YASKAWA

GPD 515/G5 Drive
Technical Manual

Models: GPD515C- and CIMR-G5M Document Number: TM 4515

Section 1. RECEIVING AND INSTALLATION

1.1 GENERAL

The GPD 515/G5, hereafter referred to as the drive, is a general purpose sine-coded pulse width modulated AC motor drive which generates an adjustable voltage/frequency three phase output for complete speed control of most conventional squirrel cage induction motors. Automatic stall prevention and voltage boost prevents nuisance tripping during load or line side transient conditions. The drive will not induce any voltage line notching distortion back to the utility line and maintains a displacement power factor of not less than 0.98 throughout its speed range.

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

This manual primarily describes the GPD 515/G5, but contains basic information for the operator control station as well. This manual is equally applicable to drives labelled GPD 515 or G5.

1.2 RECEIVING

The drive is 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.

If the drive will be stored after receiving, keep it in its original packaging and store according to storage temperature specifications in Appendix 2.

1.3 PHYSICAL INSTALLATION

Location of the drive 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 moisture.
- Corrosive gases or liquids.
- Vibration, airborne dust or metallic particles.

When preparing to mount the drive, lift it by its base, ***never*** by the front cover. For effective cooling as well as proper maintenance, the drive must be installed on a flat, non-flammable vertical surface (wall or panel) using four mounting screws. There MUST be a MINIMUM 4.7 in. clearance above and below the drive to allow air flow over the heat sink fins. A minimum 1.2 in. clearance is required on each side on the drive.

A GPD 515/G5 in a free-standing floor-mount cabinet must be positioned with enough clear-ance for opening the door of the cabinet; this will ensure sufficient air space for cooling. Make sure air entering the drive is below 113°F (45°C) (for protected chassis drives), or below 104°F (40°C) (for NEMA 1 drives), by adding a fan or other cooling device, if needed. See environmental specifications in Appendix 2.

1.4 ELECTRICAL INSTALLATION

All basic interconnections (using the Digital Operator) are shown in Figures 1-3 and 1-4.

1.4.1 Main Circuit Input/Output

Complete wire interconnections according to Table 1-2, Figure 1-3 and Figure 1-4. Be sure to observe the following:

- Use 600V vinyl-sheathed wire or equivalent. Wire size and type should be determined by local electrical codes.
- Avoid routing power wiring near equipment sensitive to electrical noise.
- Avoid running input and output wiring in the same conduit.
- NEVER connect AC main power to output terminals T1(U), T2(V), and T3(W).
- NEVER allow wire leads to contact metal surfaces. Short-circuit may result.
- NEVER connect power factor correction capacitors to the drive output. Consult Yaskawa when connecting noise filters to the drive output.
- WIRE SIZING MUST BE SUITABLE FOR CLASS I CIRCUITS.
- When connecting motor to drive's output terminals, include a separate ground wire. Attach ground wire solidly to motor frame and to drive's ground terminal. ⏚
- When using armored or shielded cable for connection between drive and motor, solidly connect armor or shield to motor frame, and to drive's ground terminal. ⏚
- Motor lead length should NOT EXCEED 164 feet (50 meters), and motor wiring should be run in a separate conduit from other power wiring. If lead length must exceed this distance, reduce carrier frequency (see paragraph 5.8) and consult factory for proper installation procedures.
- Use UL listed closed loop connectors or CSA certified ring connectors sized for the selected wire gauge. Install connectors using the correct crimp tool recommended by the connector manufacturer.

WIRE SIZE		TERMINAL SCREW	CLOSED-LOOP CONNECTOR	CLAMPING TORQUE			
				STEEL		COPPER	
AWG	mm^2			lb-in	N-m	lb-in	N-m
20	0.5	M3.5	1.25 - 3.5	7.8	0.9	7.0	0.8
18	0.75	M4	1.25 - 4	13.0	1.5	10.4	1.2
16	1.25	M4	1.25 - 4	13.0	1.5	10.4	1.2
14	2	M4	2 - 4	13.0	1.5	10.4	1.2
		M5	2 - 5	26.1	20.9	3.1	2.4
12	3.5	M4	3.5 - 4	13.0	1.5	10.4	1.2
		M5	3.5 - 5	26.1	20.9	3.1	2.4
10	5.5	M4	5.5 - 4	13.0	1.5	10.4	1.2
		M5	5.5 - 5	26.1	20.9	3.1	2.4
8	8	M5	8 - 5	26.1	20.9	3.1	2.4
		M6	8 - 6	40.9	34.8	4.8	4.1
6	14	M6	14 - 6	40.9	34.8	4.8	4.1
4	22	M8	22 - 8	100.0	82.6	11.7	10.7
2	38	M8	38 - 8	100.0	82.6	11.7	10.7
		M10	38 - 10	182.6	156.5	21.4	18.4
1/0	60	M10	60 - 10	182.6	156.5	21.4	18.4
3/0	80	M10	80 - 10	182.6	156.5	21.4	18.4
4/0	100	M10	100 - 10	182.6	156.5	21.4	18.4
		M12	100 - 12	313.0	191.3	36.7	23.1
MCM300	150	M12	150 - 12	313.0	191.3	36.7	23.1
MCM400	200	M12	200 - 12	313.0	191.3	36.7	23.1
MCM650	325	M12	325 - 12	313.0	191.3	36.7	23.1
		M16	325 - 16	313.0	191.3	36.7	23.1

Table 1-1. Typical Wire Sizing For Main Circuit*

SECTION A. 230V					
NEW DRIVE MODEL NO. CIMR-G5M	OLD DRIVE MODEL NO. GPD515C–	TERMINAL SYMBOL	TERMINAL SCREW	WIRE SIZE	
				AWG	mm^2
20P41F 20P71F	A003, A006	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W), ⏚	M4	14 - 10	2 - 5.5
21P51F	A008	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	14 - 10	2 - 5.5
		⏚	M4	12 - 10	3.5 - 5.5
22P21F	A011	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W), ⏚	M4	12 - 10	3.5 - 5.5
23P71F	A017	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W), ⏚	M4	10	5.5
25P51F 27P51F	A025, A033	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M5	8	8
		⏚	M5	10 - 8	5.5 - 8
20111F	A049	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, ⊕3, T1 (U), T2 (V), T3 (W)	M6	4	22
		⏚	M6	8	8
20151F	A064	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, ⊕3, T1 (U), T2 (V), T3 (W)	M8	3	30
		⏚	M6	8	8
20181F 20221F	A080, A096	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, ⊕3, T1 (U), T2 (V), T3 (W)	M8	3	30
		⏚	M8	6	14
		ℓ1 (r), ℓ2 (𝓇)	M4	20 - 10	0.5 - 5.5
20300F	A130	L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), T3 (W)	M10	4/0	100
		⊖, ⊕3, ⏚	M8	4	22
		ℓ1 (r), ℓ2 (𝓇)	M4	20 - 10	0.5 - 5.5
20370F	A160	L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), T3 (W)	M10	1/0 x 2P	60 x 2P
		⊖, ⊕3, ⏚	M8	4	22
		ℓ1 (r), ℓ2 (𝓇)	M4	20 - 10	0.5 - 5.5
20550F	A224	L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), T3 (W)	M10	1/0 x 2P	60 x 2P
		⊖, ⊕3, ⏚	M8	3	30
		ℓ1 (r), ℓ2 (𝓇)	M4	20 - 10	0.5 - 5.5
20750F	A300	L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), T3 (W)	M12	4/0 x 2P	100 x 2P
		⊖, ⊕3, ⏚	M8	1	50
		ℓ1 (r), ℓ2 (𝓇)	M4	20 - 10	0.5 - 5.5

* Consult local electrical codes for wire sizing requirements.

Table 1-1. Typical Wire Sizing For Main Circuit - Continued*

Section B. 460V					
NEW DRIVE MODEL NO. CIMR-G5M	OLD DRIVE MODEL NO. GPD515C–	TERMINAL SYMBOL	TERMINAL SCREW	WIRE SIZE	
				AWG	mm^2
40P41F	B001	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W), ⏚	M4	14 - 10	2 - 5.5
40P71F 41P51F	B003, B004,	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	14 - 10	2 - 5.5
43P71F	B008	⏚	M4	12 - 10	3.5 - 5.5
44P01F 45P51F	B011, B014	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W), ⏚	M4	12 - 10	3.5 - 5.5
47P51F	B021	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W), ⏚	M4	8 - 6	8 - 14
40111F 40151F	B027, B034	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M5	8 - 6	8 - 14
		⏚	M6	8	8
40181F	B041	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, ⊕3, T1 (U), T2 (V), T3 (W)	M6	6	14
		⏚	M8	8	8
		ℓ1 (r), ℓ2 (↯)	M4	20 - 10	0.5 - 5.5
40221F	B052	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, ⊕3, T1 (U), T2 (V), T3 (W)	M6	4	22
		⏚	M8	8	8
		ℓ1 (r), ℓ2 (↯)	M4	20 - 10	0.5 - 5.5
40301F	B065	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, ⊕3, T1 (U), T2 (V), T3 (W)	M8	4	22
		⏚	M8	8	8
		ℓ1 (r), ℓ2 (↯)	M4	20 - 10	0.5 - 5.5
40371F	B080	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, ⊕3, T1 (U), T2 (V), T3 (W)	M8	3	30
		⏚	M8	6	14
		ℓ1 (r), ℓ2 (↯)	M4	20 - 10	0.5 - 5.5
40451F	B096	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, ⊕3, T1 (U), T2 (V), T3 (W)	M8	1	50
		⏚	M8	6	14
		ℓ1 (r), ℓ2 (↯)	M4	20 - 10	0.5 - 5.5
40551F	B128	L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), T3 (W)	M10	4/0	100
		⊖, ⊕3, ⏚	M8	4	22
		ℓ1 (r), ℓ2 200 (↯200), ℓ2 400 (↯400)	M4	20 - 10	0.5 - 5.5
40750F	B165	L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), T3 (W)	M10	1/0 x 2P	60 x 2P
		⊖, ⊕3, ⏚	M8	4	22
		ℓ1 (r), ℓ2 200 (↯200), ℓ2 400 (↯400)	M4	20 - 10	0.5 - 5.5
41100F	B224	L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), T3 (W)	M10	1/0 x 2P	60 x 2P
		⊖, ⊕3, ⏚	M8	3	30
		ℓ1 (r), ℓ2 200 (↯200), ℓ2 400 (↯400)	M4	20 - 10	0.5 - 5.5
41600F	B302	L1 (R), L2 (S), L3 (T), T1 (U), T2 (V), T3 (W)	M12	4/0 x 2P	100 x 2P
		⊖, ⊕3, ⏚	M8	1	50
		ℓ1 (r), ℓ2 200 (↯200), ℓ2 400 (↯400)	M4	20 - 10	0.5 - 5.5
41850F 42200F 43000F	B340, B450, B605	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕3, T1 (U), T2 (V), T3 (W)	M16	MCM650 x 2P	325 x 2P
		⏚	M8	1/0	60
		ℓ1 (r), ℓ2 200 (↯200), ℓ2 400 (↯400)	M4	20 - 10	0.5 - 5.5

* Consult local electrical codes for wire sizing requirements.

Table 1-1. Typical Wire Sizing For Main Circuit - Continued*

Section C. 600V					
NEW DRIVE MODEL NO. CIMR-G5M	OLD DRIVE MODEL NO. GPD515C–	TERMINAL SYMBOL	TERMINAL SCREW	WIRE SIZE	
				AWG	mm^2
51P51F 52P21F	C003, C004	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	14-10	2 - 5.5
		⏚			
53P71F	C006	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	14-10	2 - 5.5
		⏚		12-10	3.5-5.5
55P51F	C010	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	12-10	3.5-5.5
		⏚			
57P51F	C012	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	10	5.5
		⏚		12-10	3.5-5.5
50111F	C017	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M5	10-6	5.5-14
		⏚	M6		
50151F	C022	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M5	8-6	8-14
		⏚	M6	10-6	5.5-14
50181F 50221F	C027 C032	L1 (R), L2 (S), L3 (T), ⊖ ,⊕1, B1, B2, T1 (U), T2 (V), T3 (W)	M6	8-6	8-14
		⏚	◆	10-6	5.5-14
		ℓ1 (r), ℓ2(↻)	M4	14 - 10	2 - 5.5
50301F	C041	L1 (R), L2 (S), L3 (T), ⊖ ,⊕1, T1 (U), T2 (V), T3 (W)	M8	6-1/0	14-50
		⏚	◆	8-2	8-30
		ℓ1 (r), ℓ2(↻)	M4	14 - 10	2 - 5.5
50371F	C052	L1 (R), L2 (S), L3 (T), ⊖ ,⊕1, T1 (U), T2 (V), T3 (W)	M8	4-1/0	22-50
		⏚	◆	8-2	8-30
		ℓ1 (r), ℓ2(↻)	M4	14 - 10	2 - 5.5
50451F	C062	L1 (R), L2 (S), L3 (T), ⊖ ,⊕1, T1 (U), T2 (V), T3 (W)	M8	3-1/0	30-50
		⏚	◆	8-2	8-30
		ℓ1 (r), ℓ2(↻)	M4	14 - 10	2 - 5.5
50551F	C077	L1 (R), L2 (S), L3 (T), ⊖ ,⊕1, T1 (U), T2 (V), T3 (W)	M8	2-1/0	30-50
		⏚	◆	6-2	22-30
		ℓ1 (r), ℓ2(↻)	M4	14 - 10	2 - 5.5
50751F	C099	L1 (R), L2 (S), L3 (T), ⊖ ,⊕1, T1 (U), T2 (V), T3 (W)	M8	2/0-1/0	50-60
		⏚	◆	4-2	22-30
		ℓ1 (r), ℓ2(↻)	M4	14 - 10	2 - 5.5
50900F	C130	L1 (R), L2 (S), L3 (T), ⊖ ,⊕1, T1 (U), T2 (V), T3 (W)	M10	3/0-300	80-150
		⏚	◆	4-2/0	22-60
		ℓ1 (r), ℓ2(↻)	M4	14 - 10	2 - 5.5
51100F	C172	L1 (R), L2 (S), L3 (T), ⊖ ,⊕1, T1 (U), T2 (V), T3 (W)	M12	300-400	150-200
		⏚	◆	4-2/0	22-60
		ℓ1 (r), ℓ2(↻)	M4	14 - 10	2 - 5.5
51600F	C200	L1 (R), L2 (S), L3 (T), ⊖ ,⊕1, T1 (U), T2 (V), T3 (W)	M12	350-400	180-200
		⏚	◆	3-2/0	30-60
		ℓ1 (r), ℓ2(↻)	M4	14 - 10	2 - 5.5

* Consult local electrical codes for wire sizing requirements.

◆Indicates terminal uses a pressure lug.

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

SECTION A. 230V

TERMINAL	FUNCTION				
	New Model No. CIMR-G5M	20P41F - 27P51F	20111F - 20151F	20181F 20221F	20300F - 20750F
	Old Model No. GPD515C-	A003 - A033	A049 - A064	A080, - A096	A130 - A300
L1 (R) L2 (S) L3 (T)	Three phase Main circuit input power supply 200 / 208 / 220V at 50 Hz; 200 / 208 / 220 / 230V at 60 Hz				
T1 (U) T2 (V) T3 (W)	Three phase AC output to motor 0V to max. input voltage level				
B1 B2	DB Resistor terminals (B1 & B2)		– – – – – –		
⊖					
⊕1 ⊕2	DC Reactor terminals (⊕1 & ⊕2) DC Bus terminals (⊕1 & ⊖)				– – – – – –
⊕3	– – – – – –		DB Unit terminals (⊕3 & ⊖)		
ℓ_1 (r) ℓ_2 (t)	– – – – – –			Power for heat sink fan: ℓ_1 to ℓ_2 : 230 VAC	
⏚	Ground terminal (100 ohms or less)				

SECTION B. 460V

TERMINAL	FUNCTION			
	New Model No. CIMR-G5M	40P41F - 40151F	40181F - 40451F	40551F - 43000F
	Old Model No. GPD515C-	B001 - B034	B041 - B096	B128 - B605
L1 (R) L2 (S) L3 (T)	Three phase Main circuit input power supply 380 / 400 / 415 / 460V at 50/60 Hz			
T1 (U) T2 (V) T3 (W)	Three phase AC output to motor 0V to max. input voltage level			
B1 B2	DB Resistor terminals (B1 & B2)		– – – – – –	
⊖				
⊕1 ⊕2	DC Reactor terminals (⊕1 & ⊕2) DC Bus terminals (⊕1 & ⊖)			– – – – – –
⊕3	– – – – – –		DB Unit terminals (⊕3 & ⊖)	
ℓ_1 (r) ℓ_2 (t) ℓ_2 200 (t200) ℓ_2 400 (t400)	– – – – – –		Power for heat sink fan: ℓ_1 to ℓ_2 : 230 VAC – – – – – –	Power for heat sink fan: ℓ_1 to ℓ_2 200: 230 Vac ℓ_1 to ℓ_2 400: 460 Vac
⏚			Ground terminal	

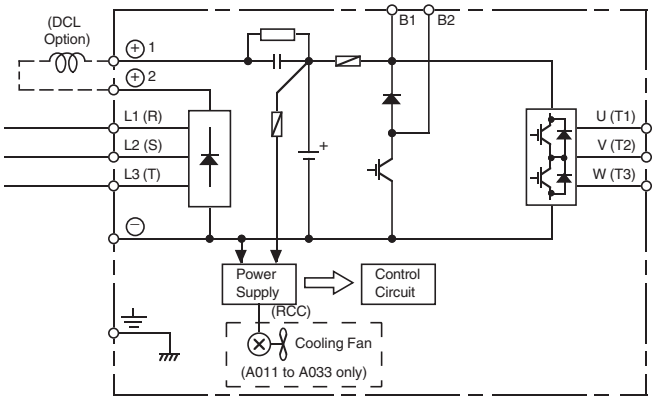
– – – – – indicates that terminals are not present.

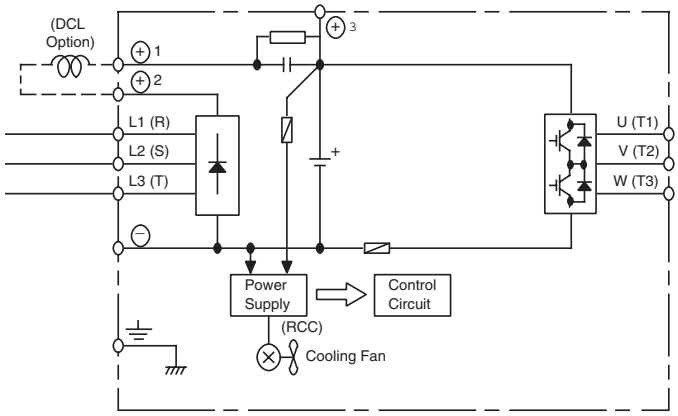
Table 1-2. Terminal Functions and Voltages of Main Circuit

SECTION C. 600V				
TERMINAL	FUNCTION			
	New Model No. CIMR-G5M	51P51F - 50151F	50181F - 50221F	50301F - 51600F
	Old Model No. GPD515C-	C003 - C022	C027 - C032	C041 - C200
L1 (R) L2 (S) L3 (T)	Three phase Main circuit input power supply 500 / 575 / 600V at 50 Hz / 60HZ			
T1 (U) T2 (V) T3 (W)	Three phase AC output to motor 0V to max. input voltage level			
B1 B2	DB Resistor terminals (B1 & B2)			----------
⊖				
⊕1 ⊕2	DC Reactor terminals (⊕1 & ⊕2) DC Bus terminals (⊕1 & ⊖)		DB Units terminals (⊕1 & ⊖) (C041 to C200 only) DC Bus terminals (⊕1 & ⊖)	
ℓ_1 (r) ℓ_2 (s)	----------		Power for heat sink fan: ℓ_1 to ℓ_2 : 600 VAC	
⏚	Ground terminal (100 ohms or less)			

Main Circuit Configuration Block Diagrams 230V

CIMR-G5M20P41F to 27P51F
GPD515C-A003 to -A033

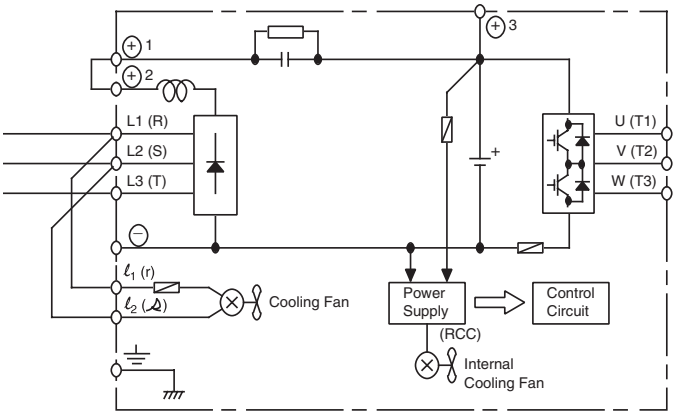


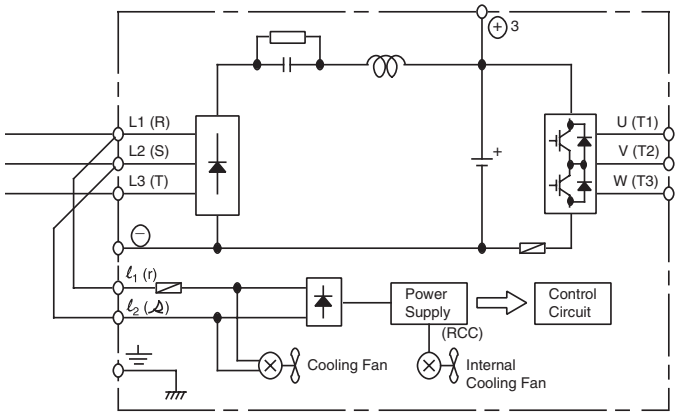


CIMR-G5M20111F to 20151F
GPD515C-A049 to -A064

CIMR-G5M20181F, 20221F
GPD515C-A080, -A096

When using DC input as main circuit power, connect 230Vac to control power transformer terminals ℓ (r) and ℓ (s).



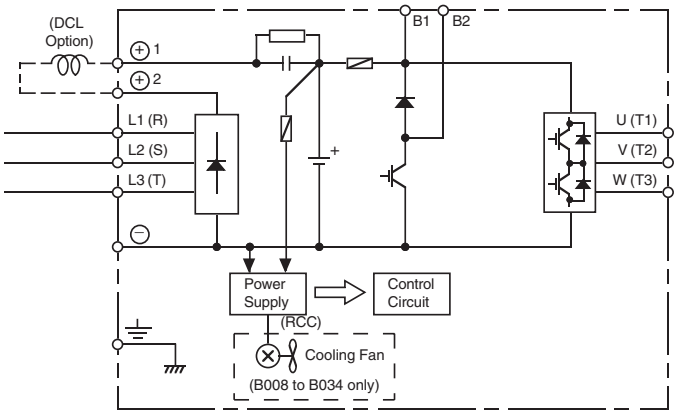


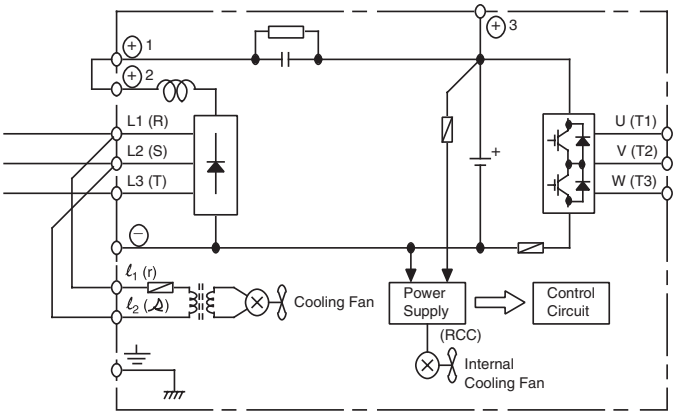
CIMR-G5M20300F to 20750F
GPD515C-A130 to -A300

When using DC input as main circuit power, connect 230Vac to control power transformer terminals ℓ (r) and ℓ (s).

Main Circuit Configuration Block Diagrams 460V

CIMR-G5M40P41F to 40151F
GPD515C- B001 to - B034



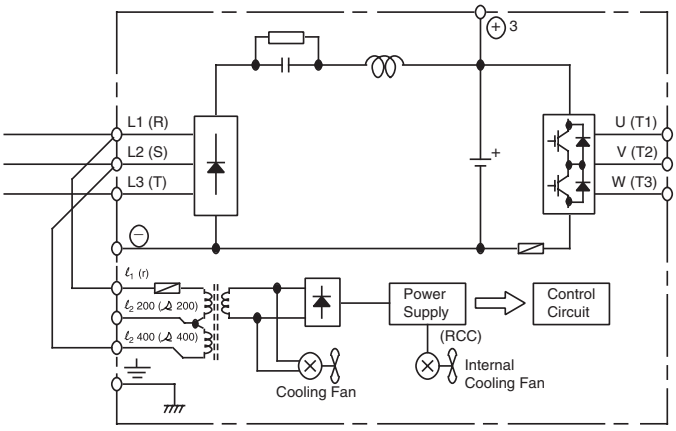


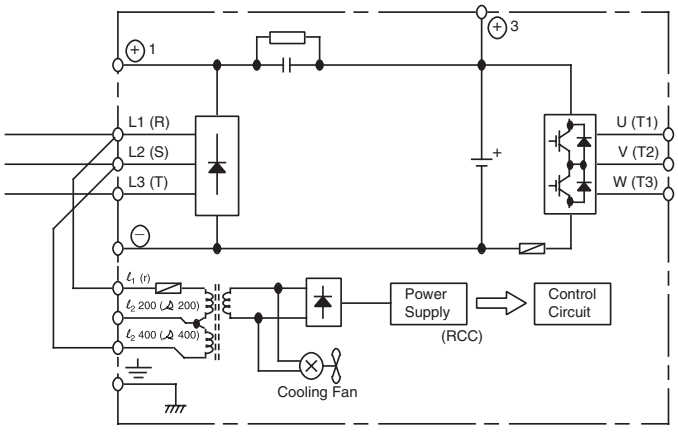
CIMR-G5M40181F to 40451F
GPD515C- B041 to - B096

When using DC input as main circuit power, connect 460Vac to control power transformer terminals ℓ_1 (r) and ℓ_2 (s).

CIMR-G5M40551F to 41600F
GPD515C- B128 to - B302

When using DC input as main circuit power, connect 460Vac to control power transformer terminals ℓ_1 (r) and ℓ_2 400 (s400).





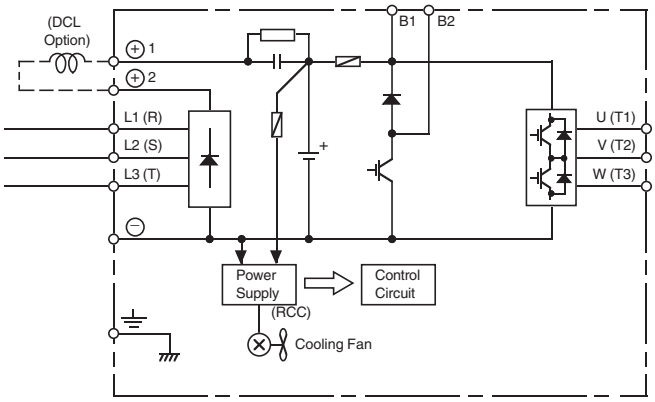
CIMR-G5M41850F to 43000F
GPD515C- B340 to - B605

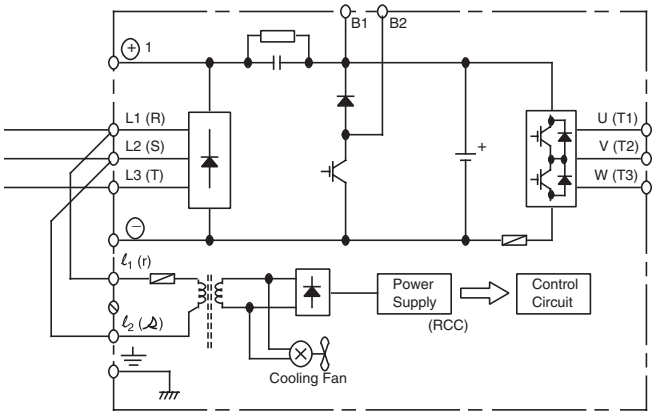
When using DC input as main circuit power, connect 460Vac to control power transformer terminals ℓ_1 (r) and ℓ_2 400 (s400).

Main Circuit Configuration Block Diagrams 600V

CIMR-G5M51P51F to 50151F
GPD515C- C003 to - C022

When using DC input as main circuit power, connect 600Vac to control power transformer terminals r and s.



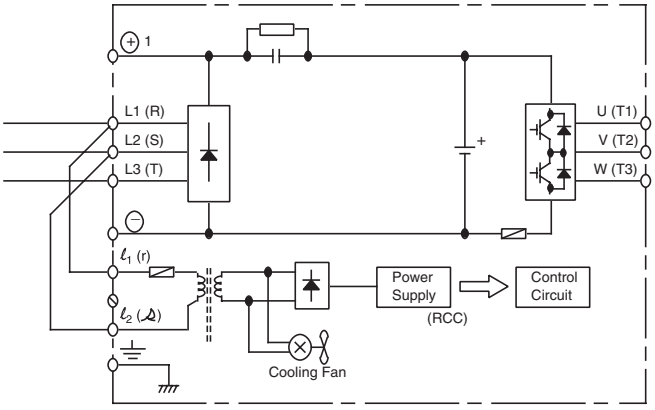


CIMR-G5M50181F to 50221F
GPD515C-C027 to -C032

When using DC input as main circuit power, connect 600Vac to control power transformer terminals r and s.

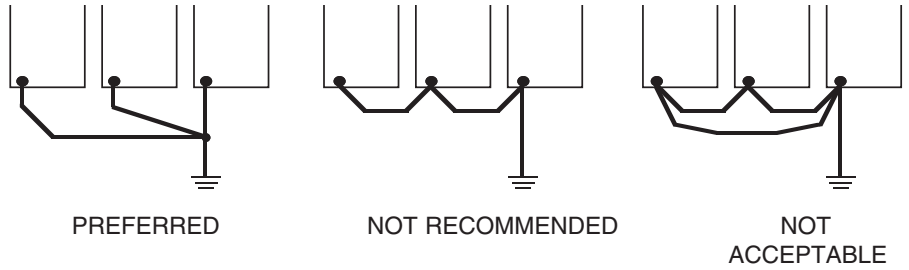
CIMR-G5M50301F to 51600F
GPD515C-C041 to -C200

When using DC input as main circuit power, connect 600Vac to control power transformer terminals r and s.

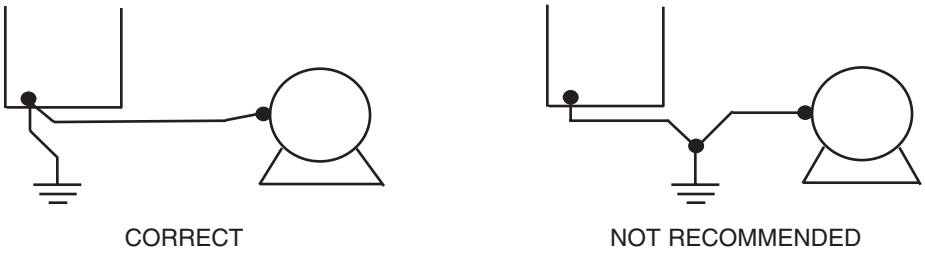


1.4.2 Grounding

- The drive must be solidly grounded using the main circuit ground terminal. ⏚
- If Drive is installed in a cabinet with other equipment, ground leads for all equipment should be connected to a common low-impedance ground point within the cabinet.
- The supply neutral should be connected to the ground point within the cabinet.
- Select appropriate ground wire size from Table 1-1.
- Make all ground wires as short as practical.
- NEVER ground the drive in common with welding machines or other high power electrical equipment.
- Where several drives are used, ground each directly to the ground point (see Figure 1-1). DO NOT FORM A LOOP WITH THE GROUND LEADS.
- When connecting a motor to the drive's output terminals, include a separate ground wire. Attach ground wire solidly to motor frame and to drive's ground terminal. ⏚
- When using armored or shielded cable for connection between drive and motor, solidly connect armor or shield to motor frame, and to the drive's ground terminal. ⏚



A. Grounding of Three Drives



B. Grounding of Drive & Vector Control Motor (VCM)

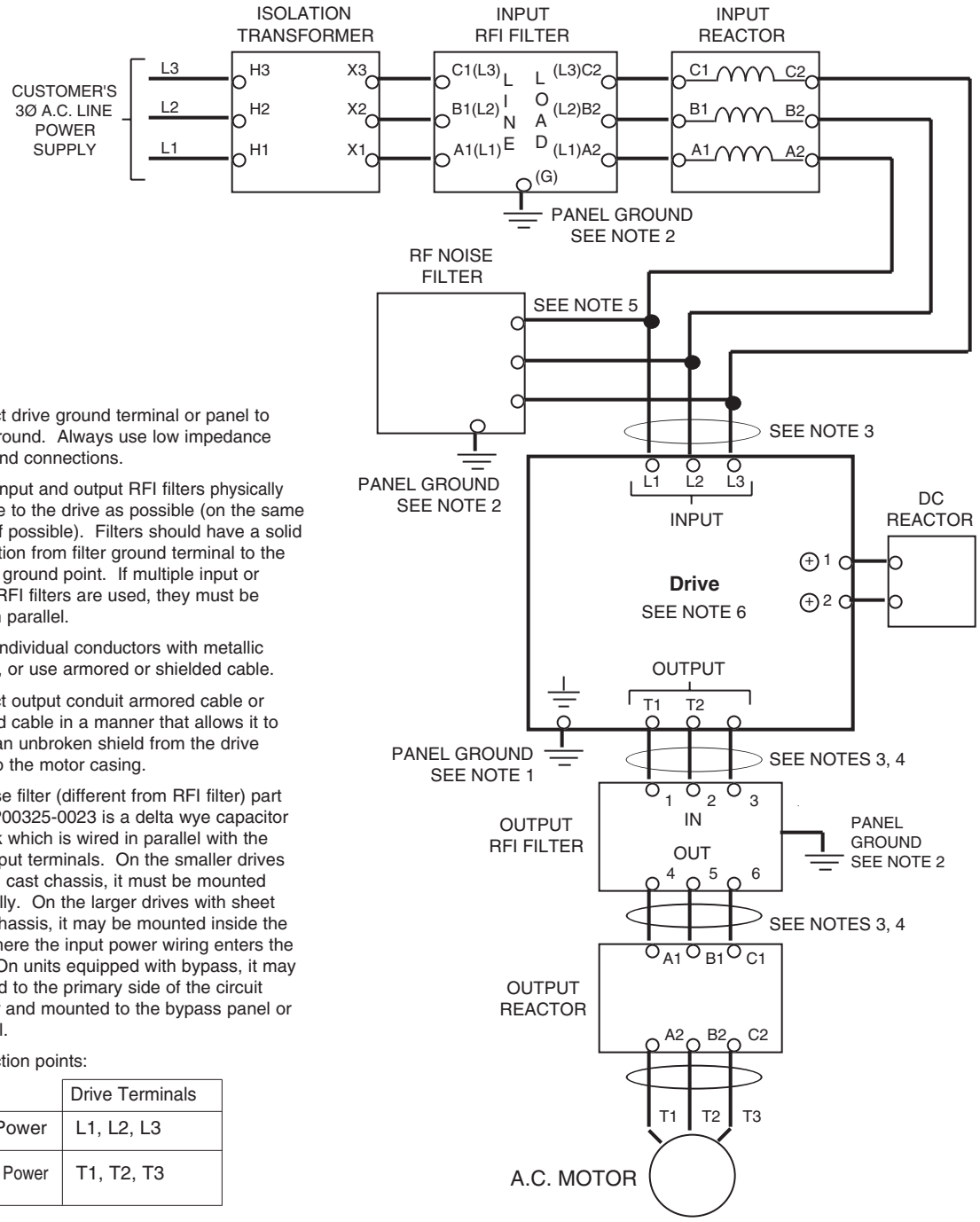
Figure 1-1. Grounding

1.4.3 Auxiliary Input and Output Power Option Devices

A disconnect device (circuit breaker, contactor, disconnect switch, etc.) should NOT be used as a means of starting and stopping the drive or motor.

A disconnect device can be installed for emergency stop purposes, but when that disconnect device is opened, there may be loss of electrical braking.

Figure 1-2 is a factory guideline for proper wiring practices and relative locations within the electrical path from the line to the load. It does not imply what devices are needed for a particular application, nor does it show what devices were shipped with a particular order. Therefore, disregard those items in the diagram which are not being used in your installation. However, it ***is*** recommended that an input or DC reactor be used with models GPD515C-A003 thru -A064 (CIMR-G5M20P41F thru 20151F), -B001 thru -B034 (40P41F thru 40151F) , and -C003 thru -C062 (51P51F thru 51451F) when wired to a source of 600 kVA or greater. Mount all optional power devices close to the drive, and keep electrical connections as short as possible.



NOTES

1. Connect drive ground terminal or panel to earth ground. Always use low impedance paths and connections.
2. Mount input and output RFI filters physically as close to the drive as possible (on the same panel, if possible). Filters should have a solid connection from filter ground terminal to the cabinet ground point. If multiple input or output RFI filters are used, they must be wired in parallel.
3. Shield individual conductors with metallic conduit, or use armored or shielded cable.
4. Connect output conduit armored cable or shielded cable in a manner that allows it to act as an unbroken shield from the drive panel to the motor casing.
5. RF noise filter (different from RFI filter) part no. 05P00325-0023 is a delta wye capacitor network which is wired in parallel with the drive input terminals. On the smaller drives with die cast chassis, it must be mounted externally. On the larger drives with sheet metal chassis, it may be mounted inside the area where the input power wiring enters the drive. On units equipped with bypass, it may be wired to the primary side of the circuit breaker and mounted to the bypass panel or sidewall.
6. Connection points:

	Drive Terminals
Input Power	L1, L2, L3
Output Power	T1, T2, T3

Figure 1-2. Customer Connection Diagram For Isolation Transformers, Input Reactors, Input RFI Filters, DC Reactors, Output Reactors and Output RFI FIlters

1.4.3a Conformance to European EMC Directive

In order to conform to EMC standards, the following methods are required for line filter application, cable shielding and drive installation. The following explains the outline of the methods.

The line filter and the drive must be mounted on the same metal plate. The filter should be mounted as close to the drive as practical. The cable must be kept as short as possible and the metal plate should be securely grounded. The ground of the line filter and the drive must be bonded to the metal plate with as much bare-metal contact as possible.

For main circuit input cables, a screened cable is recommended within the panel, and is also suggested for external connections. The screen of the cable should be connected to a solid ground. For the motor cables, a screened cable (max. 20 m) must be used and the screen of the motor cable should be connected to ground at both ends by a short connection, again using as much bare-metal contact as possible.

For more detailed explanation, refer to document EZZ006543, “Installation Guidelines For EMC Directive using Yaskawa AC Drive Products.”

Table 1-2.1 and Figure 1-2A show the line filter list for EMC standards and the installation/wiring of the drive and line filter.

Table 1-2.1. Line Filters for Drive

New Drive Model Number CIMR-G5M	Old Drive Model Number GPD 515C-	Line Filter			
		Part Number 05P00325-	Rated Current (A)	Mass (kg)	Dimensions in mm(1) L x W x D (2)
40P41F, 40P71F	B001, B003	0106	8	1.8	320 x 143 x 46
41P51F, 43P71F, 44P01F	B004, B008, B011	0103	20	1.8	320 x 143 x 46
45P51F, 47P51F	B014, B021	0104	30	3.0	350 x 213 x 51
40111F, 40151F	B027, B034	0105	60	5.3	435 x 268 x 56
40181F, 40221F	B041, B052	0107	80	7.5	350 x 180 x 90
40301F	B065	0108	100	13.8	420 x 200 x 130
40371F	B080	0109	150	13.8	480 x 200 x 160
40451F	B096	0110	160	25	480 x 200 x 160
40551F	B128	0111	180	25	480 x 200 x 160
40750F, 41100F	B165, B224	0112	300	25	480 x 200 x 160
41600F	B302	0113	400	45	588 x 250 x 200
41850F	B340	0119	500	Consult Factory	
42200F	B450	0120	600		
43000F	B605	0121	900		

(1) 1mm = 0.0394 inches
(2) D is the distance the filter will extend outward from the surface of the metal plate.

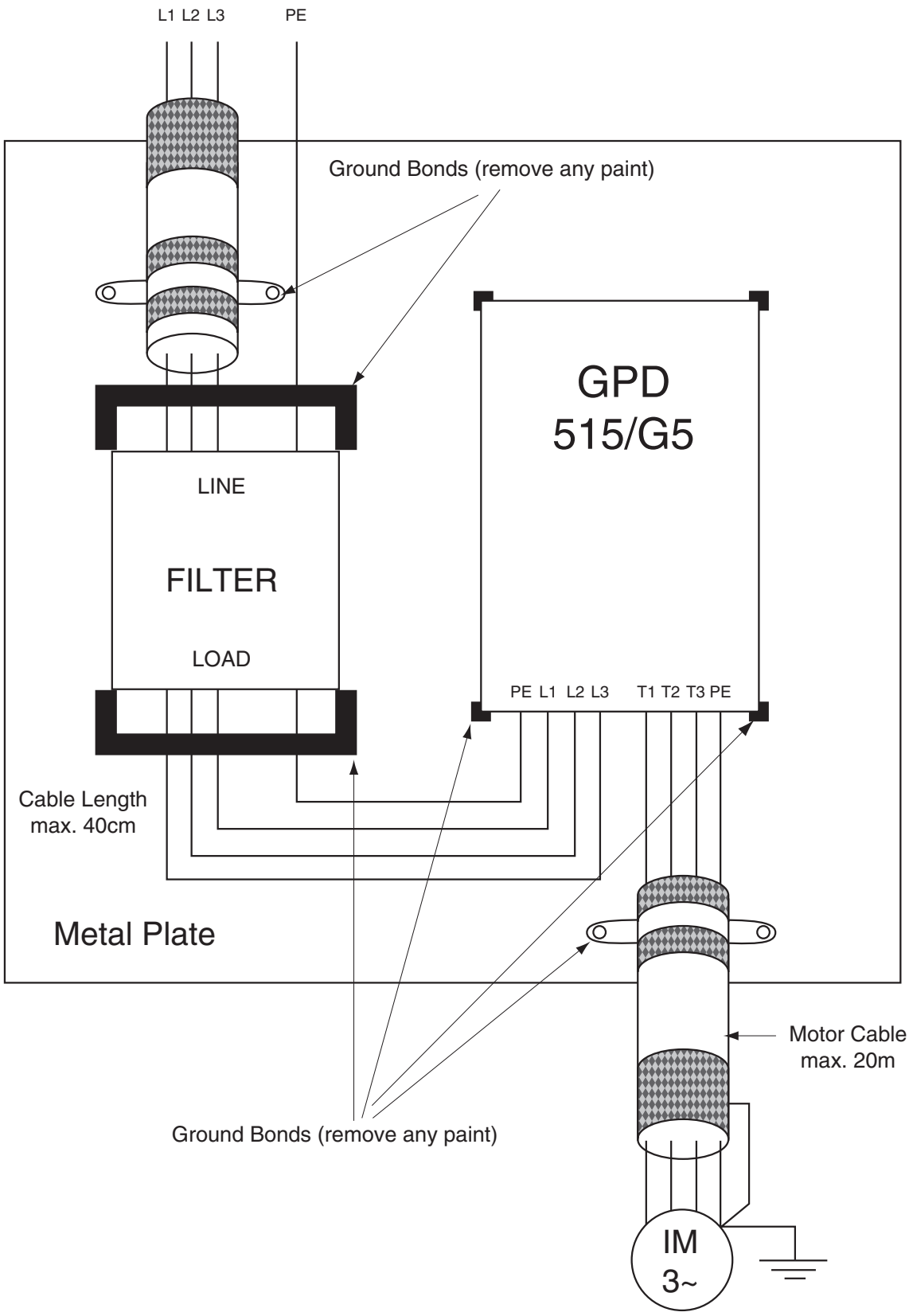


Figure 1-2A. Installation of Line Filter and GPD 515/G5

1.4.4 Control Circuit

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

- Interconnections for external two-wire control in combination with the Digital Operator are shown in Figure 1-3.
- Interconnections for external three-wire control in combination with the Digital Operator are shown in Figure 1-4.

Make wire connections according to Figures 1-3, 1-4 and Table 1-3; observe the following:

- Signal Leads: Terminals 1-8 & 11; 12-17 & 33; and 21-27.
- Control Leads: Terminals 9 & 10 and 18-20.
- Use twisted shielded or twisted-pair shielded wire (20-16 AWG [0.5 – 1.25mm2]) for control and signal circuit leads. The shield sheath MUST be connected at the drive end ONLY (terminal 12). The other end should be dressed neatly and left unconnected (floating). See Figure 1-2B.
- Signal leads and feedback leads (PG) must be separated from control leads main circuit leads and any other power cables to prevent erroneous operation caused by electrical noise.
- Lead length should NOT EXCEED 164 feet (50 meters). Wire sizes should be determined considering the voltage drop.
- All AC relays, contactors and solenoids should have RC surge supressors installed across their coils.
- All DC relays, contactors and solenoids should have diodes installed across their coils.

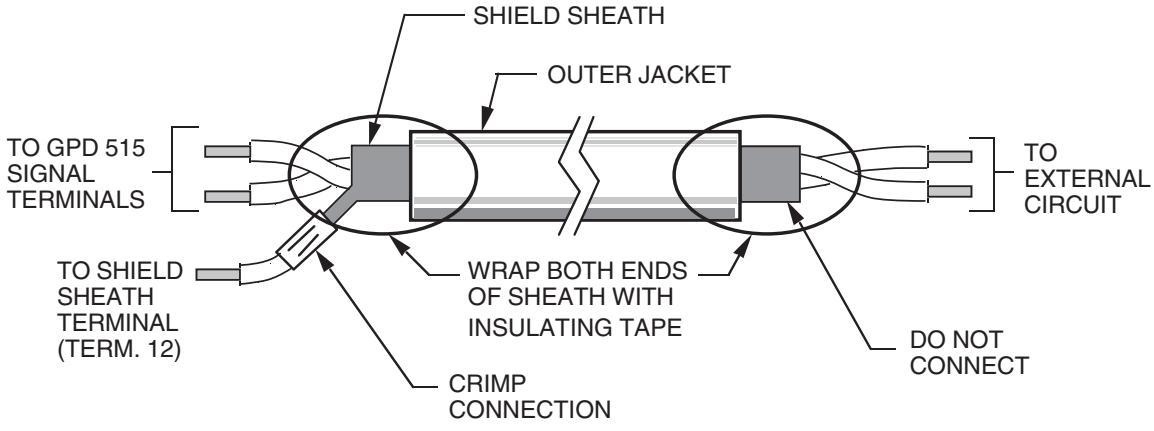


Figure 1-2B. Shielded Sheath Termination

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

TERMINAL	FUNCTIONS		DESCRIPTION / SIGNAL LEVELS
1	2-WIRE CONTROL: Forward Run / Stop signal (See NOTE 1)		Run at closed, stop at open (See NOTE 2)
	3-WIRE CONTROL: Run signal		Run at closed (See NOTE 2)
2	2-WIRE CONTROL: Reverse Run / Stop signal (See NOTE 1)		Run at closed, stop at open (See NOTE 2)
	3-WIRE CONTROL: Stop signal		Stop at open (See NOTE 2)
3	External fault input		Fault at closed (see NOTES 2 & 3). When the External Fault input is applied, the drive's Fault relay trips (shutdown) and the motor coasts to a stop. The Digital Operator displays " **EF3** " failure.
4	Fault Reset input (external)		Fault Reset at closed (see NOTES 2 & 3). The Fault Reset input will reset the Fault relay, if the drive is in "stopped" condition. Both Forward Run/Stop signal and Reverse Run/Stop signal must be OPEN.
5	Multi-step Speed Reference 1		Effective when closed (See NOTES 2 & 3)
6	Multi-step Speed Reference 2		Effective when closed (See NOTES 2 & 3)
7	Jog Reference		Run at preset jog frequency when closed
8	External baseblock		Drive output stops when closed
9, 10	Multi-function contact output (N.O.). One of 18 functions are available, by setting of parameter **H2-01** .		Contact capacity: 250 Vac at 1A or less 30 Vdc at 1A or less
11	Sequence control input common for terminals 1-8.		Sequence control input 0 V
12	Connection for shield sheath of signal leads		– – – –
13	Frequency reference analog input (voltage); auto input – can be changed to manual by setting of parameter **H3-01** .		0 to +10V (20K ohms) –10 to +10V (20K ohms)
14	Frequency reference analog input (current); can be changed to voltage input by setting of parameter **H3-08** and cutting jumper J1.		4-20mA (250 ohms)
15	Frequency reference power supply		+15V (Control power supply for frequency setting: max 20 mA)
17	Frequency reference analog input common		0 V
18	Multi-function contact output (N.O./N.C.).	Closed at fault	Contact capacity: 250 Vac at 1A or less 30 Vdc at 1A or less
19		Open at fault	
20		Common	

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

TERMINAL	FUNCTIONS		DESCRIPTION / SIGNAL LEVELS
21	Multi-function analog monitor 1 (+)	Output current or output frequency is selectable	Type of analog signal (operation parameter) to be output is selected by setting of parameters **H4-01** and **H4-04** . Monitor output: 0 to +11V; 2 mA maximum
22	Multi-function analog monitor (–)		
23	Multi-function analog monitor 2 (+)		
25	Multi-function open collector output 1	One of 18 functions available, by setting of parameters **H2-02** and **H2-03** .	Photocoupler insulation output: +48V, 50 mA maximum
26	Multi-function open collector output 2		
27	Multi-function open collector output common		0V
33	Frequency reference power supply		–15V Control power supply for frequency setting: max 20 mA

NOTES:

1. When Forward Run and Reverse Run inputs are both closed for more than 500 ms, the Digital Operator displays a blinking " **EF** " alarm code and the motor (if rotating) is decelerated by the drive to a stop. This stop condition is not stored by the drive (on Digital Operator, red LED at **STOP** key does not light); **IF ONE OF THE INPUTS IS OPENED, THE MOTOR WILL IMMEDIATELY START UP AGAIN.**

2. Terminals 1-8 source +24 Vdc (8mA max.) and operate in a Low = True (ON) configuration when connected to terminal 11.

   When using relays for input to terminals 1-8, use relays with highly reliable contacts (for very small current) with a capacity of 30 Vdc or more and rated current of 100mA or higher. When using transistor (open collector) input, use transistors with rated voltage of 35 Vdc or more and rated current of 100mA or more.

3. These terminals are multi-function inputs. The indicated functions are their settings, based on a 2-Wire reset. For 3-Wire reset definitions, and other settings, see descriptions for "Multi-Function Input Terminals", parameters **H1-01** thru **H1-06** , in paragraph 5.32.

1.4.5 Interconnection – 2-Wire Control Operation - Figure 1-3.

Notes referred to in figure 1-3.

✱ – Indicates components not supplied.

✱✱– Branch circuit protection (circuit breaker or input fuses) must be supplied by customer.

□ – Indicates customer connection terminal. Wire only to terminals shown. Note that not all terminals shown are available in all ratings – see Tables 1-1 and 1-2.

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

▲ – Function labels shown for these terminals are determined by factory settings of parameters **H1-01** through **H1-06**. See paragraph 5.32.

● – Function labels shown for these terminals are determined by factory settings of parameters **H2-01** through **H2-03**. See paragraph 5.33.

♦ – Function labels shown for these terminals are determined by factory settings of parameters **H3-01**, **-04**, **-05**, **-08**, & **-09**. See paragraphs 5.19 & 5.30.

■ – Function labels and signal levels shown for these terminals are determined by factory settings of parameters **H4-01** & **H4-04**. See paragraph 5.31.

1. If only a remote Manual Speed pot (1RH) is used, 3SS is not needed; in that case, a jumper must be added between terminals 5 and 11. This jumper will override both the Auto and Digital Operator frequency references, regardless of the programming of parameter **b1-01**. If you are using a remote speed command or the Digital Operator, DO NOT install this jumper. See paragraph 5.19.

2. The Drive Electronic Thermal Overload function (parameters **L1-01**, **L1-02**) meets standards set by UL and cUL for motor thermal overload protection. If local code requires separate mechanical overload protection, an overload relay should be installed, interlocked with the drive 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. (Belden #8760 or equivalent). 3-conductor #18 GA. (Belden #8770 of equivalent). Connect shield ONLY AT DRIVE END. Stub and isolate other end.

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

5. Customer to connect terminal ⏚ to earth ground (100 Ω or less, 230V; 10 Ω or less, 460V and 600V).

6. Wire only one of the inputs as an Auto Reference. If **H3-09** is set to " 1F ", terminals 13 and 14 are added for the internal frequency reference.

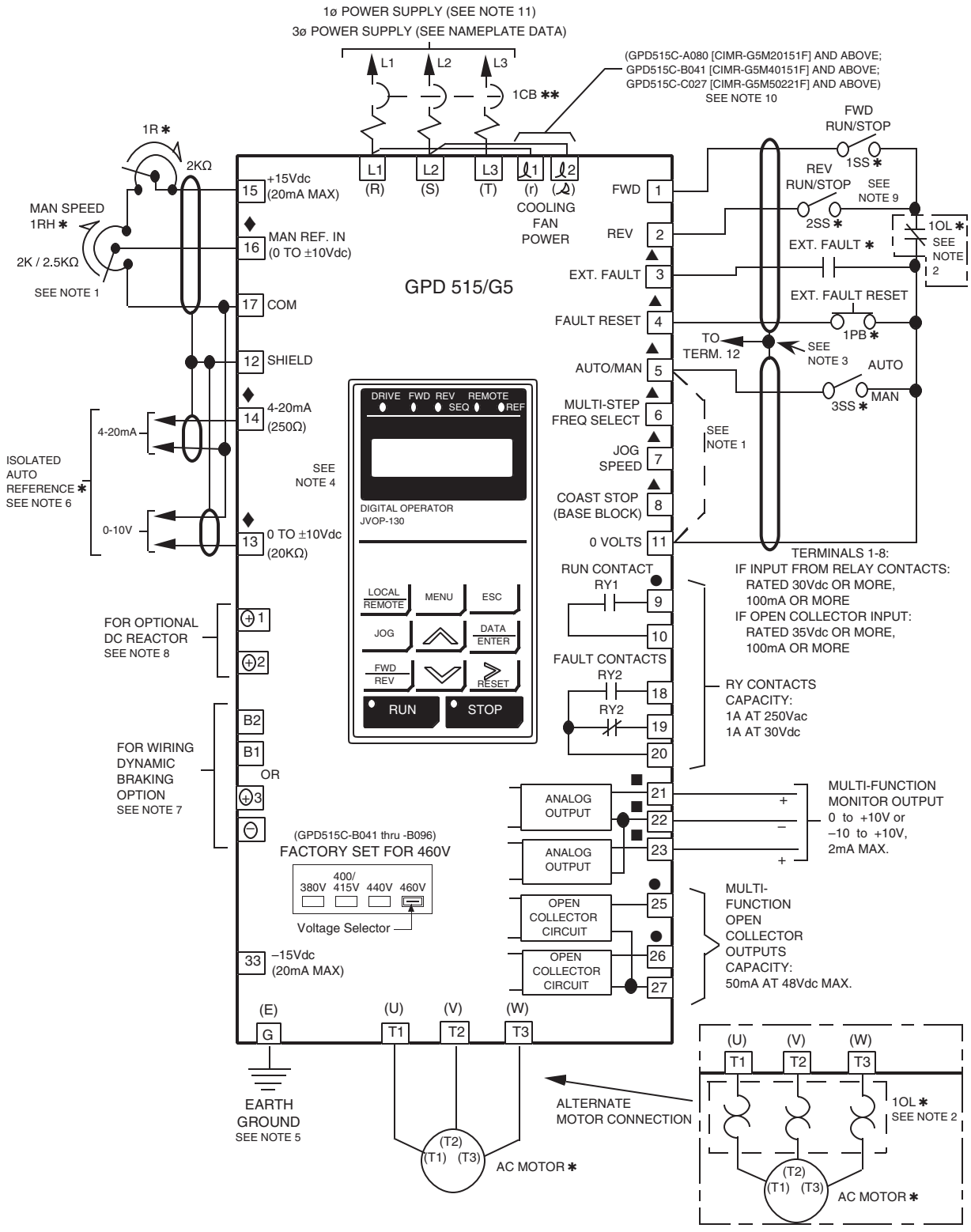
7. If the Dynamic Braking (DB) option is used, wire per Appendix 6 instructions.

8. An optional DC reactor may be added for harmonic attenuation, if needed; see separate instruction sheet for wiring.

9. If application does not allow reverse operation, **b1-04**, Reverse Run Prohibit, should be set to " 1 " (Reverse Run Disabled), and the Reverse Run/Stop input can be eliminated.

10. If supplying the drive with DC voltage instead of 3ø AC, remove jumpers from terminals ℓ1 and ℓ2 and connect a separate 1ø AC supply to ℓ1 and ℓ2 instead.

11. Use ℓ1 (R) and ℓ2 (S) for single-phase input. Note that for drives up through GPD515C-A064, -B034, and -C032 (CIMR-G5M20151F, 40151F, and 50221F) must be derated by 50%. Consult factory for derating of larger drives.



BASIC INTERCONNECT DIAGRAM FOR 2-WIRE CONTROL

Figure 1-3. 230, 460 or 600V Interconnections - 2-Wire Control (with parameters b1-01 = 1, b1-02 = 1, H1-01 = 24, H1-02 = 14, H1-03 = 3, H1-04 = 4, H1-05 = 6, and H1-06 = 8)

See Figure 1-5 for Closed-loop PG connections

1.4.6 Interconnection – 3-Wire Control Operation Figure 1-4.

Notes referred to in figure 1-4.

✱ – Indicates components not supplied.

✱✱– Branch circuit protection (circuit breaker or input fuses) must be supplied by customer.

□ – Indicates customer connection terminal. Wire only to terminals shown. Note that not all terminals shown are available in all ratings – see Tables 1-1 and 1-2.

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

▲ – Function labels shown for these terminals are determined by factory settings of parameters **H1-01** through **H1-06**: **H1-01** = 24, **H1-02** = 14, **H1-03** = 0, **H1-04** = 3, **H1-05** = 4, **H1-06** = 6. See paragraph 5.32.

● – Function labels shown for these terminals are determined by factory settings of parameters **H2-01** through **H2-03**. See paragraph 5.33.

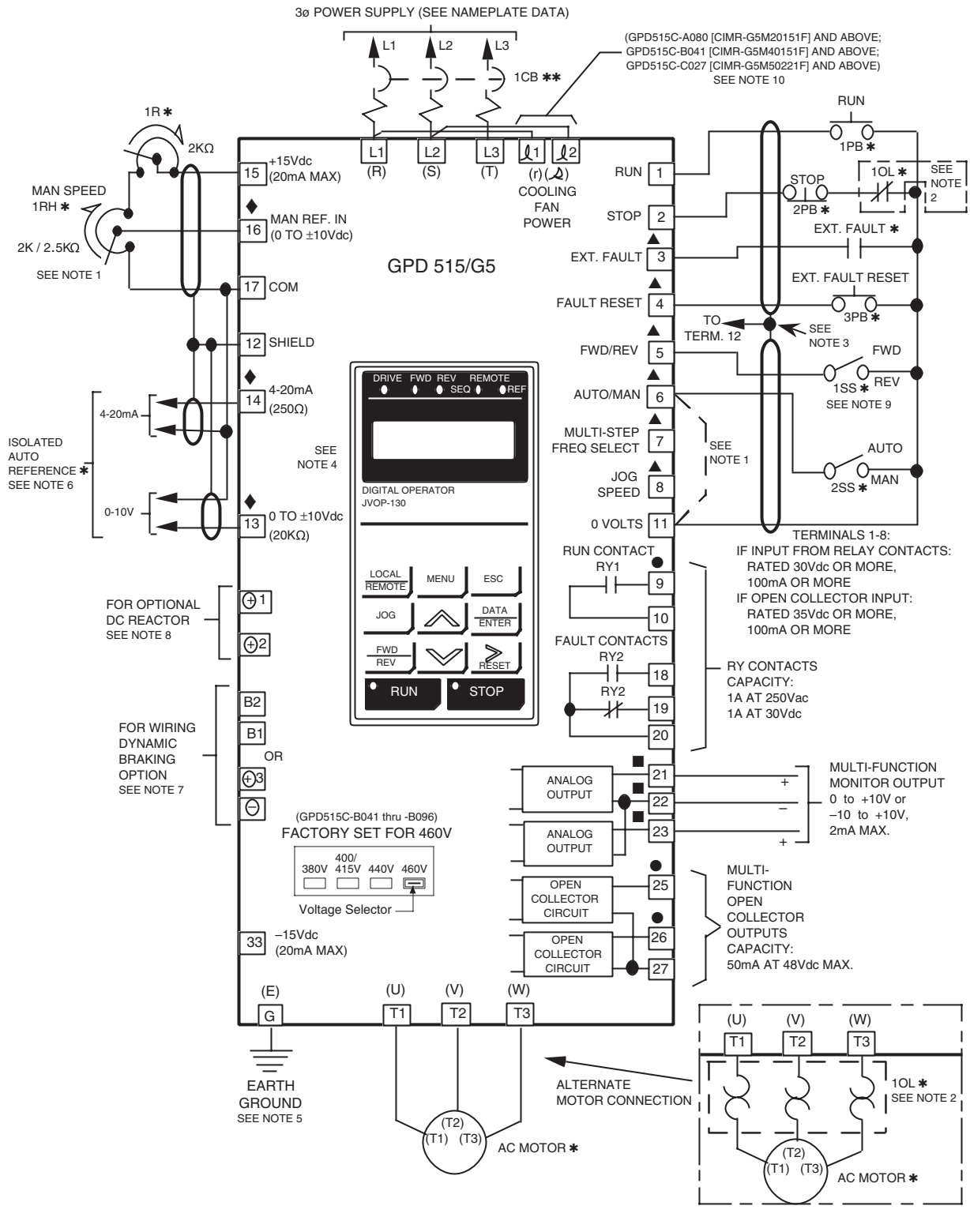
♦ – Function labels shown for these terminals are determined by factory settings of parameters **H3-01**, **-04**, **-05**, **-08**, & **-09**. See paragraphs 5.19 & 5.30.

■ – Function labels and signal levels shown for these terminals are determined by factory settings of parameters **H4-01** & **H4-04**. See paragraph 5.31.

1. If only a remote Manual Speed pot (1RH) is used, 2SS is not needed; in that case, a jumper must be added between terminals 6 and 11. This jumper will override both the Auto and Digital Operator frequency references, regardless of the programming of parameter **b1-01**. If you are using a remote speed command or the Digital Operator, DO NOT install this jumper. See paragraph 5.19.
2. The Drive Electronic Thermal Overload function (parameters **L1-01**, **L1-02**) meets standards set by UL and cUL for motor thermal overload protection. If local code requires separate mechanical overload protection, an overload relay should be installed, interlocked with the drive 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. (Belden #8760 or equivalent). 3-conductor #18 GA. (Belden #8770 of equivalent). Connect shield ONLY AT DRIVE END. Stub and isolate other end.
4. Digital Operator is standard on every drive. Remote operators, as shown, may not be required.
5. Customer to connect terminal ⏚ to earth ground (100 Ω or less, 230V; 10 Ω or less, 460V and 600V).
6. Wire only one of the inputs as an Auto Reference. If **H3-09** is set to " 1F ", terminals 13 and 14 are added for the internal frequency reference.
7. If the Dynamic Braking (DB) option is used, wire per Appendix 6 instructions.
8. An optional DC reactor may be added for harmonic attenuation, if needed; see separate instruction sheet for wiring.
9. If application does not allow reverse operation, **b1-04**, Reverse Run Prohibit, should be set to " 1 " (Reverse Run Disabled), and the Forward/Reverse input can be eliminated.
10. If supplying the drive with DC voltage instead of 3ø AC, remove jumpers from terminals ℓ1 and ℓ2 and connect a separate 1ø AC supply to ℓ1 and ℓ2 instead.
11. Use ℓ1 (R) and ℓ2 (S) for single-phase input. Note that for drives up through GPD515C-A064, -B034, and -C032 (CIMR-G5M20151F, 40151F, and 50221F) must be derated by 50%. Consult factory for derating of larger drives.

CAUTION

Before running, parameter A1-03 must be set to " 0 ". Resetting drive constant A1-03 to " 2220 " may cause the motor to run in the reverse direction WITHOUT A RUN COMMAND, and possibly result in damage to the equipment or personal injury.



BASIC INTERCONNECT DIAGRAM FOR 3-WIRE CONTROL

Figure 1-4. 230, 460 or 600V Interconnections - 3-Wire Control (with parameters b1-01 = 1, b1-02 = 1, H1-01 = 24, H1-02 = 14, H1-03 = 0, H1-04 = 3, H1-05 = 4, and H1-06 = 6)

See Figure 1-5 for Closed-loop PG connections

1.4.7 Encoder Feedback

If either the Flux Vector (A1-02 = 3) or Volts Per Hertz with Encoder (A1-02 = 1) control method is desired, an encoder feedback board for the drive is required.

The drive can accept many types of encoder feedback. Table 1-4 shows which option board is needed for each type of encoder.

Table 1-4. Encoder feedback option board types.

Option Board	Control Method(s)	Electrical Input Scheme	Required Signals From Encoder
PG-X2	***ALL***	***Quadrature, Line Driver***	***A+, A-, B+, & B- (Z+, Z- optional)***
PG-W2*	ALL	Dual Input, Quadrature, Line Driver	A+, A-, B+, B-, (Z+, Z- optional)
PG-B2	ALL	Quadrature, Single Ended	A, B, & Common
PG-D2	All, Except Flux Vector	Line Driver	A+ & A-
PG-A2	All, Except Flux Vector	Single Ended	A & Common

*Accepts inputs from two encoders. Primarily used with custom software.

The most common encoder used with the drive is the Quadrature, Line Driver style encoder. When an encoder of this type is used, a PG-X2 option board must be mounted onto the drive. The encoder then wires to the PG-X2 option board.

Table 1-5 and Figure 1-5 show connections for the PG-X2 and some typical encoders.

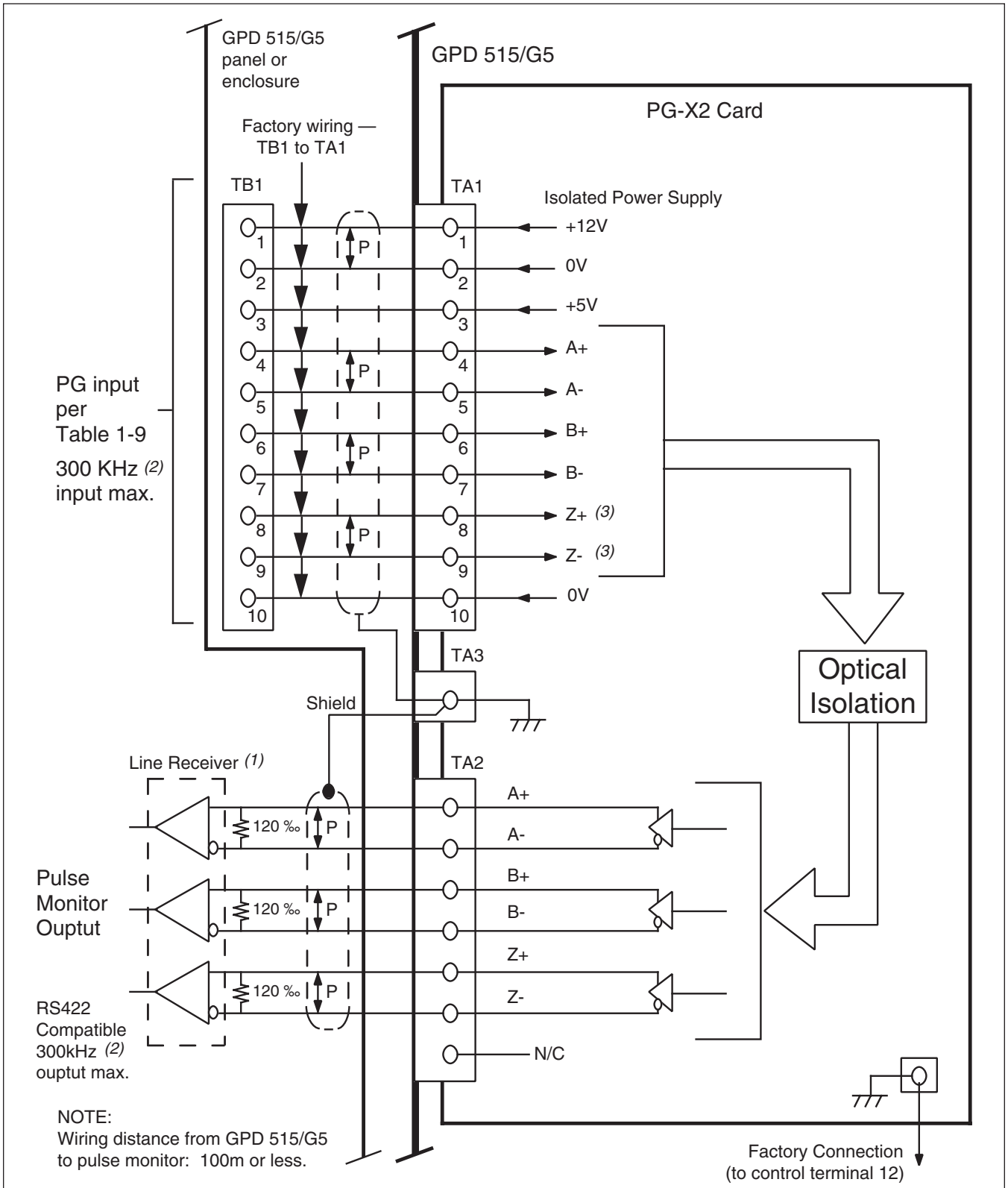
Table 1-5. Encoder (PG) Connection

FUNCTION	PG-X2 TERMINAL TA1	EPC *(1)* MODEL 755A	DYNAPAR H-20 *(2)* (Pin #)	DYNAPAR HS-35	LAKESHORE/ NORTHSTAR SL-56
+12V (200mA)	1	White	D	D	6
0V	2	Black	F	F	1
+5V	3	No Connection	No Connection	No Connection	No Connection
A+	4	Red	A	A	3
A–	5	Green	H	H	8
B+	6	Brown	B	B	2
B–	7	Yellow	I	I	7
SHIELD	**TA3**	Shield	E	No Connection	10

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

(2) For PG, Dynapar H-20, pins C, G, and J are not used.

The PG-X2 card also has a connector TA2 which provides processed PG signal output for use by an external pulse monitor. This connection can be made according to Figure 1-5.



(1) Customer supplied.

(2) Refer to Section 2.2b or 2.2d (PG-X2) to calculate frequency.

(3) Z pulses not requred for most applications.

Figure 1-5. PG-X2 Card Input/Output Connections