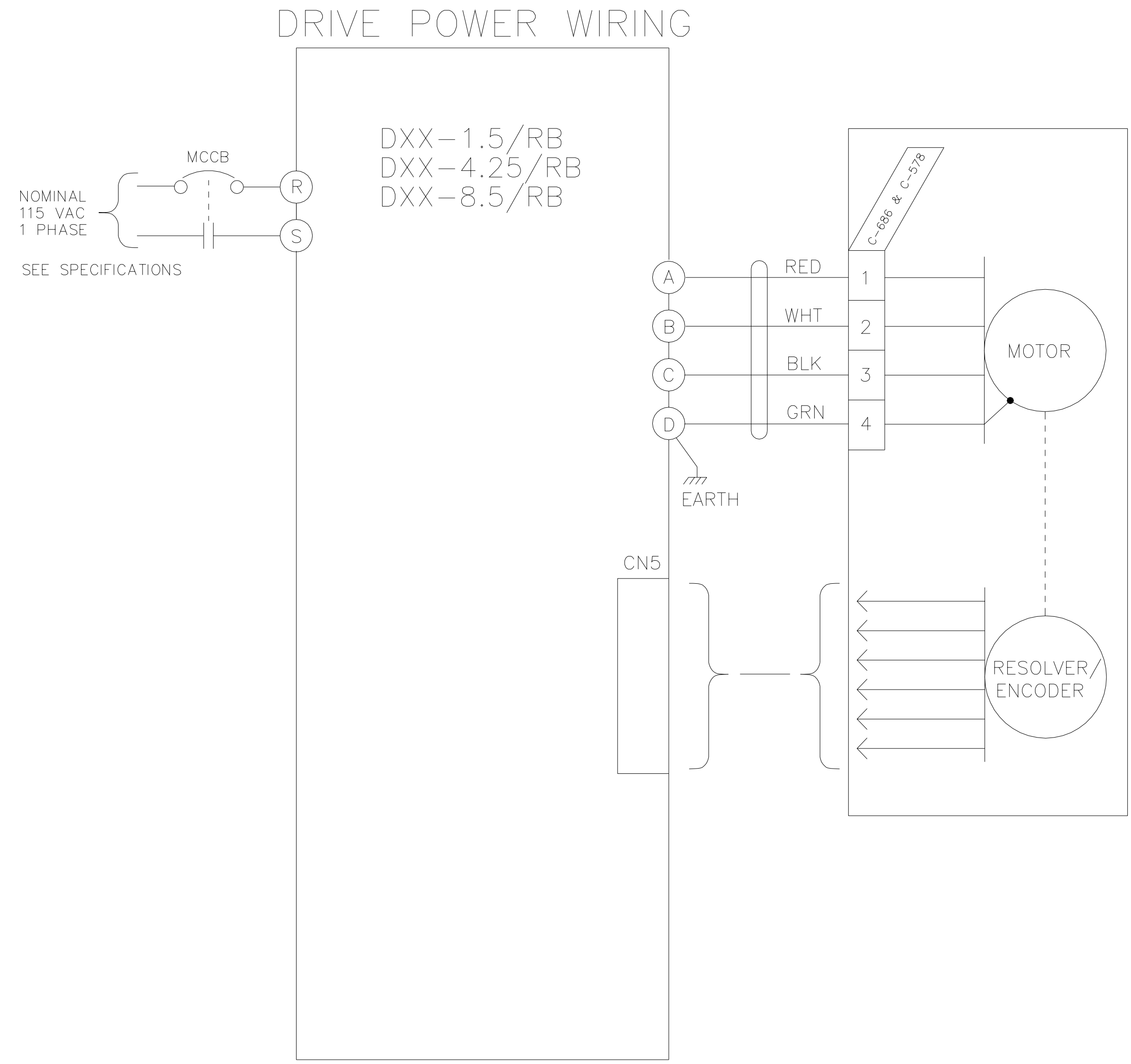


Figure 5.3 - Power and Control Signals for DSD-35 Through 115 Drivers

1. At power application the driver initializes and does fault checks. If there are no faults, the SERVO NORMAL and MC outputs will turn ON with a maximum delay of 2.5 seconds.
2. The main power is applied via the MC contactor.
3. DRIVE ENABLE may be turned ON within 0.6 seconds of SERVO NORMAL.
4. The servo will become active within 800usec.
5. When an alarm is sensed, the SERVO NORMAL and MC outputs are turned OFF. The DRIVE ENABLE must be turned OFF before alarm clearing can be accomplished.
6. The servo will become inactive within 800usec of the alarm.
7. ALARM RESET causes driver to check for clearing of the alarm condition and if all alarm states are clear, the SERVO NORMAL will turn ON within 30 ms.
8. ALARM RESET should be turned OFF before DRIVE ENABLE is turned ON.
9. The servo will become inactive within 800usec of DRIVE ENABLE being turned OFF.
10. DRIVE ENABLE should be turned off before the main power is removed to avoid an under voltage alarm, AL-03. Turning off main power while the DRIVE ENABLE is on will not damage the driver.

5.7 POWER SEQUENCING (cont'd)

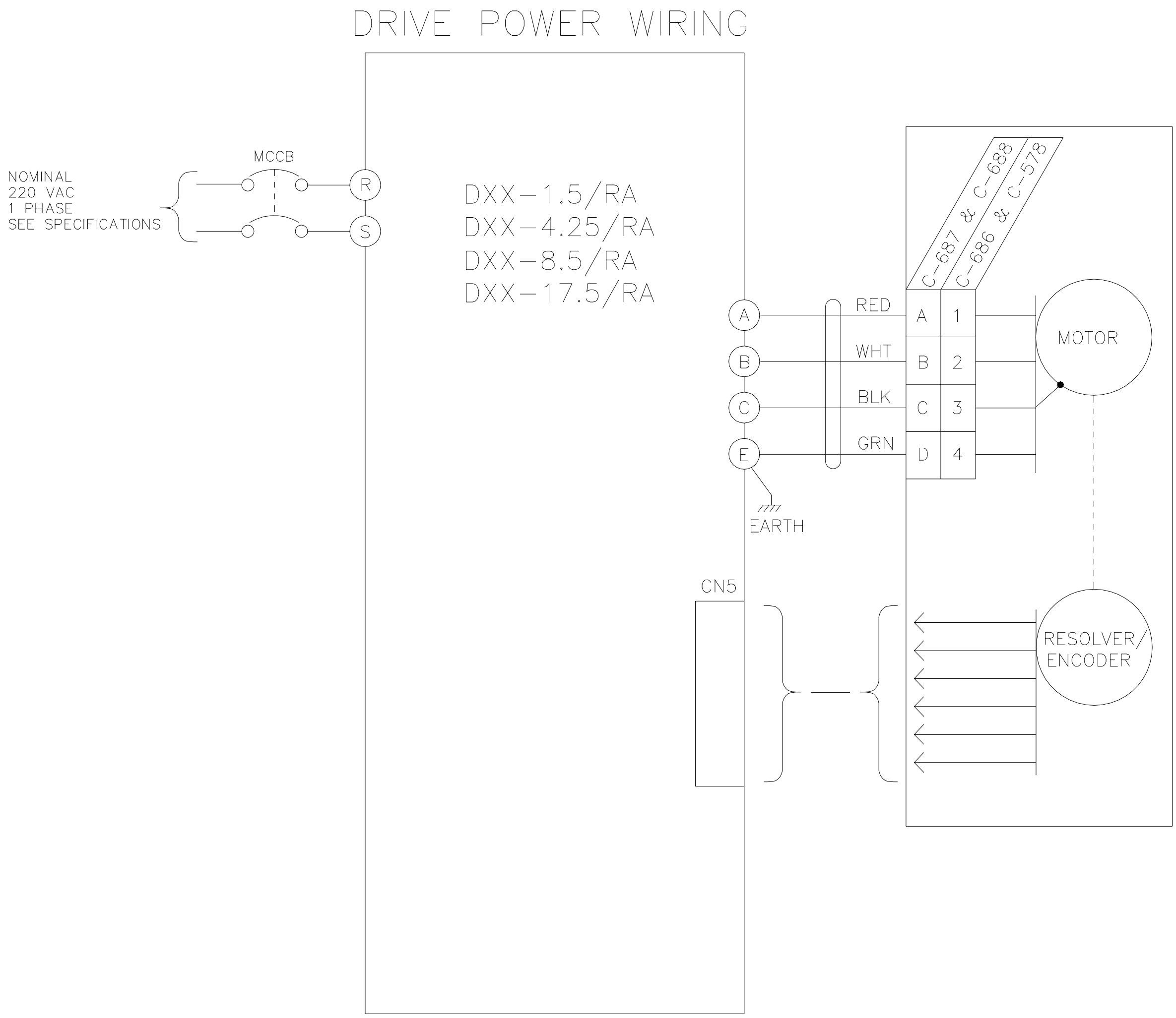


DRIVER	MCCB	R,S & EARTH CIRCUIT WIRE SIZE	REQUIRED TORQUE (LB-IN) ON POWER WIRING TERMINALS
DXX-1.5/RB DXX-4.25/RB	ABB-S271-K4NA 4 AMPS	14 AWG, 1.25 MM^2	12.00**
DXX-8.5/RB	ABB-S271-K8NA 8 AMPS	14 AWG, 1.25 MM^2	12.00**

** Field wiring connection shall be made by a UL LISTED and CSA Certified closed -loop terminal connector sized for the wire gauge involved. Connector must be fixed using the crimp tool specified by the connector manufacturer.

Figure 5.4 - DSD-1.5/RB Through DSD-8.5/RB Power Wiring

5.7 POWER SEQUENCING (cont'd)

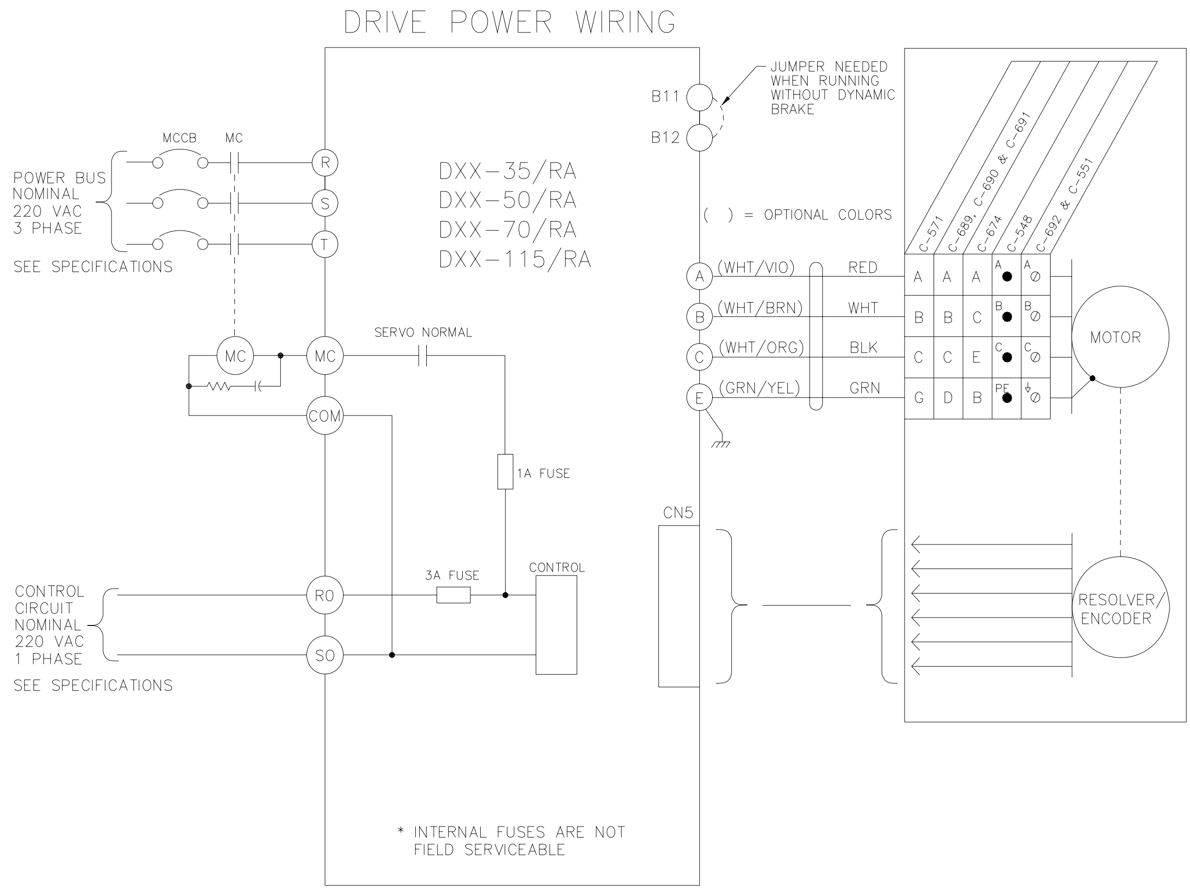


DRIVER	MCCB	R,S & EARTH CIRCUIT WIRE SIZE	REQUIRED TORQUE (LB–IN) ON POWER WIRING TERMINALS
DXX–1.5/RA & DXX–4.25/RA	(ABB) S272–K4	14 AWG, 1.25 MM^2	12.00**
DXX–8.5/RA	(ABB) S272–K8 (SQD) MG24448 8 AMPS	14 AWG, 1.25 MM^2	12.00**
DXX–17.5/RA	(ABB) S272–K16 (SQD) MG24451 16 AMPS	14 AWG, 1.25 MM^2	12.00**

** Field wiring connection shall be made by a UL LISTED and CSA Certified closed -loop terminal connector sized for the wire gauge involved. Connector must be fixed using the crimp tool specified by the connector manufacturer.

Figure 5.5 - DSD-1.5/RA Through DSD-17.5/RA Power Wiring

5.7 POWER SEQUENCING (cont'd)



DRIVER	MCCB	MC	R,S,T & EARTH CIRCUIT WIRE SIZE	RO, SO, MC, COM WIRE SIZE	REQUIRED TORQUE (LB-IN) ON POWER WIRING TERMINALS
DXX-35/RA	(ABB) S273-K16 (SQD) MG24468 16 AMPS	(SQD) LC1D18M7 W/ LAD4RCU	12 AWG, 2 MM^2	14 AWG, 1.25 MM^2	15.50
DXX-50/RA	(ABB) S273-K20 (SQD) MG24469 20 AMPS	(SQD) LC1D25M7 W/ LAD4RCU	12 AWG, 3.5 MM^2	14 AWG, 1.25 MM^2	15.50
DXX-70/RA	(ABB) S273-K32 (SQD) MG24471 30 AMPS	(SQD) LC1D32M7 W/ LAD4RCU	10 AWG, 5.5 MM^2	14 AWG, 1.25 MM^2	17.50**
DXX-115/RA	(ABB) S273-K63 (SQD) MG24474 63 AMPS	(SQD) LC1D65M7 W/ LA4DA2U	8 AWG, 16 MM^2	14 AWG, 1.25 MM^2	17.50**

** Field wiring connection shall be made by a UL LISTED and CSA Certified closed -loop terminal connector sized for the wire gauge involved. Connector must be fixed using the crimp tool specified by the connector manufacturer.

Figure 5.6 - DSD-35/RA Through DSD-115/RA Power Wiring