XD-☐, XD-☐-E

XtraDrive

Intelligent servo drive. Integrated controller and network connectivity.

- NCT. Patented non-linear algorithm for tight control
- Very low tracking error with no overshoot and zero settling time
- Supports different servo motor encoder types
- PROFIBUS embedded in the drive available
- XtraDive model available with electronic CAM
- The ideal drive for linear motor control
- Fast hardware registration input
- Intuitive text programming language
- Automatic tuning of servo parameters for optimal settling time
- Oscilloscope available via XtraWare software tool
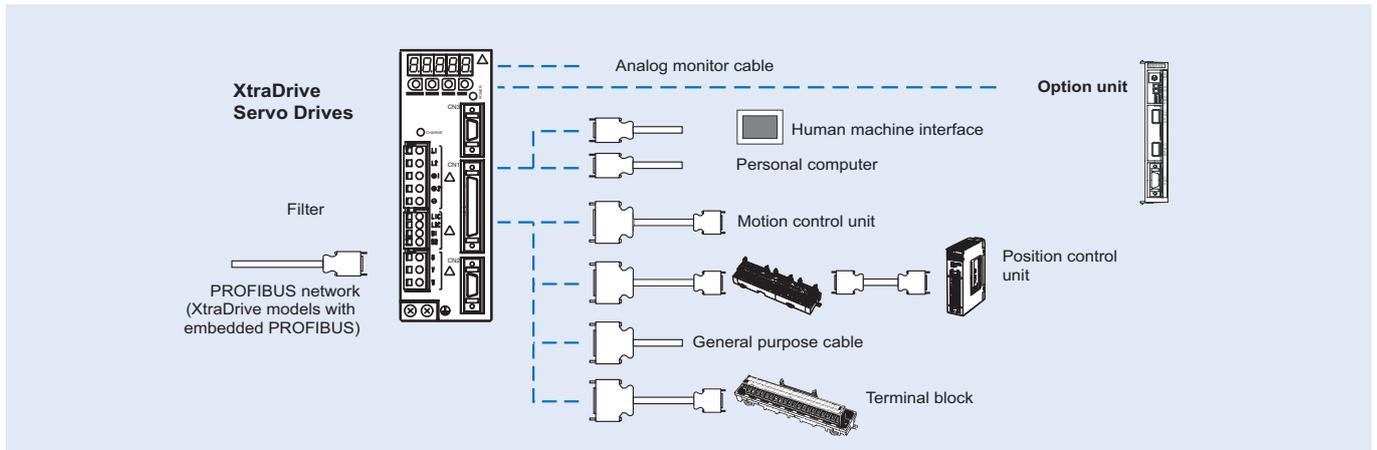- CompoWay/F is supported, it allows remote access to the drives through the PLC

Ratings

- 230 VAC single-phase 30 W to 1.5 kW (4.77 Nm)
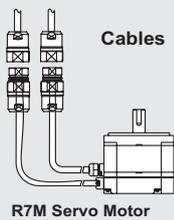- 400 VAC three-phase 0.5 kW to 5.0 kW (28.4 Nm)

System configuration
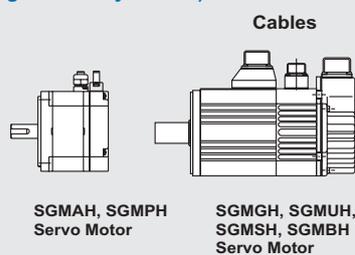

XtraDrive Servo Drives

Filter

PROFIBUS network (XtraDrive models with embedded PROFIBUS)

Analog monitor cable

Human machine interface

Personal computer

Motion control unit

Position control unit

General purpose cable

Terminal block

Option unit

(Refer to chapter SmartStep servo motors)

Cables

R7M Servo Motor

(Refer to chapter Sigma-II rotary motors)

Cables

SGMAH, SGMPH Servo Motor

SGMGH, SGMUH, SGMSH, SGMBH Servo Motor

(Refer to chapter Sigma-II linear motors)

Cables

SGLG_ linear Servo Motor

SGLF_ linear Servo Motor

SGLT_ linear Servo Motor

OMRON
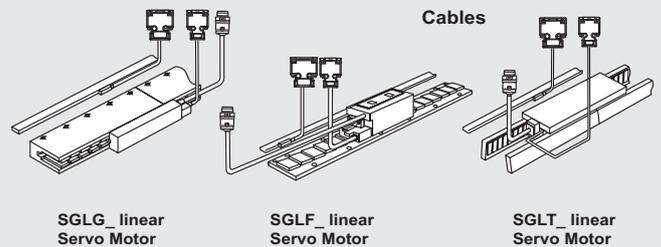
Servo motor / servo drive combination

Servo motor			Servo drive			
Voltage	Rated torque	Capacity	230 V (1-phase)	230 V (1-phase) w PROFIBUS	400 V (3-phase)	400 V (3-phase) w PROFIBUS
Sigma-II series motors (refer to the Sigma-II rotary motors chapter for details)						
SGMAH (3000 min⁻¹) 230 V	0.0955 N.m	30 W	XD-P3-MN01-☐	XD-P3-MSD0-☐	-	-
	0.159 N.m	50 W	XD-P5-MN01-☐	XD-P5-MSD0-☐	-	-
	0.318 N.m	100 W	XD-01-MN01-☐	XD-01-MSD0-☐	-	-
	0.637 N.m	200 W	XD-02-MN01-☐	XD-02-MSD0-☐	-	-
	1.27 N.m	400 W	XD-04-MN01-☐	XD-04-MSD0-☐	-	-
	2.39 N.m	750 W	XD-08-MN☐	XD-08-MSD0-☐	-	-
400 V	0.955 N.m	300 W	-	-	XD-05-TN☐	XD-05-TSD0-☐
	2.07 N.m	650 W	-	-	XD-10-TN☐	XD-10-TSD0-☐
SGMPH (3000 min⁻¹) 230 V	0.318 N.m	100 W	XD-01-MN01-☐	XD-01-MSD0-☐	-	-
	0.637 N.m	200 W	XD-02-MN01-☐	XD-02-MSD0-☐	-	-
	1.27 N.m	400 W	XD-04-MN01-☐	XD-04-MSD0-☐	-	-
	2.39 N.m	750 W	XD-08-MN☐-☐	XD-08-MSD0-☐	-	-
	4.77 N.m	1500 W	XD-15-MN☐-☐	-	-	-
400 V	0.637 N.m	200 W	-	-	XD-05-TN☐	XD-05-TSD0-☐
	1.27 N.m	400 W	-	-	XD-05-TN☐	XD-05-TSD0-☐
	2.39 N.m	750 W	-	-	XD-10-TN☐	XD-10-TSD0-☐
	4.77 N.m	1500 W	-	-	XD-15-TN☐	XD-15-TSD0-☐
SGMGH (1500 min⁻¹) 400 V	2.84 N.m	0.45 kW	-	-	XD-05-TN☐	XD-05-TSD0-☐
	5.39 N.m	0.85 kW	-	-	XD-10-TN☐	XD-10-TSD0-☐
	8.34 N.m	1.3 kW	-	-	XD-15-TN☐	XD-15-TSD0-☐
	11.5 N.m	1.8 kW	-	-	XD-20-TN☐	XD-20-TSD0-☐
	18.6 N.m	2.9 kW	-	-	XD-30-TN☐	XD-30-TSD0-☐
	28.4 N.m	4.4 kW	-	-	XD-50-TN☐	-
SGMSH (3000 min⁻¹) 400 V	3.18 N.m	1.0 kW	-	-	XD-10-TN☐	XD-10-TSD0-☐
	4.90 N.m	1.5 kW	-	-	XD-15-TN☐	XD-15-TSD0-☐
	6.36 N.m	2.0 kW	-	-	XD-20-TN☐	XD-20-TSD0-☐
	9.80 N.m	3.0 kW	-	-	XD-30-TN☐	XD-30-TSD0-☐
	12.6 N.m	4.0 kW	-	-	XD-50-TN☐	-
	15.8 N.m	5.0 kW	-	-	XD-50-TN☐	-
SGMUH (6000 min⁻¹) 400 V	1.59 N.m	1.0 kW	-	-	XD-10-TN☐	XD-10-TSD0-☐
	2.45 N.m	1.5 kW	-	-	XD-15-TN☐	XD-15-TSD0-☐
	4.9 N.m	3.0 kW	-	-	XD-30-TN☐	XD-30-TSD0-☐
	6.3 N.m	4.0 kW	-	-	XD-50-TN☐	-
SmartStep series motors (refer to the SmartStep servo motors chapter for details)						
R7M-A (3000 min⁻¹) 230 V	0.0955 N.m	30 W	XD-P3-MN01-☐	-	-	-
	0.159 N.m	50 W	XD-P5-MN01-☐	-	-	-
	0.318 N.m	100 W	XD-01-MN01-☐	XD-01-MSD0-☐	-	-
	0.637 N.m	200 W	XD-02-MN01-☐	XD-02-MSD0-☐	-	-
	1.27 N.m	400 W	XD-04-MN01-☐	XD-04-MSD0-☐	-	-
	2.39 N.m	750 W	XD-08-MN☐	XD-08-MSD0-☐	-	-
R7M-AP (3000 min⁻¹) 230 V	0.318 N.m	100 W	XD-01-MN01-☐	XD-01-MSD0-☐	-	-
	0.637 N.m	200 W	XD-02-MN01-☐	XD-02-MSD0-☐	-	-
	1.27 N.m	400 W	XD-04-MN01-☐	XD-04-MSD0-☐	-	-
	2.39 N.m	750 W	XD-08-MN☐	XD-08-MSD0-☐	-	-
Sigma linear motors (refer to the Sigma linear motors chapter for details)						
SGLGW Linear motors	230 V	Refer to the linear motors chapter for details				
SGLFW Linear motors	230 V, 400 V	Refer to the linear motors chapter for details				
SGLTW Linear motors	400 V	Refer to the linear motors chapter for details				

Type designation

Drive

$$XD - 01 - MN\ 01\text{-}E$$

- XtraDrive
- Output capacity
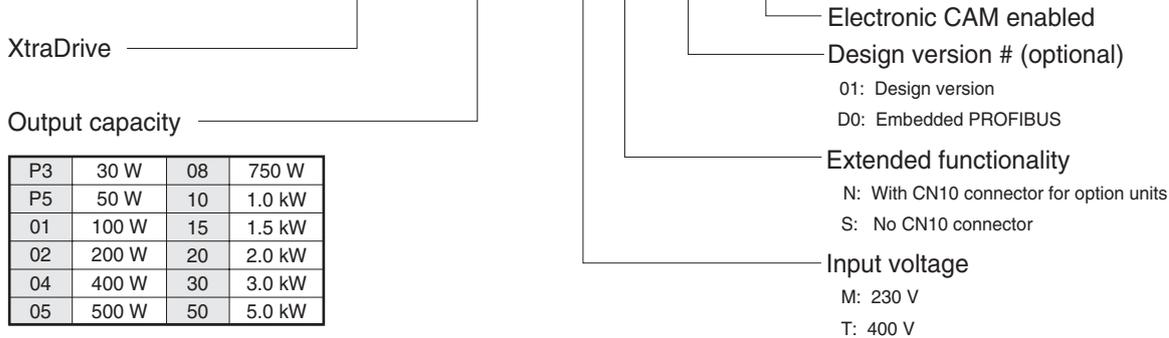
P3	30 W	08	750 W
P5	50 W	10	1.0 kW
01	100 W	15	1.5 kW
02	200 W	20	2.0 kW
04	400 W	30	3.0 kW
05	500 W	50	5.0 kW

- Electronic CAM enabled
- Design version # (optional)
  - 01: Design version
  - D0: Embedded PROFIBUS
- Extended functionality
  - N: With CN10 connector for option units
  - S: No CN10 connector
- Input voltage
  - M: 230 V
  - T: 400 V

Servo drive specifications

Single-phase, 230 V

Servo drive type			XD-P3-M☐	XD-P5-M☐	XD-01-M☐	XD-02-M☐	XD-04-M☐	XD-08-M☐	XD-15-M☐
Applicable servo motor	SGMAH-☐		A3A☐	A5A☐	01A☐	02A☐	04A☐	08A☐	15A☐
	SGMPH-☐		-	-	01A☐	02A☐	04A☐	08A☐	-
	R7M-☐		A03030-☐	A05030-☐	A10030-☐	A20030-☐	A40030-☐	A75030-☐	-
	R7M-☐		-	-	AP10030-☐	AP20030-☐	AP40030-☐	AP75030-☐	-
Basic specifications	Max. applicable motor capacity	W	30	50	100	200	400	750	1500
	Continuous output current	Arms	0.44	0.64	0.91	2.1	2.8	5.7	11.6
	Max. output current	Arms	1.3	2.0	2.8	6.5	8.5	13.9	28
	Input power	Main circuit	For single-phase, 200 to 230 VAC + 10 to -15%						
	Supply	Control circuit	For single-phase, 200 to 230 VAC + 10 to -15%						
	Control method		Single phase full-wave rectification / IGBT / PWM / sine-wave current drive method						
	Feedback		Serial encoder (incremental/absolute value)						
	Conditions	Usage/storage temperature	0 to +55 °C / -20 to 85 °C						
		Usage/storage humidity	90%RH or less (non-condensing)						
		Altitude	1000 m or less above sea level						
		Vibration/shock resistance	4.9 m/s^2 / 19.6 m/s^2						
	Configuration		Base mounted						
	Approx. weight	Kg	0.8				1.1	1.7	3.8

Three-phase, 400 V

Servo drive type			XD-05-T☐	XD-10-T☐	XD-15-T☐	XD-20-T☐	XD-30-T☐	XD-50-T☐
Applicable servo motor	SGMAH-☐		03D☐	07D☐	-	-	-	-
	SGMPH-☐		02D☐, 04D☐	08D☐	15D☐	-	-	-
	SGMGH-☐		05D☐	09D☐	13D☐	20D☐	30D☐	44D☐
	SGMSH-☐		-	10D☐	15D☐	20D☐	30D☐	40D☐/50D☐
	SGMUH-☐		-	10D☐	15D☐	-	30D☐	40D☐
Basic specifications	Max. applicable motor capacity	kW	0.45	1.0	1.5	2.0	3.0	5.0
	Continuous output current	Arms	1.9	3.5	5.4	8.4	11.9	16.5
	Max. output current	Arms	5.5	8.5	14	20	28	40.5
	Input power	Main circuit	For three-phase, 380 to 480 VAC + 10 to -15% (50/60 Hz)					
	Supply	Control circuit	24 VDC+15%					
	Control method		Three phase full-wave rectification / IGBT / PWM / sine-wave current drive method					
	Feedback		Serial encoder (incremental/absolute value)					
	Conditions	Usage/storage temperature	0 to +55 °C / -20 to +85 °C					
		Usage/storage humidity	90%RH or less (non condensing)					
		Altitude	1000 m or less above sea level					
		Vibration/shock resistance	4.9 m/s^2 / 19.6 m/s^2					
	Configuration		Base mounted					
	Approx. weight	Kg	2.8			3.8		5.5

General specifications

Speed/torque control mode — Performance	Speed control range		1:5000
	Speed variance	Load variance	During 0 to 100% load ±0.01% max. (at rated speed)
		Voltage variance	Rated voltage ±10%: 0% (at rated speed)
		Temperature variance	25 ±25 °C: ±0.1 % max (at rated speed)
	Frequency characteristics		400Hz (at J_L= J_M)
	Torque control accuracy (reproducibility)		±2%
	Soft start time setting		0 to 10s (acceleration, deceleration can each be set.)
Input signal	Speed reference input	Reference voltage	±6VDC (forward motor rotation if positive reference) at rated speed: Set at delivery Variable setting range: ±2 to ±10 VDC at rated speed/ max. input voltage: ±12 V
		Input empedance	Approx. 14 kΩ
		Circuit time constant	-
	Torque reference input	Reference voltage	±3 VDC (forward rotation if positive reference) at rated speed: Set at delivery Variable setting range ±1 to ±10 VDC at rated torque reference
		Imput impedance	Approx. 14 KΩ
		Circuit time constant	Approx. 47 µs
	Contact speed reference	Rotation direction selection	With P control signal
		Speed selection	With forward/reverse current limit signal (speed 1 to 3 selection), servo motor stops or another control method is used when both are OFF.
Position control mode — Performance	Bias Setting		0 to 450 min^{-1} (setting resolution: 1 min^{-1})
	Feed forward compensation		0 to 100 % (setting resolution: 1%)
	Position completed width setting		0 to 250 command units (setting resolution: 1 command unit)
Input signal	Command pulse	Input pulse type	Sign + pulse train, 90° phase displacement 2-phase pulse (A-phase+ B-phase) or CCW/CW pulse train
		Input pulse form	Line driver (+5 V level) , open collector (+5 V or +12 level)
		Input pulse frequency	0 to 500 Kpps (200 Kpps max. at open collector)
	Control signal		Clear signal (input pulse is same as reference pulse)
I/O signal	Position signal output		A-phase, B.phase, C-phase, (S-phase): line driver output S-phase is for absolute encoder only.
	Sequence input signal		Servo ON, P control (or control mode switching, zero clamp, command pulse inhibit), forward/reverse run prohibit, alarm reset, forward/ reverse current limit (or internal speed switching)
	Sequence output signal		Servo alarm, alarm codes (3-bit output): CN1 output terminal is fixed
			It is possible to output three types of signals form among: positioning complete (speed agree), motor rotation, servo ready, current limit, speed limit, brake release, warning, NEAR, and zero point pulse signal
Integrated functions	Communications	Interface	Digital operator (hand- held type), RS-422 port for PCs, etc. (RS-232C ports under some conditions)
		1:N communications	N may equal up to 14 when an RS-422A port is used. CompoWay/F protocol is supported on firmware version "3.20C" and higher
		Axis address setting	Set by user setting
		Functions	Status display, user constant setting monitor display, alarm traceback display, JOG run /autotuning operations, and graphing functions for speed/torque command signal, etc
		PROFIBUS	(Only models with PROFIBUS) PROFIBUS DP slave, node address 0-125 set by rotary switches, baud rate from 9.6 kbps to 12 Mbps. LED Indicators: Bus failure and system failure
	Auto tuning function		Position speed loop gain and integral time constant can be automatically set.
	Dynamic brake (DB)		Operates during main power OFF, servo alarm, servo OFF or overtravel
	Regenerative processing		Regenerative resistor externally mounted (option)
	Overtravel (OT) prevention function		DB stop, deceleration stop or coast to stop during P-OT, N-OT operation
	Encoder divider function		Optional division possible
	Electronic gearing		0,01< A/B<100
	Internal speed setting function		3 speeds may be set internally
	Protective functions		Overcurrent, overvoltage, insufficient voltage, overload, main circuit sensor error, heatsink overheat, power phase loss, overflow, overspeed, encoder error, runaway, CPU error, parameter error, etc.
	Analog monitor functions for supervision		Integrates analog monitor connectors for supervision of the speed and torque reference signals, etc.
	Display functions		CHARGE, POWER, 7-segments LEDx5 (Integrated digital operator function, not available in models with PROFIBUS)
	Others		Reverse connection, zero search, automatic motor discrimination function, and DC reactor connection terminal for high frequency power suppression function (except: 6 to 15 kW)

I/O specifications

Terminal specifications

Symbol	Name	Function	
L1, L2 or L1, L2, L3	Main circuit AC input terminal	AC power input terminals for the main circuit	
U	Servo motor connection terminal	Red	Terminals for outputs to the servo motor.
V		White	
W		Blue	
L1C, L2C	Control power input terminal	AC power input terminals for the control circuit.	
⏚	Frame ground	Ground terminal. Ground to a maximum of 100 Ω (class 3)	
B1, B2 or B1, B2, B3	Main circuit DC output terminal	5 kW or less: Connect an external regenerative resistor if regenerative energy is high. 5.5 kW: There is no internal regenerative resistor. Be sure to connect an external regenerative resistor unit.	
⊕1, ⊕2	DC reactor connection terminal for suppressing power supply harmonic waves	Normally, short ⊕1 and ⊕2. If a countermeasure against power supply harmonic waves is needed, connect a DC reactor between ⊕1 and ⊕2.	
⊕	Main circuit DC output terminal (+)	Normally, not connected. This terminal exists on the servo drives with a capacity opf 6.0 kW or higher only.	
⊖	Main circuit DC output terminal (n-)	Normally, not connected.	

Encoder connector (CN2)

Pin	Symbol	Function
1, 2, 3	PPG0V	Encoder power supply GND
4, 5, 6	PPG5V	Encoder power supply +5 V
7	-	-
8	PS+	Encoder serial signal input
9	PS–	Encoder serial signal input
10	SePG5V	Serial encoder power supply +5 V (Sigma-II)
11	SePG0V	Serial encoder power supply GND (Sigma-II)
12	BAT+	Battery + (used only with absolute encoder)
13	BAT-	Battery - (used only with absolute encoder)
14	PC+	Encoder + C-phase input
15	PC–	Encoder –C-phase input
16	A+	Encoder + A-phase input
17	A–	Encoder –A-phase input
18	B+	Encoder + B-phase input
19	B–	Encoder –B-phase input
20	-	-
Shell	FG	Cable shield ground

I/O signals (CN1) - input signals

Pin No.	Signal Name		Function	
40	Common	/S-ON	Servo ON: Turns ON the servo motor when the gate block in the inverter is released.	
41		/P-CON	Function selected by parameter.	
			Proportional control reference	Switches the speed control loop from PI (proportional/ integral) to P (proportional) control when ON.
			Direction reference	With the internal set speed selected: switch the rotation direction.
			Control mode switching	Position ↔ speed Position ↔ torque } Enables control mode switching. Torque ↔ speed
			Zero-clamp reference	Speed control with zero-clamp function: referencevspeed is zero when ON.
			Reference pulse block	Position control with reference pulse stop: stops reference pulse input when ON.
42 43		P-OT N-OT	Forward run prohibited Reverse run prohibited	Overtravel prohibited: stops servo motor when movable part travels beyond the allowable range of motion.
45 46		/P-CL /N-CL	Function selected by parameter.	
			Forward external torque limit ON Reverse external torque limit ON	Current limit function enabled when ON.
			Internal speed switching	With the internal set speed selected: switches the internal speed settings.
44		/ALM-RST	Alarm reset: releases the servo alarm state.	
47		+24VIN	Control power supply input for sequence signals: users must provide the +24 V power supply. Allowable voltage fluctuation range: 11 to 25 V	
4 (2)		SEN	Initial data request signal when using an absolute encoder.	
21 22		BAT (+) BAT (-)	Connecting pin for the absolute encoder backup battery. Do not connect when a battery is connected to the host controller.	
5 (6)	Speed	V-REF	Speed reference speed input: ±2 to ±10 V/rated motor speed (input gain can be modified using a parameter.)	
9 (10)	Torque	T-REF	Torque reference input: ±1 to ±10 V/rated motor torque (input gain can be modified using a parameter.)	
7 8 11 12	Position	PULS /PULS SIGN /SIGN	Reference pulse input for line driver only	Input mode is set from the following pulses. Sign + pulse string CCW/CW pulse Two-phase pulse (90° phase differential)
15 14		CLR /CLR	Positional error pulse clear input: clears the positional error pulse during position control.	
3 13 18		PL1 PL2 PL3	+12 V pull-up power is supplied when PULS, SIGN, and CLR reference signals are open-collector outputs (+12 V power supply is built into the SERVOPACK).	

Note: 1. Pin numbers in parentheses () indicate signal grounds.

2. The functions allocated to /S-ON, /P-CON. P-OT, N-OT, /ALM-RST, /P-CL, and /N-CL input signals can be changed by using the parameters.

3. The voltage input range for speed and torque references is a maximum of ±12 V.
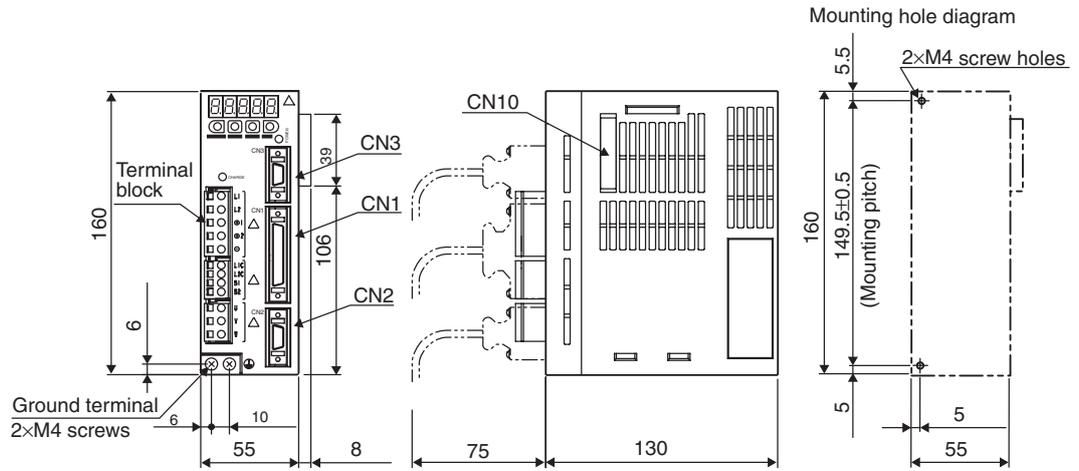
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I/O signals (CN1) - output signals

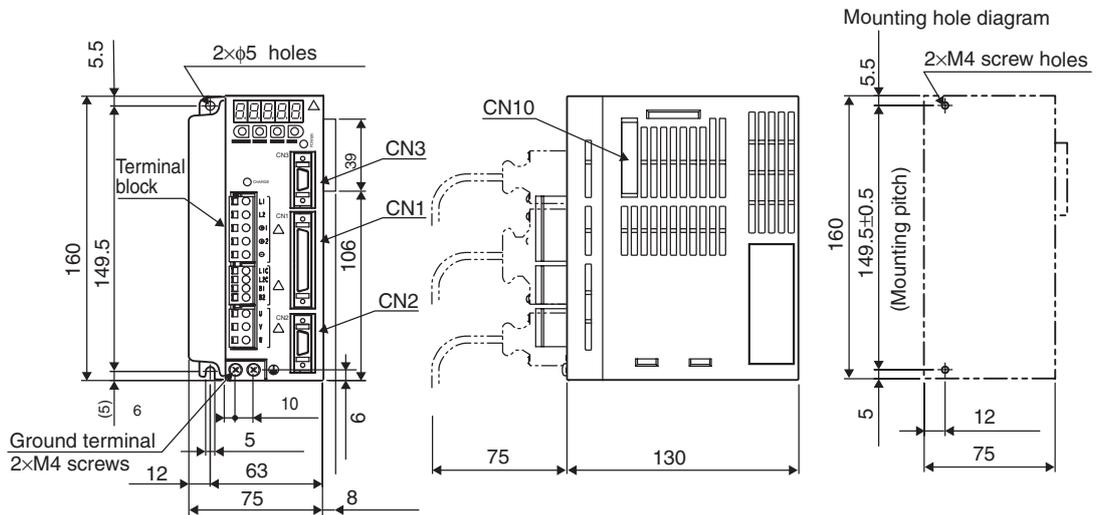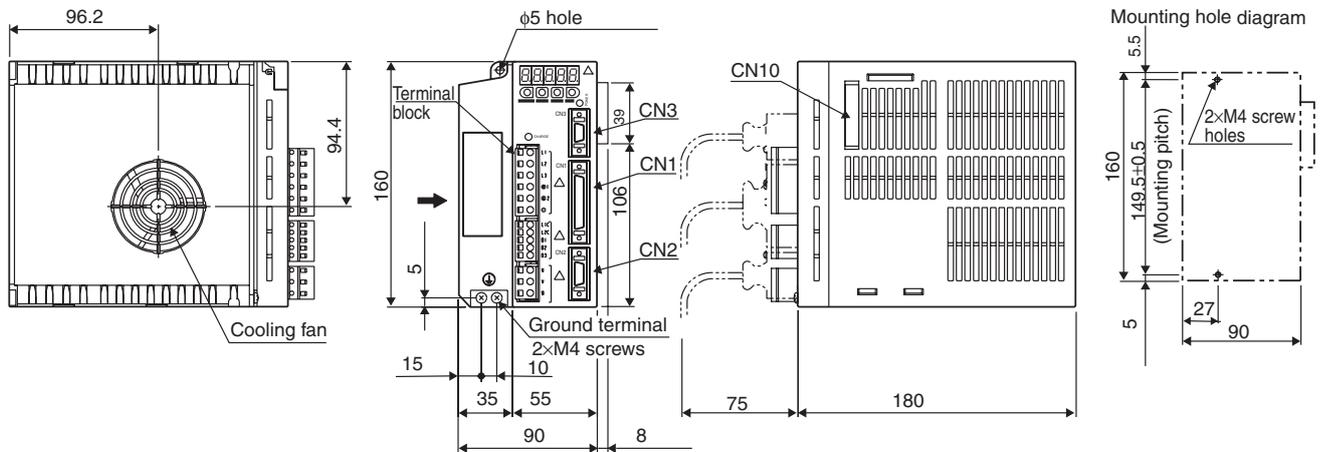| Pin No.	Signal name		Function	
31 32	Common	ALM+ ALM-	Servo alarm: Turns OFF when an error is detected.	
27 28		/TGON+ /TGON-	Detection during servo motor rotation: detects when the servo motor is rotating at a speed higher than the motor speed setting. Detection speed can be set by using the parameters.	
29 30		/S-RDY+ /S-RDY-	Servo ready: ON if there is no servo alarm when the control/main circuit power supply is turned ON.	
33 (1) 34		PAO /PAO	Phase-A signal	Converted two-phase pulse (phases A and B) encoder output signal and zero-point pulse (phase C) signal: RS-422 or the equivalent (proper line receiver is SN75175 manufactured by Texas Instruments or the equivalent corresponding to MC3486.)
35 36		PBO /PBO	Phase-B signal	
19 20		PCO /PCO	Phase-C signal	
48 49		PSO /PSO	Phase-S signal	With an absolute encoder: Outputs serial data corresponding to the number of revolutions (RS-422 or the equivalent)
37 38 39 (1)		ALO1 ALO2 ALO3	Alarm code output: Outputs 3-bit alarm codes. Open-collector: 30 V and 20 mA rating maximum	
16		TMON	Analog monitor signal	
17		VTG	Analog monitor signal	
Shell		FG	Connected to frame ground if the shield wire of the I/O signal cable is connected to the connector shell.	
25 26	Speed	/V-CMP+ /V-CMP-	Speed coincidence (output in speed control mode): Detects whether the motor speed is within the setting range and if it matches the reference speed value.	
25 26	Position	/COIN+ /COIN-	Positioning completed (output in position control mode): Turns ON when the number of positional error pulses reaches the value set. The setting is the number of positional error pulses set in reference units (input pulse units defined by the electronic gear).	
-	Reserved	/CLT /VLT /BK /WARN /NEAR	Reserved terminals The functions allocated to /TGON, /S-RDY, and /V-CMP (/COIN) can be changed by using the parameters. /CLT, /VLT, /BK, /WARN, and /NEAR signals can also be changed.	
23 24 50		-	Terminals not used Do not connect relays to these terminals.	

Note: 1. Pin numbers in parentheses () indicate signal grounds.

2. The functions allocated to /TGON, /S-RDY, and /V-CMP (/COIN) can be changed by using the parameters. /CLT, /VLT, /BK, /WARN, and /NEAR signals can also be changed.

AC servo systems

Dimensions

Servo drives

XD-P3-M☐ to XD-02-M☐ (230V, 30 to 200W)

Mounting hole diagram

CN10

Terminal block

CN3
CN1
CN2

Ground terminal
2×M4 screws

2×M4 screw holes

160
106
39
6
160
149.5±0.5 (Mounting pitch)
5.5
5

55
8
75
130
6
10
5
55

XD-04-M☐ (230V, 400W)

Mounting hole diagram

2×φ5 holes

Terminal block

CN10

CN3
CN1
CN2

Ground terminal
2×M4 screws

2×M4 screw holes

5.5
160
149.5
106
39
160
149.5±0.5 (Mounting pitch)
5.5
5

(5)
6
10
6
12
63
75
8
5
75
130
12
75

XD-08-M☐ (230V, 750W)

96.2
94.4

Cooling fan

φ5 hole

Terminal block

CN10

CN3
CN1
CN2

Ground terminal
2×M4 screws

Mounting hole diagram

160
106
39
5
160
149.5±0.5 (Mounting pitch)
5.5
5

2×M4 screw holes

15
35
55
10
90
8
75
180
27
90

OMRON

XD-05-T☐ to -15-T☐ (400V, 0.5 to 1.5kW)
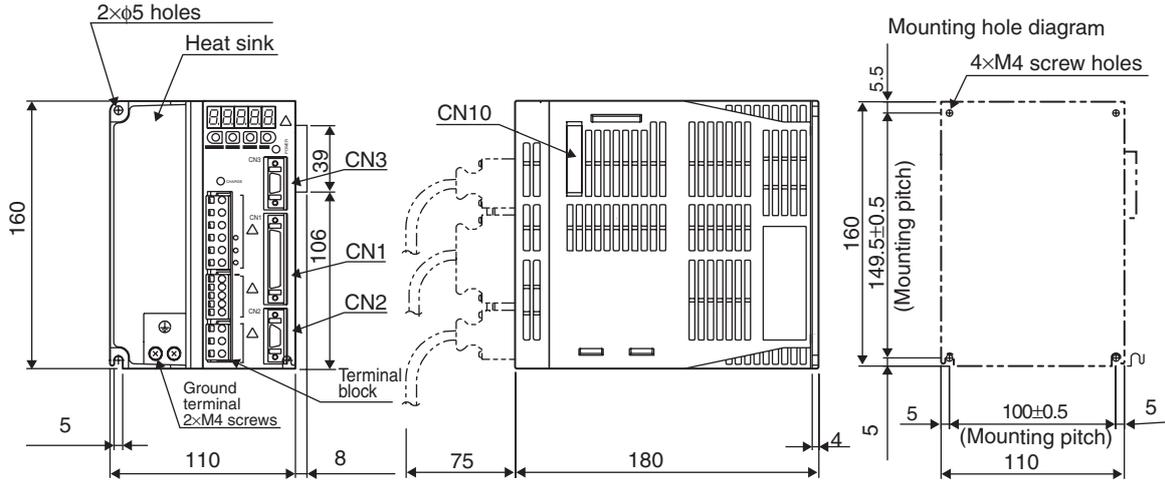
XD-15-M☐ (230V, 1.5kW)
XD-20-T☐, XD-30-T☐ (400V, 2/3kW)
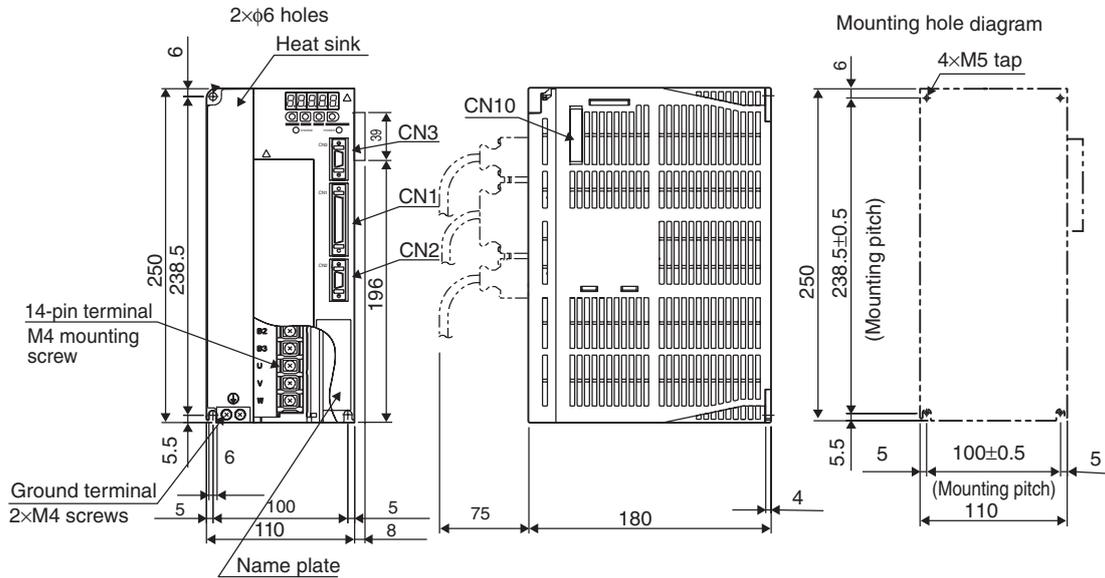
XD-50-T☐ (400V, 5kW)

Filters

R88A-FIW104-SE

Units:mm (in)

R88A-FIW107-SE, R88A-FIW115-SE

Model		R88A-FIW107-SE	R88A-FIW115-SE
Dimensions in mm	A	75	90
	B	240+5	300+5
	C	50	60
	D	12	15
	E	1	1.2

Units:mm

R88A-FIW125-SE

Units:mm(in)
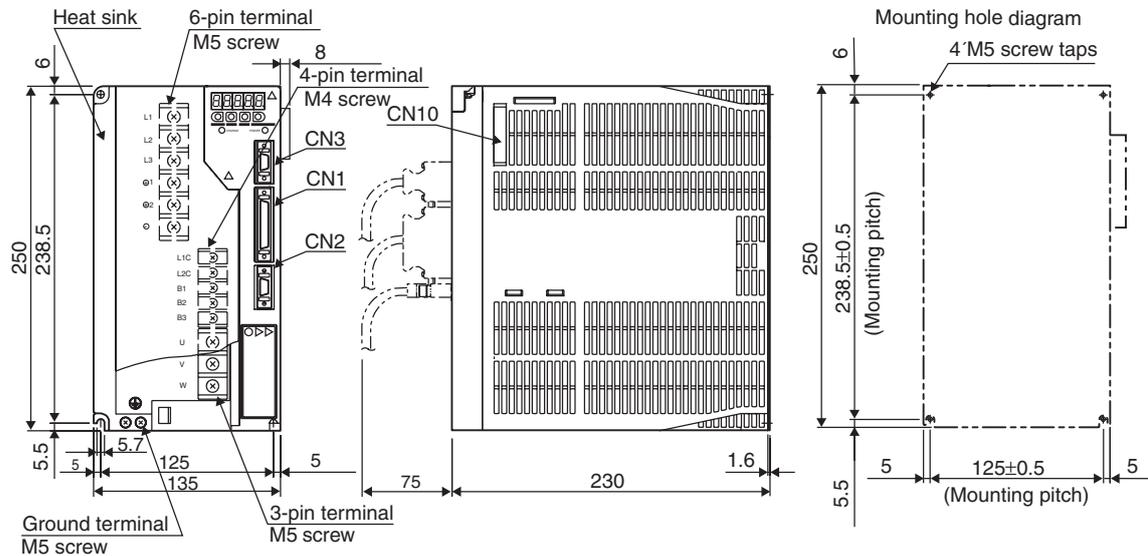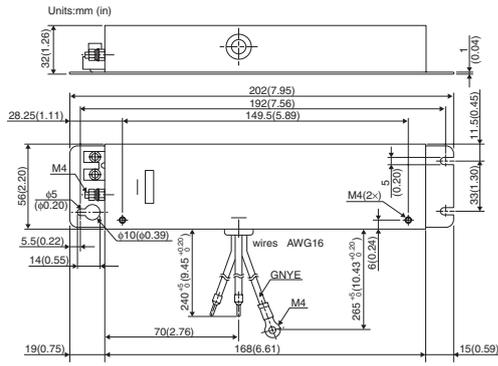
R88A-FIW4006-SE, R88A-FIW4010-SE

Model		R88A-FIW4006-SE	R88A-FIW4010-SE
Dimensions in mm (in)	A	32 (1.26)	35 (1.38)
	B	16 (0.63)	18 (0.71)
	C	202 (7.95)	291 (11.46)
	D	192 (7.56)	281 (11.06)
	E	150 (5.91)	239 (9.41)
	F	300 (11.81)	270 (10.63)
	G	70 (2.76)	90 (3.54)
	H	168 (6.61)	257 (10.12)

Units:mm(in)

R88A-FIW4020-SE

Units:mm(in)

OMRON
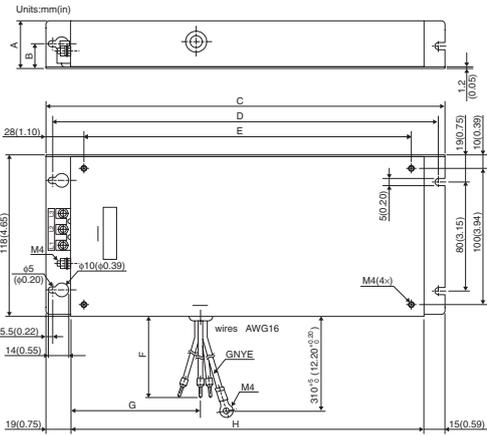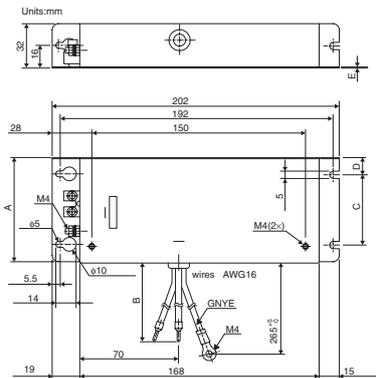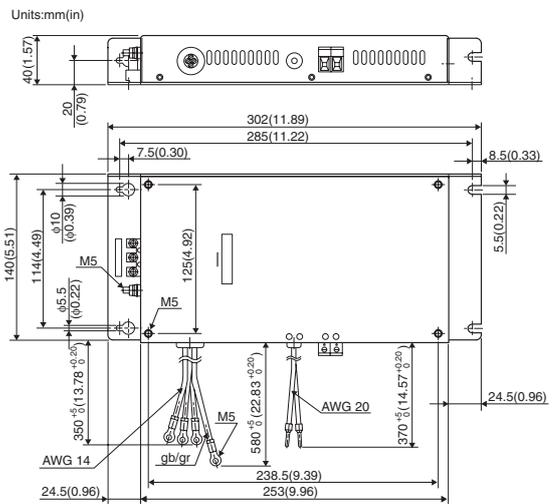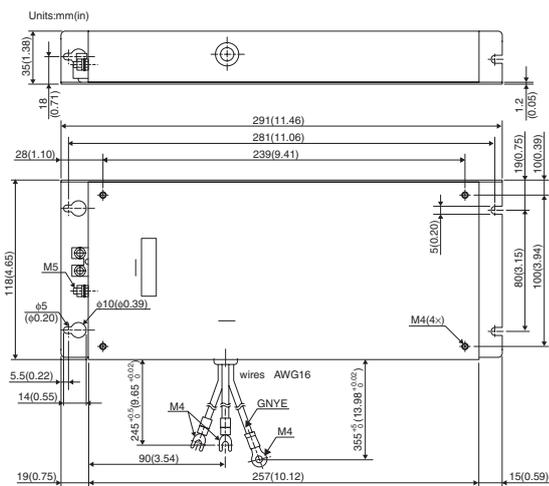
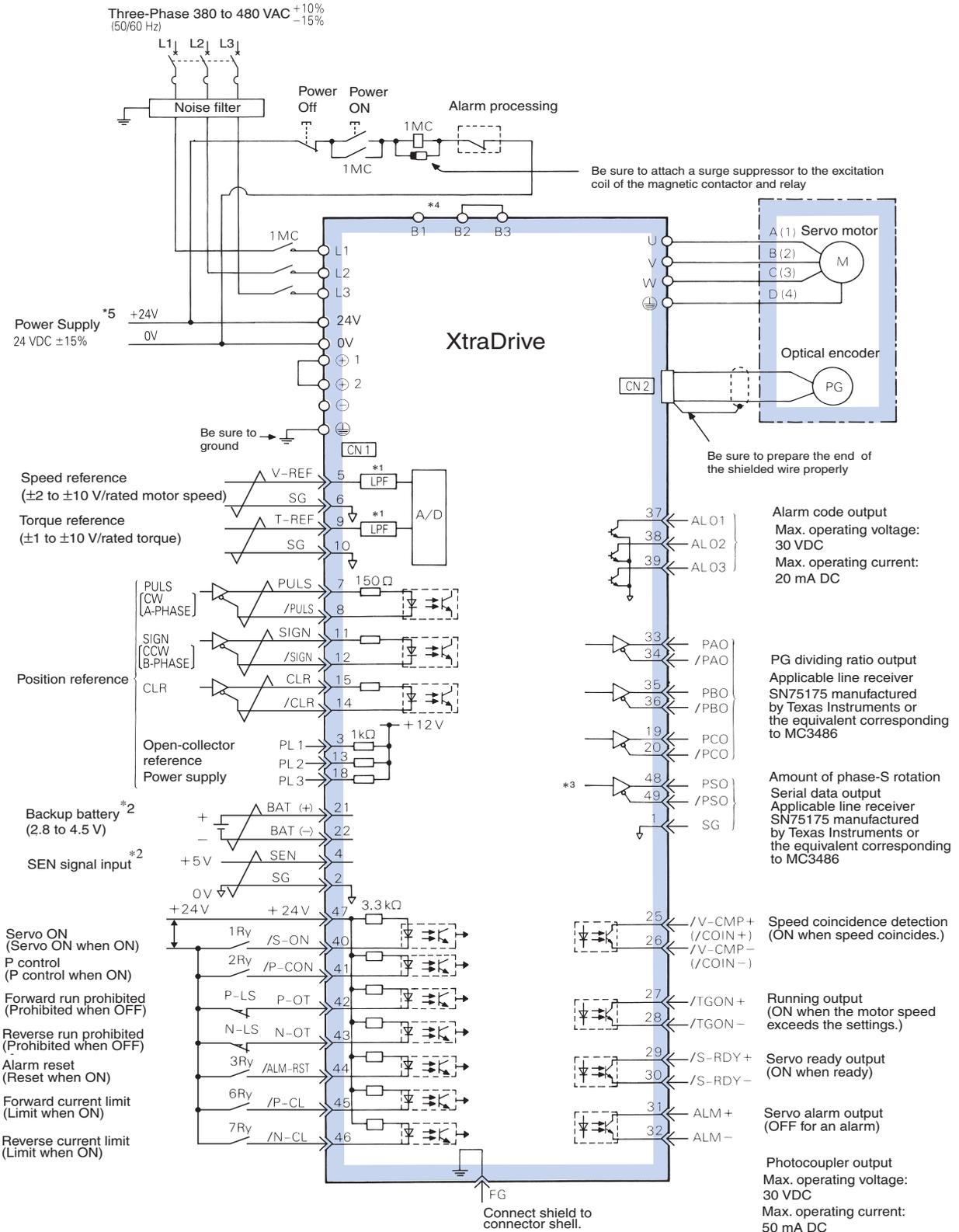## Installation

Single-phase, 230 VAC
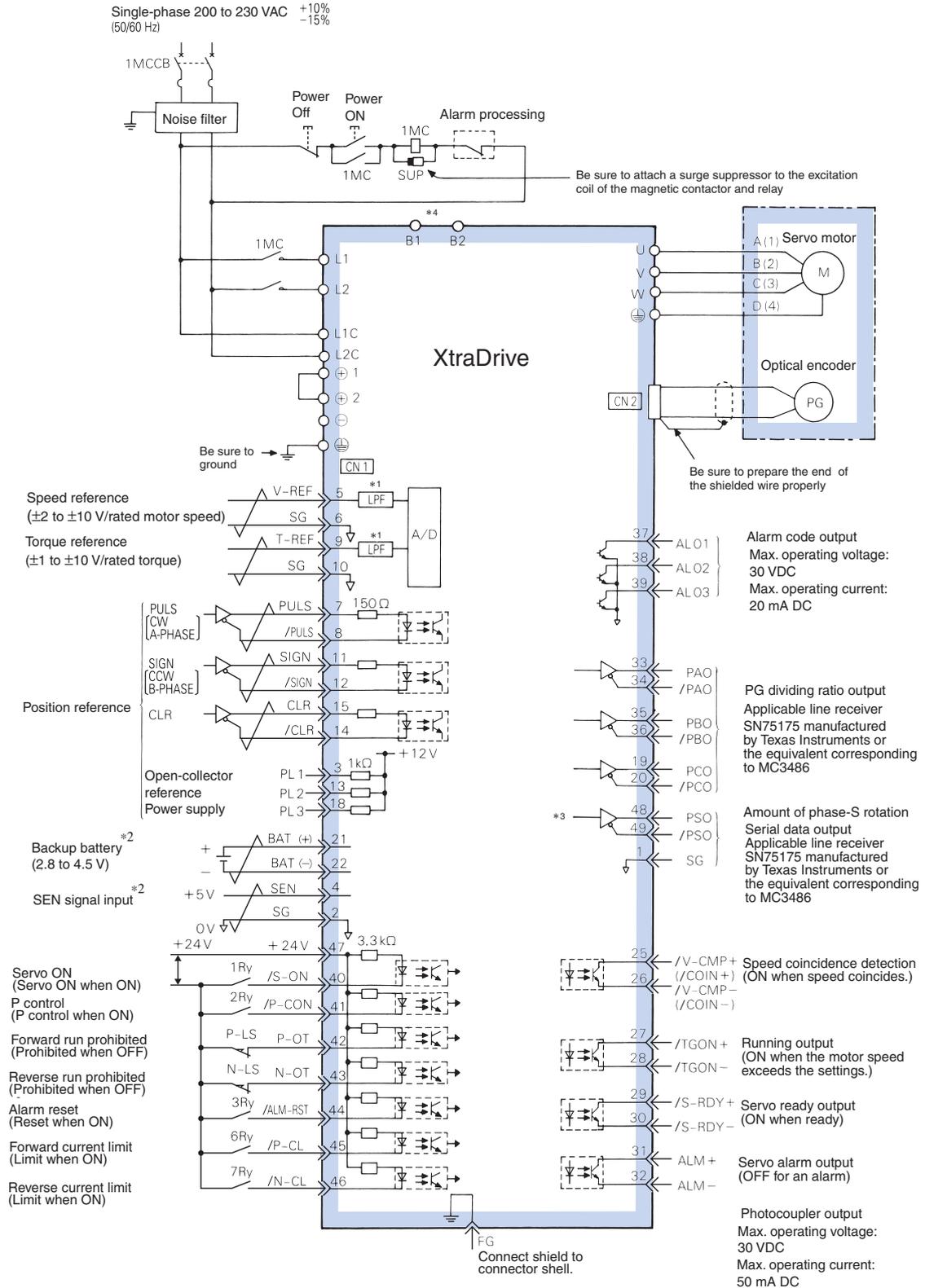
*1 The time constant for the primary filter is 47 µs.
*2 Connect when using an absolute encoder.
*3 Used only with an absolute encoder.
*4 Regenerative resistor can be connected between B1 and B2.
*6 TI stands for Texas Instruments Inc.

Three-phase, 400 VAC

Three-Phase 380 to 480 VAC $^{+10\%}_{-15\%}$
(50/60 Hz)

*1 The time constant for the primary filter is 47 µs.
*2 Connect when using an absolute encoder.
*3 Used only with an absolute encoder.
*4 For using an external regenerative resistor, connect it between B1 and B2.
*5 The 24VDC power is supplyed by the user.
*6 TI stands for Texas Instruments Inc.

XtraDrive