



**MAGNETEK**  
MATERIAL HANDLING  
ELECTROMOTIVE SYSTEMS

# IMPULSE<sup>®</sup>•D+ Active Front End Line Regeneration Technical Specifications

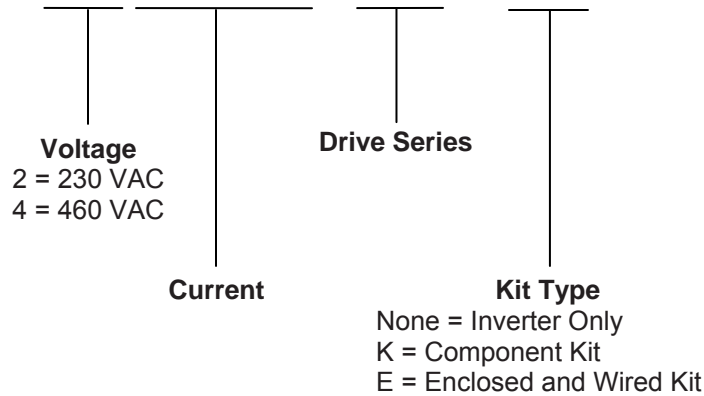


Part Number: 146-50080 R1  
September 2013



**Model Numbers**

# 4300-D+K





**Standard Specifications**

**IMPULSE®•D+ Active Front End Line Regeneration Unit**

Voltage		230 V Class								460 V Class										
Model XXXX-D+		2015	2030	2057	2083	2140	2200	2270	2400	4008	4016	4030	4043	4058	4086	4145	4210	4300	4410	4560
Rating	Rated Output Current (DC)	15	30	61	91	152	197	273	394	8	15	30	45	61	91	152	197	280	409	561
	Rated Input Current (AC)	15	29	57	83	140	200	270	400	8	16	30	43	58	86	145	210	300	410	560
Input	Rated Voltage/ Rated Frequency	200 to 240 VAC 50/60 Hz								380 to 480 VAC 50/60 Hz										
	Allowable Voltage Fluctuation	-15 to +10%																		
	Allowable Frequency Fluctuation	±2%																		
Control Characteristics	Control Method	Sine-wave PWM control																		
	Input Power Factor	Input power factor of 0.99 min. (for rated operation)																		
	Output Voltage Accuracy	±5%																		
	Overload Protection	Unit stops after 60 s at 150% of rated output current or after 3 s at 200% of rated output current.																		
	Voltage Reference Range	300 to 360 VDC								600 to 730 VDC										
	Carrier Frequency	6 kHz				4 kHz				6 kHz				4 kHz		2 kHz				
	Main Control Functions	Current Limit, Cooling Fan on/off Switch, Removable Terminal Block with Parameter Backup Function, MEMOBUS/Modbus Comm (RS-422/RS-485 max, 115.2 kbps)																		
Protection Functions	Momentary Overcurrent Protection	Unit stops when input current exceeds 250%																		
	Fuse Burnout	Operation stops if the fuse burns out																		
	Overloads	Operation stops after 60 s at 150% of rated output current. Operation stops after 3 s at 200% of rated output current. (electrical operation and regeneration)																		
	Overvoltage Protection	Output	Stops when DC bus voltage exceeds approx. 410 VDC								Stops when DC bus voltage exceeds approx. 820 VDC									
		Input	Stops when input voltage exceeds approx. 227 VAC								Stops when input voltage exceeds approx. 554 VAC									
	Undervoltage Protection	Output	Stops when DC bus voltage falls below approx. 190 VDC								Stops when DC bus voltage falls below approx. 380 VDC									
		Input	Stops when input voltage falls below approx. 150 VAC								Stops when input voltage falls below approx. 300 VAC									
	Momentary Power Loss	Immediately stops after Momentary Power Loss is detected.																		
	Power Supply Frequency Fault	Operation stops for a deviation of ±6 Hz or more from the rated input frequency.																		
	Heatsink Overheat Protection	Thermistor																		
Ground Fault Protection <sup>1</sup>	Protection by electronic circuit																			
Charge LED	Charge LED remains lit until DC bus has fallen below approx. 50 V																			
Environment	Area of Use	Indoors																		
	Ambient Temperature	-10 to +50° C (IP00/IP20/Open Type Enclosure)																		
	Humidity	95% RH or less (no condensation)																		
	Shock	(2015 to 2140-D+, 4008 to 4145-D+) 10 to 20 Hz: 9.8m/s <sup>2</sup> , 20 to 55 Hz: 5.9m/s <sup>2</sup> (2200 to 2400-D+, 4210 to 4560-D+) 10 to 20 Hz: 9.8m/s <sup>2</sup> , 20 to 55 Hz: 2.0m/s <sup>2</sup>																		
	Storage Temperature	-20 to +60° C (short-term temperature during transportation)																		
	Altitude	Up to 1000 meters (derating required at altitudes from 1000 m to 3000 m)																		
Protection Design	IP00/IP20/Open Type enclosure																			
Safety Standard <sup>*2</sup>	UL508C, IEC61800-5-1, IEC61800-3, CSA																			

\*1: Protection may not be provided under the following conditions as the motor windings are grounded internally during run:

- Low resistance to ground from the drive cable or terminal block.
- Drive already has a short circuit when the power is turned on.

\*2: Application pending.

NOTE: You must install a harmonic filter module and input AC reactor 1 for IMPULSE®•D+ models 2005-D+ to 4300-D+.

You must install a reactor for the harmonic filter, a capacitor for the harmonic filter, and input AC reactors 1 and 2 for IMPULSE®•D+ models 4410-D+ and 4560-D+.



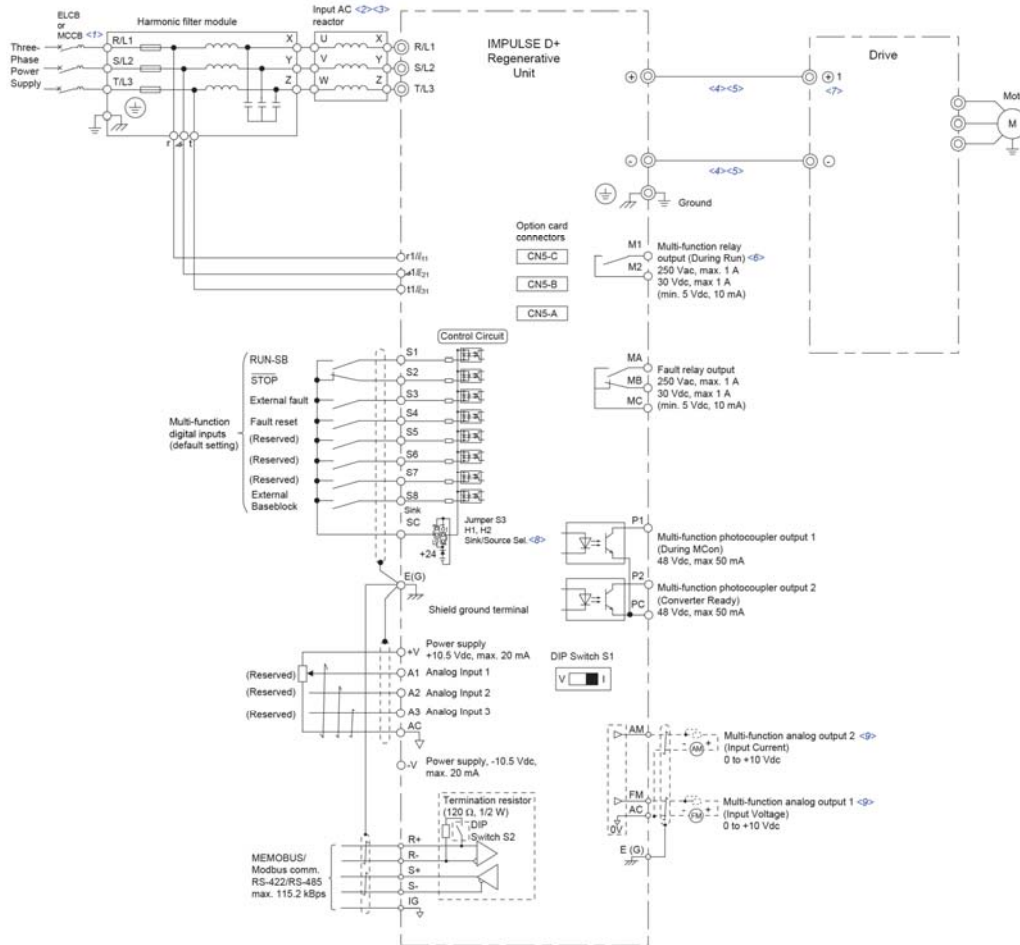
**IMPULSE®•D+ Standard Configuration Devices**

Voltage		230 V Class								460 V Class										
Model XXXX-D+		2015	2030	2057	2083	2140	2200	2270	2400	4008	4016	4030	4043	4058	4086	4145	4210	4300	4410	4560
Harmonic Filter Module	Rated Current A	15	29	57	83	140	200	270	400	8	16	30	43	58	86	145	210	300	--	--
	Inductance mH	2.45	1.27	0.64	0.44	0.26	0.18	0.14	0.09	9.19	4.59	2.45	1.71	1.27	0.85	0.51	0.35	0.25	0.18	0.13
Input AC Reactor 1	Rated Current A	15	29	57	83	140	200	270	400	8	16	30	43	58	86	145	210	300	410	560
	Inductance mH	2.45	1.27	0.64	0.44	0.26	0.18	0.14	0.09	9.19	4.59	2.45	1.71	1.27	0.85	0.51	0.35	0.25	0.18	0.13
Input AC Reactor 2	Rated Current A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	410	560
	Inductance mH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.06	0.05
Reactor for Harmonic Filter	Rated Current A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	64	87
	Inductance mH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.022	0.0158
Condenser for Harmonic Filter	Rated Capacity µF	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	290	402



**Standard Connection Diagrams**

**Model: 2015 to 2400-D+, 4008 to 4300-D+**



<1> When a noise filter is attached on the IMPULSE®•D+ unit's power supply side, use a noise filter of the reactor type (without a capacitor) such as FINEMET(R) zero-phase reactor, and attach it after the MCCB at the power supply side. Do not use a capacitor-built-in type noise filter since the harmonic components may overheat or damage the capacitor.

<2> The wiring between the input AC reactor and the IMPULSE®•D+ unit must be within 10 m.

<3> Always use the specified AC reactor and harmonic filter (harmonic filter module) to avoid abnormal operations.

<4> The DC current bus bar wiring between the IMPULSE®•D+ unit and the drive must be within 5 m.

<5> If you install a breaker or contactor on the unit side for an emergency shutoff, observe the following precautions. Confirm that the CHARGE indicators on the drive and unit are not lit before you close the breaker or contactor on the unit output (DC) side. If the power supply is turned on while voltages are charging, an overcurrent will flow and the device may be damaged. Always confirm that the breaker or contactor on the unit output (DC) side is turned on before you turn on the power supply to the unit.

<6> Make sure that the IMPULSE®•D+ unit starts before the drive when the power supply is turned on. Stop the devices in the following order before you turn off the power supply: the drive, the motor, and then the IMPULSE®•D+ unit. A fault may occur if you use the drive without operating the unit or if you turn off the power supply while the IMPULSE®•D+ unit is operating.

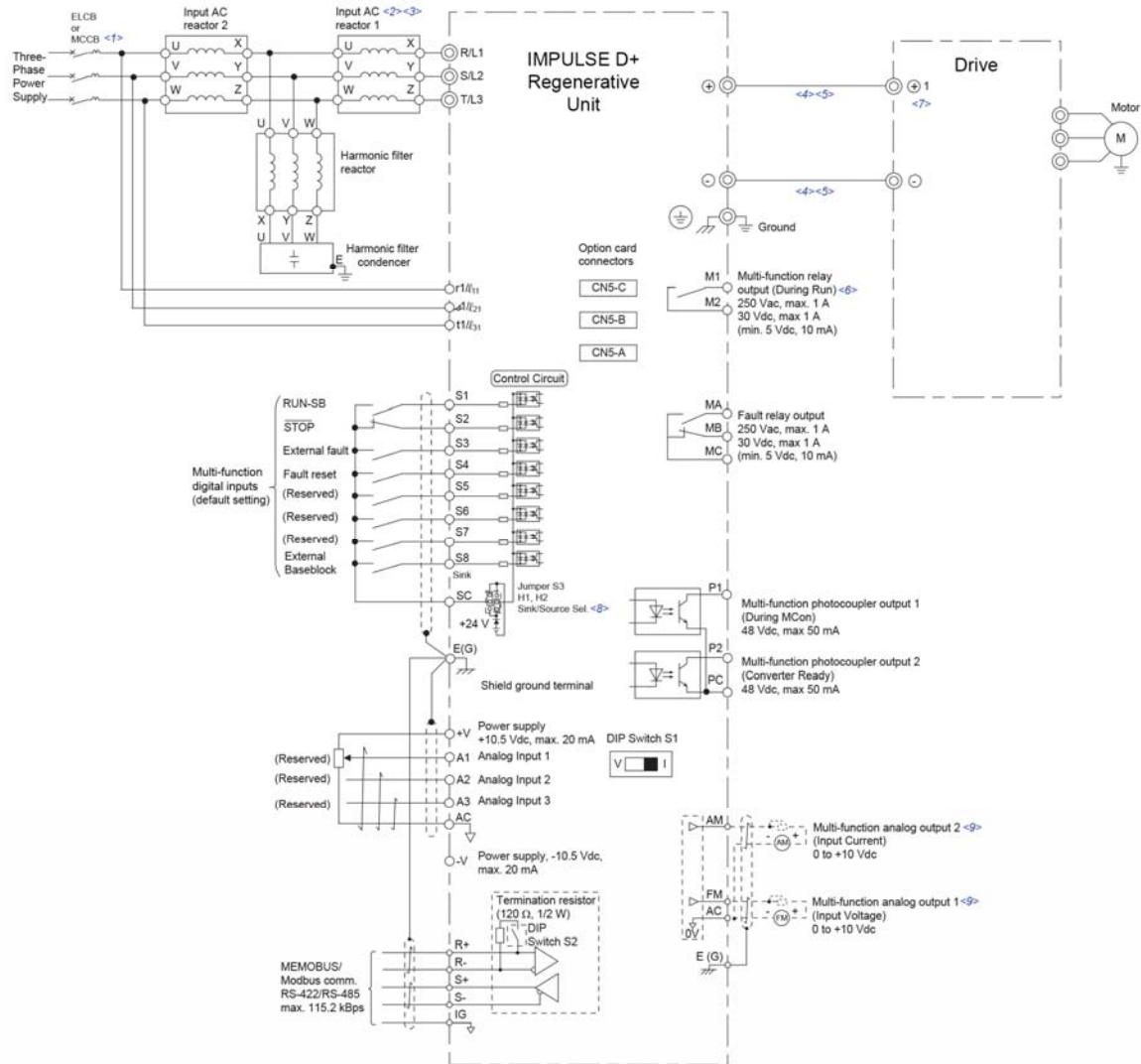
<7> Do not connect a power supply to the drive's AC power supply terminals (R/L1, S/L2, and T/L3).

<8> This figure shows an example of a sequence input to S1 through S8 using a non-powered relay or an NPN transistor (0 V common/sink mode: default). Set either sinking or sourcing with the sinking/sourcing jumpers (S3).

<9> Monitor outputs work with devices such as analog frequency meters, ammeters, voltmeters, and wattmeters. Do not use these outputs in a feedback loop.



**Model: 4410-D+, 4560-D+**



- <1> When a noise filter is attached on the IMPULSE®•D+ unit's power supply side, use a noise filter of the reactor type (without a capacitor) such as FINEMET zero-phase reactor, and attach it after the MCCB at the power supply side. Do not use a capacitor-built-in type noise filter since the harmonic components may overheat or damage the capacitor.
- <2> The wiring between the input AC reactor and the IMPULSE®•D+ unit must be within 10 m.
- <3> Always use the specified AC reactor and harmonic filter (harmonic filter module) to avoid abnormal operations.
- <4> The DC current bus bar wiring between the IMPULSE®•D+ unit and the drive must be within 5 m.
- <5> If you install a breaker or contactor on the unit side for an emergency shutoff, observe the following precautions. Confirm that the CHARGE indicators on the drive and unit are not lit before you close the breaker or contactor on the unit output (DC) side. If the power supply is turned on while there is a voltage charge, an overcurrent will flow and the device may be damaged. Always confirm that the breaker or contactor on the unit output (DC) side is turned on before you turn on the power supply to the unit.
- <6> Make sure that the IMPULSE®•D+ unit starts before the drive when the power supply is turned on. Stop the devices in the following order before you turn off the power supply: the drive, the motor, and then the IMPULSE®•D+ unit. A fault may occur if you use the drive without operating the unit or if you turn off the power supply while the IMPULSE®•D+ unit is operating.
- <7> Do not connect a power supply to the drive's AC power supply terminals (R/L1, S/L2, and T/L3).
- <8> This figure shows an example of a sequence input to S1 through S8 using a non-powered relay or an NPN transistor (0 V common/sink mode: default). Set either sinking or sourcing with the sinking/sourcing jumpers (S3).
- <9> Monitor outputs work with devices such as analog frequency meters, ammeters, voltmeters, and wattmeters. Do not use these outputs in a feedback loop.



## Terminal Functions

### IMPULSE®•D+ Active Front End Line Regeneration Unit

#### Main Circuit Terminals

Terminal	Type	Function
R/L1	Main circuit power supply inputs	These are the power supply input terminals that connect to the input reactor.
S/L2		
T/L3		
r1/l11	Power supply voltage detection inputs	These terminals are to detect the power supply voltage order and voltage levels.
A1/l21		
t1/l31		
-	DC voltage output	These terminals output a DC voltage
+		
⊖	Grounding terminal	For 230 V class: 100 Ω or less For 460 V class: 10 Ω or less

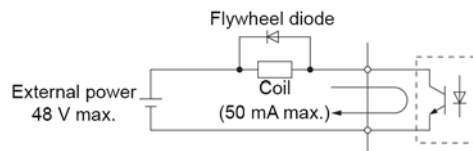


**Control Circuit Input Terminals (230/460 V Class)**

Terminal Type	Terminal	Terminal Name (Default Setting)	Function (Signal Level)
Multi-Function Digital Inputs	S1	Multi-function selection input 1 (RUN-SB)	Photocoupler 24 VDC, 8 mA The factory setting is for Sinking Mode. Use the sinking/sourcing mode jumper (S3) to change the sinking/sourcing mode setting to select an internal or external power supply. For details, refer to the Installation Manual.
	S2	Multi-function selection input 2 (STOP)	
	S3	Multi-function selection input 3 (External fault)	
	S4	Multi-function selection input 4 (Fault reset)	
	S5	Multi-function selection input 5 (Reserved)	
	S6	Multi-function selection input 6 (Reserved)	
	S7	Multi-function selection input 7 (Reserved)	
	S8	Multi-function selection input 8 (External Baseblock)	
	SC	Multi-function selection input common	
Analog Inputs	+V	Analog reference input	10.5 VDC (max allowable current 20 mA)
	-V	Analog reference input	-10.5 VDC (max allowable current 20 mA)
	A1	Multi-function analog input 1 (Reserved)	-10 to +10 VDC, 0 to 10 VDC (input impedance: 20 kΩ)
	A2	Multi-function analog input 2 (Reserved)	-10 to +10 VDC, 0 to 10 VDC (input impedance: 20 kΩ) 4 to 20 mA, 0 to 20 mA (input impedance: 250Ω) Voltage or current input must be selected by DIP switch S1 and H3-09.
	A3	Multi-function analog input 3 (Reserved)	-10 to +10 VDC, 0 to 10 VDC (input impedance: 20 kΩ) Use DIP switch S4 on the terminal board to select between analog and PTC input.
	AC	Frequency reference common	0 V
	E(G)	Ground for shielded lines and option cards	—
Fault Relay Output	MA	N.O. output (Fault)	30 VDC, 10 mA to 1 A 250 VAC, 10 mA to 1 A MB N.C. output Minimum load: 5 VDC, 10 mA
	MB	N.C. output (Fault)	
	MC	Fault output common	
Multi-Function Digital Output <sup>1</sup>	M1	Multi-function digital output (During run 1)	Default setting: During Run 1 The M1-M2 terminals close during operation. When the DC bus voltage reaches the reference value after the operation of the unit is started, the M1-M2 terminals close.
	M2		
Multi-Function Photocoupler Output	P1	Photocoupler output 1 (During MC on)	Photocoupler output <sup>2</sup> 48 V, 2 to 50 mA
	P2	Photocoupler output (Converter ready)	
	PC	Photocoupler output common	
Monitor Output	FM	Analog monitor output	-10 to +10 VDC, or 0 to +10 VDC
	AM	Analog monitor output	
	AC	Monitor common	0 V

\*1: Do not assign functions to terminals M1 and M2 that involve frequent switching, unless absolutely necessary, because doing so may shorten the relay performance life. The switching life is estimated at 200,000 times (1 A, resistive load).

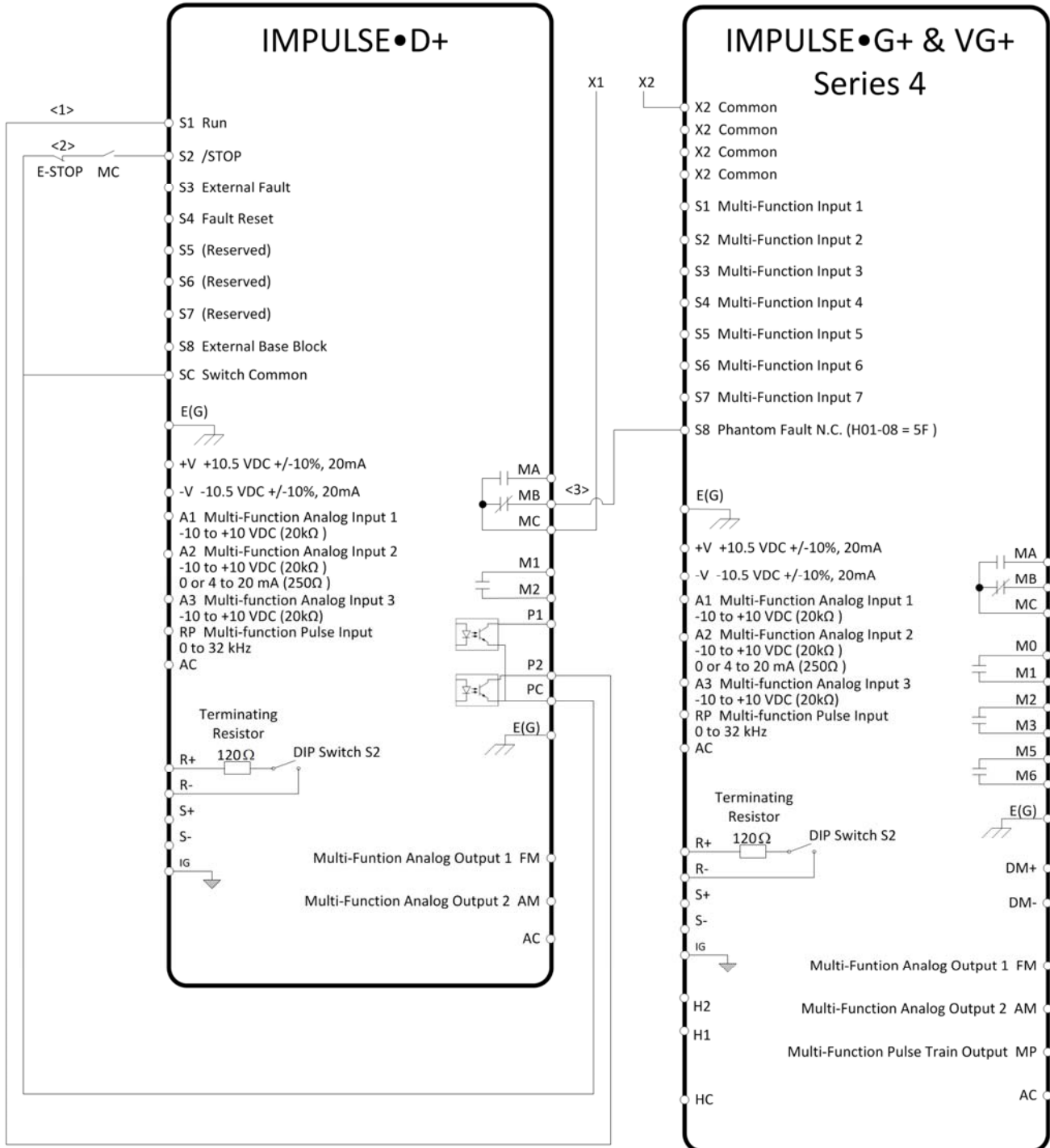
\*2: Connect a flywheel diode as shown when driving a reactive load such as a relay coil. The diode must be rated for use of a voltage higher than the circuit voltage.







**Minimum Control Wiring Example**



<1> The IMPULSE®•D+ S1 (RUN) input is wired to regulate DC Bus Voltage when the P2 (READY) output is active.  
 <2> Any crane control that can remove power shall deactivate the S2 (STOP) input. In this example, the E-STOP and Main Contactor (MC) disable DC bus regulation. Use control switch contacts rather than auxiliary contacts. If auxiliary contacts are required, use an early make/break type.  
 <3> In the event of an IMPULSE®•D+ fault, the MB contact will open, causing all drives on the common bus to stop motion.



**Serial Communication Terminals (230/460 V Class)**

Type	No.	Signal Name	Function (Signal Level)	
MEMOBUS/ Modbus Communications*	R+	Communications input (+)	MEMOBUS/Modbus communications: Use an RS-422 or RS- 485 cable to connect the unit.	RS-422/RS-485 MEMOBUS/Modbus communications protocol 115.2 kbps (max.)
	R-	Communications input (-)		
	S+	Communications output (+)		
	S-	Communications output (-)		
	IG	Shield ground	0 V	

\*: Enable the termination resistor in the last unit in a MEMOBUS/Modbus network by setting DIP switch S2 to the ON position.

**IMPULSE®•D+ Standard Configuration Devices**

**2015 to 2400-D+, 4008 to 4300-D+**

**Harmonic Filter Module**

Terminal	Type	Function
R/L1	Main circuit power supply inputs	These terminals are connected to the power supply.
S/L2		
T/L3		
r	Power supply voltage detection inputs	These terminals are to detect the power supply voltage order and voltage levels.
t		
X	Harmonic filter module outputs	These terminals are connected to the input AC reactor 1.
Y		
Z		
	Grounding terminal	Grounding terminals For 230 V class: 100 Ω or less For 460 V class: 10 Ω or less

**Input AC Reactor 1**

Terminal	Type	Function
U	Input AC reactor 1 inputs	These terminals connect to a harmonic filter module.
V		
W		
X	Input AC reactor 1 outputs	These terminals connect to the IMPULSE®•D+ energy-saving unit.
Y		
Z		



**4410-D+ and 4560-D+**

Input AC Reactor 1

Terminal	Type	Function
U	Input AC reactor 1 inputs	These terminals connect to the input AC reactor 2 and the reactor for the harmonic filter.
V		
W		
X	Input AC reactor 1 outputs	These terminals connect to the IMPULSE®•D+ energy-saving unit.
Y		
Z		

Input AC Reactor 2

Terminal	Type	Function
U	Input AC reactor 2 inputs	These terminals connect to the power supply.
V		
W		
X	Input AC reactor 2 outputs	These terminals connect to the input AC reactor 2 and the reactor for the harmonic filter.
Y		
Z		

Reactor for Harmonic Filter

Terminal	Type	Function
U	Reactor inputs for harmonic filter	These terminals connect to the input AC reactor 1 and the input AC reactor 2.
V		
W		
X	Reactor outputs for harmonic filter	These terminals connect to the capacitor for the harmonic filter.
Y		
Z		

Capacitor for Harmonic Filter

Terminal	Type	Function
U	Capacitor inputs for harmonic filter	These terminals connect to the capacitor for the harmonic filter.
V		
W		
E	Grounding terminal	Grounding terminals For 230 V class: 100 Ω or less For 460 V class: 10 Ω or less



**Dimensions**

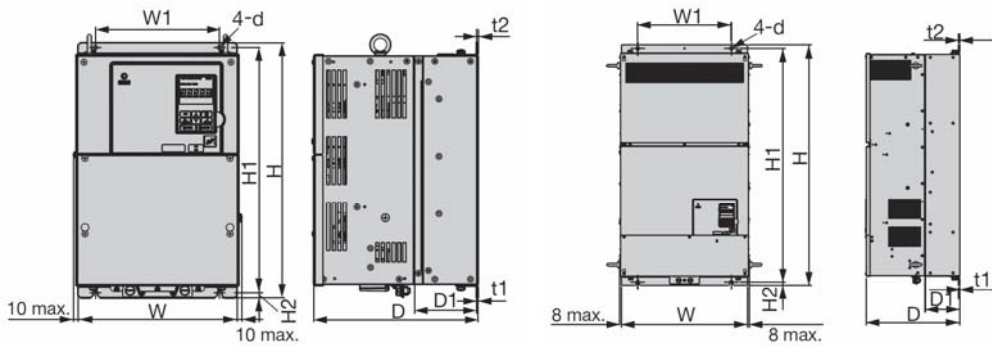
**IMPULSE®•D+ Active Front End Line Regeneration Unit**

**Enclosures**

Enclosures of standard products vary depending on the model. Refer to the table below.

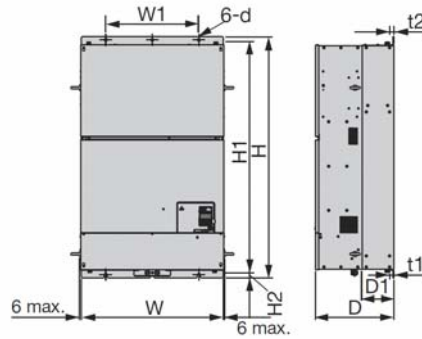
Voltage Class		230 V Class								460 V Class										
Model XXXX-D+		2015	2030	2057	2083	2140	2200	2270	2400	4008	4016	4030	4043	4058	4086	4145	4210	4300	4410	4560
Open Chassis	IP00	--			Standard					--			Standard							
	IP20	Standard			--					Standard			--							

**Open Chassis (IP00)**  
 Dimensions (in)



**Figure 1**

**Figure 2**



**Figure 3**



230 V Class

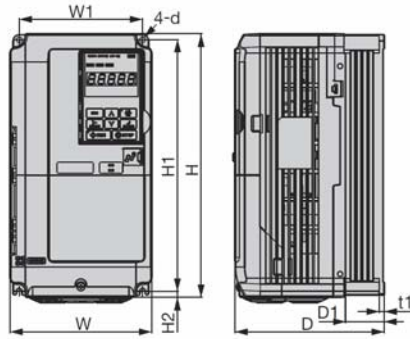
Model Number	Figure	Dimensions (in)										Weight (lb)	Cooling
		W	H	D	W1	H1	H2	D1	t1	t2	d		
2083-D+	1	10.83	17.72	10.16	8.66	17.13	0.30	3.94	0.09	0.09	M6	44	Fan Cooled
2140-D+		12.80	21.65	11.14	10.24	21.06	0.30	4.33	0.09	0.09		71	
2200-D+	2	17.72	27.76	12.99	12.80	26.77	0.49	5.12	0.13	0.13	M10	126	
2270-D+												135	
2400-D+	3	19.69	31.50	13.78	14.57	30.43	0.51	5.12	0.18	0.18	M12	187	

460 V Class

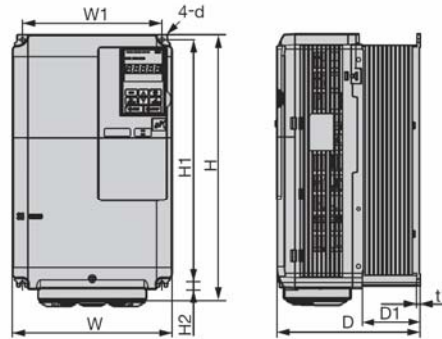
Model Number	Figure	Dimensions (in)										Weight (lb)	Cooling
		W	H	D	W1	H1	H2	D1	t1	t2	d		
4043-D+	1	10.83	17.72	10.16	8.66	17.13	0.30	3.94	0.09	0.09	M6	46	Fan Cooled
4058-D+												75	
4086-D+													
4145-D+												79	
4210-D+	3	19.69	31.50	13.78	14.57	30.43	0.51	5.12	0.18	0.18	M12	187	
4300-D+												403	
4410-D+													428
4560-D+													



**Open Chassis (IP20)**  
 Dimensions (in)



**Figure 4**



**Figure 5**

**230 V Class**

Model Number	Rated Output Capacity (kW)	Figure	Dimensions (in)												Weight (lb)	Cooling
			W	H	D	W1	H0	H1	H2	H3	D1	t1	t2	d		
2015-D+	5	4	7.09	11.81	7.36	6.30	--	11.18	0.32	--	2.95	0.20	--	M5	11	Fan Cooled
2030-D+	10															
2057-D+	20	5	8.66	14.37	7.76	7.56	13.78	13.19	0.32	0.59	3.07	0.20	--	M6		

**460 V Class**

Model Number	Rated Output Capacity (kW)	Figure	Dimensions (in)												Weight (lb)	Cooling
			W	H	D	W1	H0	H1	H2	H3	D1	t1	t2	d		
4008-D+	5	4	7.09	11.81	7.36	6.30	--	11.18	0.32	--	2.95	0.20	--	M5	11	Fan Cooled
4016-D+	10															
4030-D+	20	5	8.66	14.37	7.76	7.56	--	13.19	0.32	--	3.07	0.20	--	M6		



**Combination of Standard Configuration Devices**

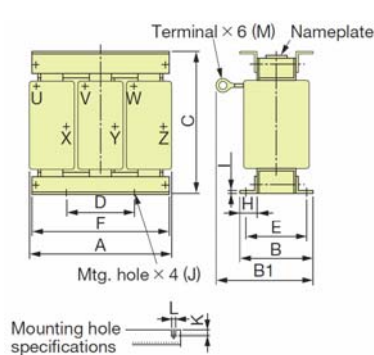
**Standard Configuration Devices**

The standard configuration devices depend on the IMPULSE®•D+ model. Use the following table to select a combination.

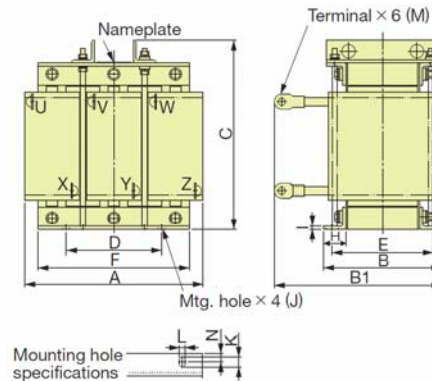
Voltage Class	230 V Class								460 V Class											
	Model XXXX-D+	2015	2030	2057	2083	2140	2200	2270	2400	4008	4016	4030	4043	4058	4086	4145	4210	4300	4410	4560
Harmonic Filter Module	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	--	--
Input AC Reactor 1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Input AC Reactor 2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	•	•	•
Reactor for Harmonic Filter	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	•	•	•
Condenser for Harmonic Filter	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	•	•	•

**Input AC Reactor 1**

Select the reactor according to the capacity of the IMPULSE®•D+.



**Figure 6**



**Figure 7**

**Input AC Reactor 1  
230 V Class**

Inverter Model Number	Reactor Model Number	Qty	Figure	Dimensions (in)													Weight (lb)	
				A	B	B1	C	D	E	F	H	I	J	K	L	M		N
2015-D+	REA1-2015-D+	1	6	6.30	4.49	6.77	5.24	2.95	3.74	6.30	0.98	0.09	M6	0.39	0.28	M4	--	18.1
2030-D+	REA1-2030-D+			8.07	4.17	7.05	6.81	2.95	3.35	8.07	0.98	0.13	M6	0.47	0.28	M5	--	31
2057-D+	REA1-2057-D+		7	10.47	5.75	9.37	9.88	5.91	4.53	8.66	1.57	0.24	M8	0.71	0.39	M6	0.59	62
2083-D+	REA1-2083-D+			10.55	6.34	10.24	11.42	5.91	5.16	8.66	1.57	0.24	M8	0.71	0.39	M8	0.59	84
2140-D+	REA1-2140-D+			12.99	6.34	10.55	13.15	6.69	5.16	10.63	1.57	0.24	M10	0.87	0.47	M8	0.59	143
2200-D+	REA1-2200-D+			12.60	8.31	12.05	13.50	6.69	7.13	10.63	1.57	0.24	M10	0.87	0.47	M12	0.59	174
2270-D+	REA1-2270-D+			14.96	8.66	12.60	15.04	7.87	7.09	12.60	1.97	0.24	M12	1.06	0.59	M12	0.79	225
2400-D+	REA1-2400-D+			17.52	9.45	15.20	17.17	9.45	7.87	16.54	1.97	0.24	M12	1.06	0.59	M12	0.79	362



460 V Class

Inverter Model Number	Reactor Model Number	Qty	Figure	Dimensions (in)													Weight (lb)	
				A	B	B1	C	D	E	F	H	I	J	K	L	M		N
4008-D+	REA1-4008-D+	1	6	6.30	4.09	6.38	5.24	2.95	3.35	6.30	0.98	0.09	M6	0.39	0.28	M4	--	15.7
4016-D+	REA1-4016-D+			8.11	3.98	6.73	6.81	2.95	3.15	8.07	0.98	0.13	M6	0.47	0.28	M4	--	29
4030-D+	REA1-4030-D+			9.06	5.75	8.15	7.87	5.91	4.53	9.06	1.38	0.13	M8	0.39	0.39	M6	--	57
4043-D+	REA1-4043-D+		7	10.43	6.34	9.57	11.42	5.91	5.16	8.66	1.57	0.24	M8	0.71	0.39	M8	0.59	75
4058-D+	REA1-4058-D+			10.55	6.93	10.71	11.22	5.91	5.75	8.66	1.57	0.24	M8	0.71	0.39	M8	0.59	97
4086-D+	REA1-4086-D+			12.99	6.34	10.75	13.03	6.69	5.16	10.63	1.57	0.24	M10	0.87	0.47	M8	0.59	124
4145-D+	REA1-4145-D+			12.60	8.31	12.17	14.41	6.69	7.13	10.63	1.57	0.24	M10	0.87	0.47	M8	0.59	192
4210-D+	REA1-4210-D+			15.16	9.25	12.99	15.04	7.87	7.68	12.60	1.97	0.24	M12	1.06	0.59	M12	0.79	269
4300-D+	REA1-4300-D+			17.72	9.45	13.19	16.69	9.45	7.87	16.54	1.97	0.24	M12	1.06	0.59	M12	0.79	331
4410-D+	REA1-4410-D+			20.08	11.81	16.14	18.98	9.65	9.84	19.29	2.56	0.24	M12	1.06	0.59	M12	0.98	489
4560-D+	REA1-4560-D+	22.05	12.60	17.13	21.61	11.81	10.24	20.87	2.95	0.24	M12	1.06	0.59	M12	1.18	646		

Input AC Reactor 2  
460 V Class

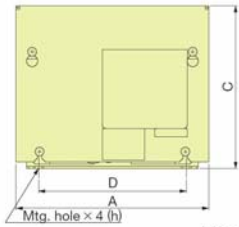
Inverter Model Number	Reactor Model Number	Qty	Figure	Dimensions (in)													Weight (lb)	
				A	B	B1	C	D	E	F	H	I	J	K	L	M		N
4410-D+	REA2-4410-D+	1	7	12.99	6.93	12.72	12.83	6.69	5.75	10.63	1.57	0.24	M10	0.87	0.47	M12	0.59	132
4560-D+	REA2-4560-D+			15.16	8.66	13.78	15.04	7.87	7.09	12.60	1.97	0.24	M12	1.06	0.59	M12	0.79	225



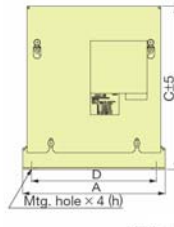
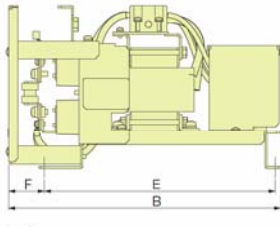


**Harmonic Filter Module**

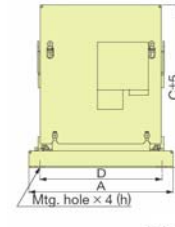
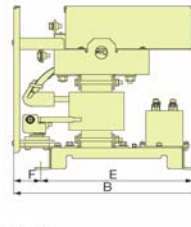
Select the appropriate harmonic filter modules according to the IMPULSE®•D+ models.



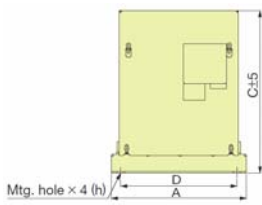
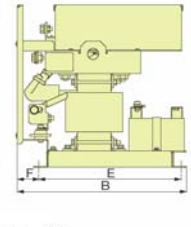
**Figure 8**



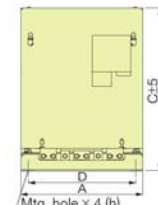
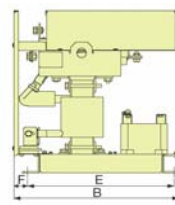
**Figure 9**



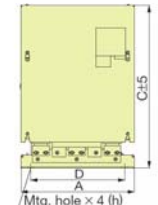
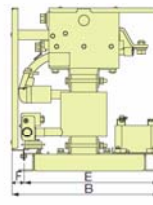
**Figure 10**



**Figure 11**



**Figure 12**



**Figure 13**

**230 V Class**

Model Number	Harmonic Filter Module Model	Figure	Dimensions (in)							Weight (lb)
			A	B	C	D	E	F	H	
2015-D+	HF-2015-D+	8	8.23	11.22	6.93	6.30	9.45	1.54	M6	14.3
2030-D+	HF-2030-D+	8	8.23	11.61	7.24	6.30	9.84	1.54	M6	20
2057-D+	HF-2057-D+	9	9.13	11.85	10.43	7.99	9.72	1.73	M8	31
2083-D+	HF-2083-D+	10	10.24	12.01	11.06	8.66	10.08	1.54	M8	35
2140-D+	HF-2140-D+	11	11.42	13.98	13.70	9.84	12.36	1.18	M10	27
2200-D+	HF-2200-D+	12	11.42	13.86	13.78	10.00	12.36	1.06	M10	60
2270-D+	HF-2270-D+	12	11.42	13.86	15.24	10.00	12.36	1.06	M10	95
2400-D+	HF-2400-D+	13	13.78	14.96	19.69	11.42	13.78	0.75	M10	137

**460 V Class**

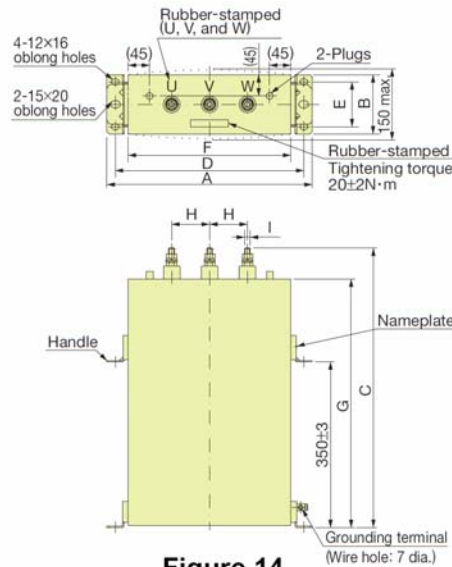
Model Number	Harmonic Filter Module Model	Figure	Dimensions (in)							Weight (lb)
			A	B	C	D	E	F	H	
4008-D+	HF-4008-D+	8	8.23	11.22	6.93	6.30	9.45	1.54	M6	15
4016-D+	HF-4016-D+	8	8.23	11.61	7.01	6.30	9.84	1.54	M6	20
4030-D+	HF-4030-D+	9	9.13	11.85	10.43	7.99	9.72	1.73	M8	33
4043-D+	HF-4043-D+	10	10.24	12.01	11.54	8.66	10.08	1.54	M8	35
4058-D+	HF-4058-D+	10	10.24	12.01	11.54	8.66	10.08	1.54	M8	42
4086-D+	HF-4086-D+	11	11.42	13.98	13.70	9.84	12.36	1.18	M10	60
4145-D+	HF-4145-D+	11	11.42	13.98	15.16	9.84	12.36	1.18	M10	86
4210-D+	HF-4210-D+	13	13.78	14.96	19.69	11.42	13.78	0.75	M10	141
4300-D+	HF-4300-D+	13	13.78	14.96	19.69	11.42	13.54	0.98	M10	161



**Reactor for Harmonic Filter, Condenser for Harmonic Filter**

Reactor For Harmonic Filter

Inverter Model Number	Reactor Model No.	Figure	Dimensions (in)													Weight (lb)
			A	B	B1	C	D	E	F	H	I	J	K	L	M	
4410-D+	FR-4410-D+	6	6.42	4.21	5.91	5.31	2.95±0.08	3.35±0.08	6.42	0.98	0.09	M6	0.39	0.28	M8	13.9
4560-D+	FR-4560-D+		7.17	4.02	6.18	5.91	2.95±0.08	3.15±0.08	7.17	0.98	0.09	M6	0.39	0.28	M8	16.8



**Figure 14**

Condenser for Harmonic Filter

Inverter Model Number	Condenser Model No.	Figure	Dimensions (in)										Weight (lb)
			A	B	C	D	E	F	G	H	H1	I	
4410-D+	FC-4410-D+	14	17.24	5.04	19.76	15.67±0.12	3.74±0.08	13.58	17.05	3.15±0.20	--	M12	60
4560-D+	FC-4560-D+		17.24	5.04	23.70	15.67±0.12	3.74±0.08	13.58	20.98	3.15±0.20	--	M12	73



## Fully-Enclosed Design

### Watt Loss Data

#### IMPULSE®•D+ Line Regen Unit

##### 230 V Class

Model Number	2015-D+	2030-D+	2057-D+	2083-D+	2140-D+	2200-D+	2270-D+	2400-D+
Rated Output Current A	15	30	61	91	152	197	273	394
Heat Loss W	131	224	420	512	903	1626	2191	2641

##### 460 V Class

Model Number	4008-D+	4016-D+	4030-D+	4043-D+	4058-D+	4086-D+	4145-D+	4210-D+	4300-D+	4410-D+	4560-D+
Rated Output Current A	8	15	30	45	61	91	152	197	280	409	561
Heat Loss W	120	216	417	370	845	1423	1761	2647	3825	3688	5487

### Standard Configuration Devices

##### 230 V Class

Model Number		2015-D+	2030-D+	2057-D+	2083-D+	2140-D+	2200-D+	2270-D+	2400-D+
Heat Loss W	Harmonic Filter Module	32	55	80	89	122	133	156	265
	Input AC Reactor 1	80	120	225	270	365	540	665	875

##### 460 V Class

Model Number		4008-D+	4016-D+	4030-D+	4043-D+	4058-D+	4086-D+	4145-D+	4210-D+	4300-D+	4410-D+	4560-D+
Heat Loss W	Harmonic Filter Module	37	57	77	84	96	158	216	272	365	--	--
	Input AC Reactor 1	75	100	145	285	290	375	580	610	1065	1205	1305
	Input AC Reactor 2	--	--	--	--	--	--	--	--	--	365	460
	Reactor for Harmonic Filter	--	--	--	--	--	--	--	--	--	45	55
	Condenser for Harmonic Filter	--	--	--	--	--	--	--	--	--	29	41



## Peripheral Devices and Options

### Peripheral Devices

Name	Purpose	Model, Manufacturer
Ground Fault Interrupter (GFI)	Always install a GFI on the power-supply side to protect the power supply system and to prevent an overload at the occurrence of short circuit, and to protect the drive from ground faults that could result in electric shock or fire.  <i>NOTE: When a GFI is installed for the upper power supply system, an MCCB can be used instead of a GFI.</i>  Choose a GFI designed to minimize harmonics specifically for energy-saving units. Use one GFI per energy-saving unit, each with a current rating of at least 30 mA.	NV series* by Mitsubishi Electric Corporation NS Series* by Schneider Electric
Circuit Breaker	Always install a circuit breaker on the power-supply side to protect the power supply system and to prevent an overload at the occurrence of a short circuit.	
Magnetic Contactor	Interrupts the power supply to the drive. In addition to protecting drive circuitry, a magnetic contactor also prevents damage to a braking resistor if used.	
Surge Protector	Absorbs the voltage surge from switching of electromagnetic contactors and control relays. Install a surge protector to the magnetic contactors and control relays as well as magnetic valves and magnetic braking coil.	DCR2 series RFN series by Nippon Chemicon Corporation
Noise Filter (Zero Phase Reactor)	Reduces noise from the line that enters into the input power system of energy-saving unit should be installed as close as possible to IMPULSE®•D+. Can be used on both the input and output sides.	F6045GB or F11080GB by Hitachi Metals, Ltd.

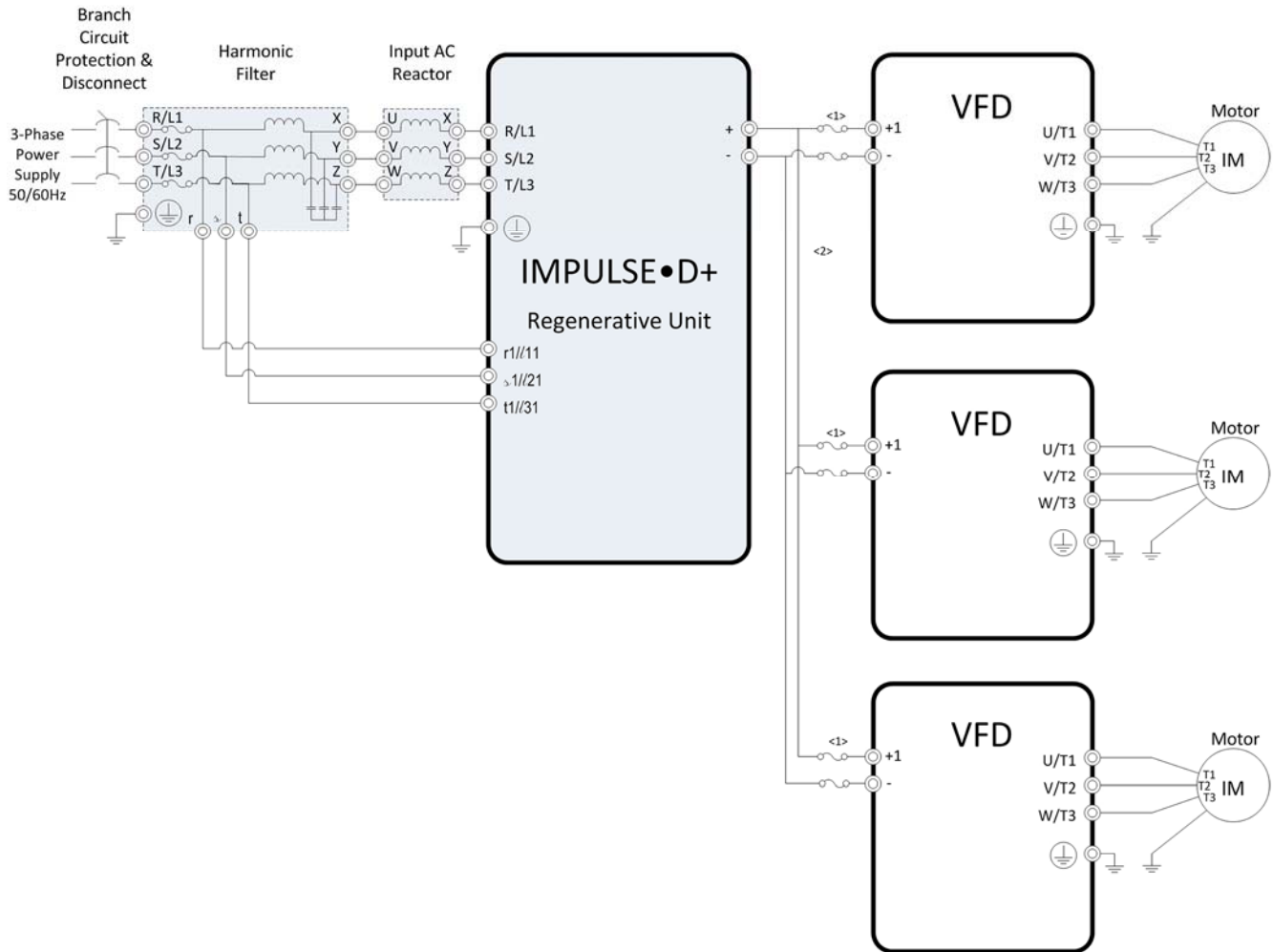
\*: Recommended by Magnetek. Contact the manufacturer in question for availability and specifications of non-Magnetek products.

### Options

Name	Purpose	Model, Manufacturer
24 V Power Supply	Provides power supply for the control circuit and option boards.  <i>NOTE: Parameter settings cannot be changed when the drive is operating solely from this power supply.</i>	PS-A10LB (230 V class) PS-A10HB (460 V class)
USB Copy Unit (RJ-45/USB compatible plug)	Can copy parameter settings easily and quickly to be later transferred to another drive. Adapter for connecting the IMPULSE®•D+ to the USB port of a PC.	JVOP-181



**Common Bus Connection Diagram for IMPULSE®•D+ Active Front End Line Regeneration Unit**



<1> When connecting multiple drives to a common DC bus, select the fuses per the **Recommended Input Fuse Selection** tables.  
 <2> The DC current bus wiring between the IMPULSE®•D+ unit and drive(s) must be within 5 meters.



**Recommended Input Fuse Selection**

**230 V Class IMPULSE®•G+/VG+ Series 4**

XXXX-G+/VG+S4	Fuse Type	
	Manufacturer: Bussmann	
	Model	Fuse Ampere Rating (A)
Three-Phase 230 V Class		
2003	FWH-70B	70
2005	FWH-70B	70
2007	FWH-70B	70
2008	FWH-70B	70
2011	FWH-70B	70
2014	FWH-90B	90
2017	FWH-90B	90
2025	FWH-100B	100
2033	FWH-200B	200
2047	FWH-200B	200
2060	FWH-200B	200
2075	FWH-300A	300
2085	FWH-300A	300
2115	FWH-350A	350
2145	FWH-400A	400
2180	FWH-400A	400
2215	FWH-600A	600
2283	FWH-700A	700
2346	FWH-800A	800
2415	FWH-1000A	1000



**460 V Class IMPULSE®•G+/VG+ Series 4**

XXXX-G+/VG+S4	Fuse Type	
	Manufacturer: Bussmann	
	Model	Fuse Ampere Rating (A)
Three-Phase 460 V Class		
4001	FWJ-40A	40
4003	FWJ-50A	50
4004	FWJ-70A	70
4005	FWJ-70A	70
4007	FWJ-90A	90
4009	FWJ-90A	90
4014	FWJ-90A	90
4018	FWJ-100A	100
4024	FWJ-125A	125
4031	FWJ-200A	200
4039	FWJ-250A	250
4045	FWJ-250A	250
4060	FWJ-250A	250
4075	FWJ-250A	250
4091	FWJ-250A	250
4112	FWJ-350A	350
4150	FWJ-400A	400
4180	FWJ-500A	500
4216	FWJ-600A	600
4260	FWJ-700A	700
4304	FWJ-800A	800
4370	FWJ-800A	800
4450	FWJ-1000A	1000
4605	FWJ-1200A	1200



## Application Notes

### Application Precautions

#### Installation of IMPULSE<sup>®</sup>•D+ Standard Configuration Devices

You must install both the IMPULSE<sup>®</sup>•D+ energy-saving unit and the IMPULSE<sup>®</sup>•D+ standard configuration devices.

#### IMPULSE<sup>®</sup>•D+ Sequence for Power Loss and Harmonic Filter Installation

Always sequence the power supply for the IMPULSE<sup>®</sup>•D+ unit so that the power supply circuit is opened after the operation of the IMPULSE<sup>®</sup>•D+ is stopped.

Always install the specified harmonic filter (harmonic filter module) to reduce the impact of voltage surges on other devices when the circuit opens for any unexpected reason during operation.

#### Panel Installation

Install the IMPULSE<sup>®</sup>•D+ in a clean environment by either selecting an area free of airborne oil mist, corrosive gas, flammable gas, dust, and lint, or install the IMPULSE<sup>®</sup>•D+ in a fully-enclosed panel. If you install the IMPULSE<sup>®</sup>•D+ in a panel, determine cooling methods and panel dimensions so that the ambient temperature of the IMPULSE<sup>®</sup>•D+ and harmonic filter module are within the allowable temperature range. Do not install the IMPULSE<sup>®</sup>•D+ on wood or other inflammable materials.

#### Installation Direction

Install the IMPULSE<sup>®</sup>•D+ upright on a wall.

#### Interlocks

An interlock is required between the IMPULSE<sup>®</sup>•D+ and a drive to stop the drive if the IMPULSE<sup>®</sup>•D+ fails or if an error occurs in the IMPULSE<sup>®</sup>•D+. It is also necessary to provide a suitable time to restart the drive if it will be restarted for momentary power losses.

Restarting can be timed with the During MC ON signal that is output from the control circuit terminals of the IMPULSE<sup>®</sup>•D+.

Create a sequence to turn off the output from the drive with an external base block input to the drive or by a similar means when the During MC ON signal opens (refer to \*6 in the Standard Connection Diagram).

#### *Example 1: Not Restarting for Momentary Power Losses (Coasting to a Stop for Momentary Power Losses)*

Connect the During MC ON output from the IMPULSE<sup>®</sup>•D+ to the external fault input on the drive. Use an N.C. input for the external fault input on the drive and set the drive to detect external faults only during operation to prevent an external fault from being detected when the power supply is turned on.

#### *Example 2: Restarting the System for Momentary Power Losses*

Change the setting for the external base block input terminal S8 on the drive from the default setting of an N.O. contact to an N.C. contact. Connect the During MC ON output from the IMPULSE<sup>®</sup>•D+ to the external base block input on the drive. Set restarting for momentary power losses in the drive.

**NOTE:** For G+ Mini/IMPULSE<sup>®</sup>•T, an external base block is not set in the default settings. Set an external base block (N.C.) for one of the multi-function input terminals.

#### *Example 3: Inputting a Run Commands to the Drive*

Always input Run Commands to the drive while the IMPULSE<sup>®</sup>•D+ is operating. You can check the operating status of the IMPULSE<sup>®</sup>•D+ with a During Run 1 signal on a multi-function output. For an example of a drive sequence, refer to Standard IMPULSE<sup>®</sup>•D+ Connection Diagram.





### **Wiring Check**

Do not short the output terminals or apply voltage to output terminals (U/T1, V/T2, W/T3), because this can cause serious damage to the IMPULSE<sup>®</sup>•D+ and the harmonic filter module.

Be sure to perform a careful check of all sequence wiring and other connections before turning the power on. Make sure there are no short circuits on the control terminals (+V, AC, etc.), because this could damage the IMPULSE<sup>®</sup>•D+.

### **Inspection and Maintenance**

Capacitors in the IMPULSE<sup>®</sup>•D+ do not immediately discharge after shutting off the power. After shutting off the power, wait at least the amount of time specified on the unit and harmonic filter module before touching any components.

Failure to comply may result in injury to personnel from electrical shock. Take proper precautions to prevent burns, because the heatsink of the IMPULSE<sup>®</sup>•D+ and the reactors of the harmonic filter module can get very hot during operation. When replacing the cooling fan, shut off the power to the IMPULSE<sup>®</sup>•D+ and wait at least 15 minutes to ensure that the heatsink has cooled down.

Before wiring the harmonic filter module or performing any maintenance, shut off the power and then wait at least the amount of time specified on the module to ensure that the heatsink has cooled down before touching any components.

### **Wiring**

Magnetek recommends using ring terminals on all models. Use only the tools recommended by the terminal manufacturer for crimping.

### **Transporting and Installation**

Do not steam-clean the IMPULSE<sup>®</sup>•D+ and harmonic filter module.

During transport, keep the unit from coming into contact with salts, fluorine, bromine, phthalate esters, and other such harmful chemicals.

Carry any standard configuration device or peripheral device in a method suitable for the weight of the device. If the devices are handled incorrectly, they may fall and result in injury or device damage.

### **Peripheral Devices**

When installing a noise filter on the power supply side, use a reactor type noise filter without a capacitor (such as FINEMET zero-phase reactor) and install it after the MCCB on the power supply side. Do not use a noise filter with a built-in capacitor, because the harmonic components may overheat or damage the capacitor. Install a noise filter recommended by Magnetek.

### **Installing a Ground Fault Interrupter or an MCCB**

Be sure to install an MCCB or an ELCB recommended by Magnetek on the power supply side of the IMPULSE<sup>®</sup>•D+ to protect internal circuitry.

The type of MCCB to be selected varies with the power factor on the power supply side (power supply voltage, output frequency, load characteristics, and others). Sometimes a fairly large MCCB may be required due to the effects of the harmonic current on operating characteristics. If you use an ELCB that is not recommended, use one with harmonic suppression that is designed specifically for drives. A malfunction may be caused by high-frequency leakage current, so the rated current of the ELCB must be 30 mA or higher per drive. If a malfunction occurs in an ELCB without any protection, adjust the carrier frequency of the drive, replace the ELCB with one that has countermeasures against high frequency, or use an ELCB which has a rated current of 200 mA or higher per drive.



Select an MCCB or an ELCB with a rated capacity greater than the short-circuit current for the power supply.

#### **Magnetic Contactor for Input Power**

Use a magnetic contactor (MC) to ensure that power to the IMPULSE<sup>®</sup>•D+ can be completely shut off when necessary. The MC should be wired so that it opens when a fault output terminal is activated.

#### **Wire Gauges and Wiring Distance**

The IMPULSE<sup>®</sup>•D+ phase control can be unstable as a result of voltage loss across a long cable running between the IMPULSE<sup>®</sup>•D+ and the power supply. Make sure that appropriate wire gauge is used.

The optional LCD operator requires a dedicated cable to connect to the IMPULSE<sup>®</sup>•D+. If an analog signal is sent via the input terminals to operate the IMPULSE<sup>®</sup>•D+, make sure that the cable between the analog operator and the IMPULSE<sup>®</sup>•D+ is not longer than 50 m, and that the cable is separated from the main circuit wiring. Use reinforced main circuit and reinforced relay sequence circuitry to prevent inductance from surrounding devices.

To use a multi-function analog input, use twisted shielded pair cables and ground the shield. Refer to the Standard Connection diagram for details.

#### **Generator Power Supplies**

Contact Magnetek for details.

#### **Connecting a Phase-advance Capacitor or Thyristor-controlled Device to the Power Supply**

A phase-advance capacitor is not required for the IMPULSE<sup>®</sup>•D+. Installing a phase-advance capacitor will reduce the power factor.

For a phase-advance capacitor already installed on the same power supply system as the IMPULSE<sup>®</sup>•D+, install a series reactor on the phase-advance capacitor to prevent oscillation with the IMPULSE<sup>®</sup>•D+.

Contact Magnetek if any device generating voltage surge or voltage distortion, such as the thyristor controller of the DC motor drive or magnetic agitator, uses the same power supply.

#### **Countermeasures for EMC (Radio Noise) and High Frequency (Harmonic) Leakage Current**

Preventive actions are not required for harmonic current, but preventive actions for EMC (radio noise) or harmonic leakage current are required as for a general drive.

If there are nearby devices that are easily affected by noise, install a zero-phase reactor as a noise filter.

If you install an MCCB or ELCB at the power supply, use an MCCB or ELCB designed for drives. The MCCB or ELCB should have countermeasures for high frequency leakage current.

#### **Compliance with Harmonic Suppression Guidelines**

A guideline for the reduction of harmonic emissions is available for users whose equipment requires 6.6 kV or more from the power supply system.

Although the IMPULSE<sup>®</sup>•D+ is equivalent to a self-excited, three-phase bridge ( $K_S=0$ ), that generates no harmonics, note that the harmonics are not completely eliminated.

#### **Impact of Power Supply Distortion**

When the power supply voltage is distorted or when several devices are connected in parallel to the same power supply, the relative harmonic content becomes larger, because the harmonics of the power supply system enter the IMPULSE<sup>®</sup>•D+.