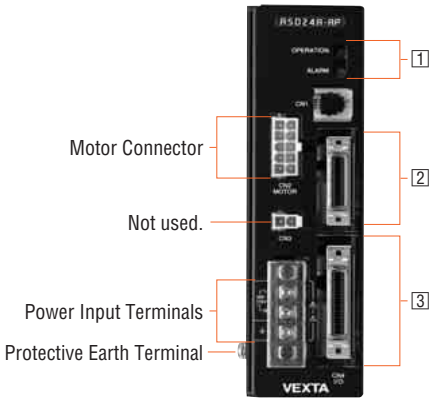
Connection and Operation (Built-In Controller Package)

Names and Functions of Driver Parts



1 Signal Monitor Display

◇LED Indicators

Indication	Color	Function	When Activated
OPERATION	Green	Power Supply Indication	Lights when AC power is on.
ALARM	Red	Alarm Indication	Blinks when protective functions are activated.

◇Alarm

Blink Count	Protective Function	When Activated	Alarm Code Output	Operation	Reset
1	Stack Overflow	Too many nested LOOP, ENDL, CALL, etc.	90h (Decimal: 144)	The program stops. The motor performs stop operation set by MSTOPACT.	✻ Possible
	Memory Read Error	The data stored in the memory is damaged.	91h (Decimal: 145)		
	Program Reference Error	The called program does not exist.	94h (Decimal: 148)		
	Compilation Error	The executed program is not executable.	95h (Decimal: 149)		
	Operation Result Overflow	The operation result exceeds the range of −8 388 608 to +8 388 607.	98h (Decimal: 152)		
	Parameter Out-of-Range Error	The parameter exceeds its setting range.	99h (Decimal: 153)		
	Divide by Zero	Divide by zero was executed.	9Ah (Decimal: 154)		
	General I/O Definition Error	The signal assignment method for general I/O ports was not correct.	9Ch (Decimal: 156)		
	PC Command Execution Error	A PC command was executed while the motor was operating or not energized.	9Dh (Decimal: 157)		
2	Overheat Protection	The temperature of the heat sink in the driver has reached approx. 85°C (185°F).	21h (Decimal: 33)	The motor loses it's holding torque.	✻ Possible
	Overload Protection	A load exceeding the maximum torque was applied to the motor for the duration set by the OLTIME command.	30h (Decimal: 48)		
	Overspeed Error	The speed of the motor's output shaft has exceeded 5000 r/min.	31h (Decimal: 49)		
3	Overvoltage Protection	The driver's primary inverter voltage has exceeded the limit of tolerance.	22h (Decimal: 34)	The motor loses it's holding torque.	✻ Possible
4	Excessive Position Deviation	The position of the motor's output shaft has deviated from the position specified by the operation command, by at least the number of revolutions set by the OVERFLOW command.	10h (Decimal: 16)	The motor loses it's holding torque.	✻ Possible
5	Overcurrent Protection	An excessive current has flowed into the power element of the driver's inverter section.	20h (Decimal: 32)	The motor loses it's holding torque.	✻ Impossible
6	External Stop	An E-STOP signal has been input.	68h (Decimal: 104)	The program stops. The motor loses it's holding torque (ESTOPACT = 0).	✻ Possible
7	Incorrect Limit-Sensor Logic	Both the +LS and −LS are ON simultaneously.	60h (Decimal: 96)	The motor stops immediately.	✻ Possible
	Reverse Limit-Sensor Connection	The +LS and −LS are connected in reverse.	61h (Decimal: 97)		
	Mechanical Home Seeking Error	Return to mechanical home could not be executed correctly.	62h (Decimal: 98)		
	Overtravel	The motor has exceeded its hardware limit.	66h (Decimal: 102)	The program stops. The motor stops immediately (ESTOPACT = 1).	
	Software Overtravel	The motor has exceeded its software limit.	67h (Decimal: 103)	Decelerates to a stop.	
	External Stop	An E-STOP signal has been input.	68h (Decimal: 104)	The motor stops immediately.	
	Invalid Operation Data	An inoperable operation pattern has been started.	70h (Decimal: 112)	Motion is stopped.	
8	Resolver Sensor Error	The motor cable has not been connected or a motor's error has occurred in a sensor.	42h (Decimal: 66)	The motor loses it's holding torque.	✻ Impossible
	Initial Rotor Revolution Error	The driver's power was turned on while the motor's output shaft was turning by external force.	43h (Decimal: 67)		
9	NVRAM Error	Motor control parameters has been damaged.	41h (Decimal: 65)	The motor loses it's holding torque.	✻ Impossible
Lights (No blinking)	System Error	Driver failure has occurred.	F0h (Decimal: 240)	The motor loses it's holding torque.	✻ Impossible

✻Possible - The alarm can be cleared with the ALMCLR command or an ACL input.
Impossible - The AC power must be cycled to clear these alarms.

Features C-14 / System Configuration C-20 / Product Line C-25

2 Limit Sensor Input and Communication Signals (CN5) (20 pins)

Indication	Input/Output	Pin No.	Signal	Signal Name
CN5	Input	1	COM1	Power Supply for Input Signals
		2	COM2	Power Supply for Input Signals
	–	3	–	No Connection
	–	4	–	No Connection
	Output	5	TX	RS-232C Transmit
	–	6	–	No Connection
	Input	7	RX	RS-232C Receive
	–	8	–	No Connection
	–	9	–	No Connection
	Input	10	N24	External Power Supply Terminal (GND)
	Input	11	COM1	Power Supply for Input Signals
		12	COM2	Power Supply for Input Signals
		13	+LS	+LS Limit Sensor
		14	−LS	−LS Limit Sensor
		15	HOMELS	HOME Sensor
		16	SENSOR	Sensor
		17	–	No Connection
		18	–	No Connection
		19	COM1	Power Supply for Input Signals
		20	COM2	Power Supply for Input Signals

3 Input/Output Signals (CN4) (36 pins)

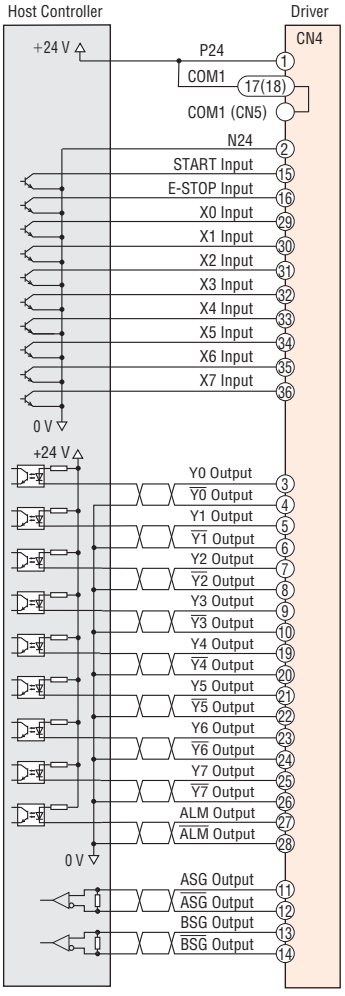
Indication	Input/Output	Pin No.	Signal	Signal Name
CN4	Input	1	P24	Power Supply for RS-232C, ASG and BSG (24 VDC)
		2	N24	Power Supply for RS-232C, ASG and BSG (GND)
	Output	3	Y0	General Output*1 (Y0 to Y3)
		4	$\overline{Y0}$	
		5	Y1	
		6	$\overline{Y1}$	
		7	Y2	
		8	$\overline{Y2}$	
		9	Y3	
		10	$\overline{Y3}$	
		11	ASG	A-phase Pulse Output (Line driver output)
		12	$\overline{ASG}$	
		13	BSG	B-phase Pulse Output (Line driver output)
		14	$\overline{BSG}$	
	Input	15	START	START
		16	E-STOP	External Stop
		17	COM1	Power Supply for Input Signal
		18		
	Output	19	Y4	General Output*1 (Y4 to Y7)
		20	$\overline{Y4}$	
		21	Y5	
		22	$\overline{Y5}$	
		23	Y6	
		24	$\overline{Y6}$	
		25	Y7	
		26	$\overline{Y7}$	
		27	ALM	Alarm
		28	$\overline{ALM}$	
	Input	29	X0	General Input*2 (X0 to X7)
		30	X1	
		31	X2	
		32	X3	
		33	X4	
		34	X5	
		35	X6	
		36	X7	

*1 The following signals can be assigned arbitrarily via program settings. Additionally, the output logic of each signal can be switched. END output, RUN output, MOVE output, HOME-P output, TIM output, MBC output

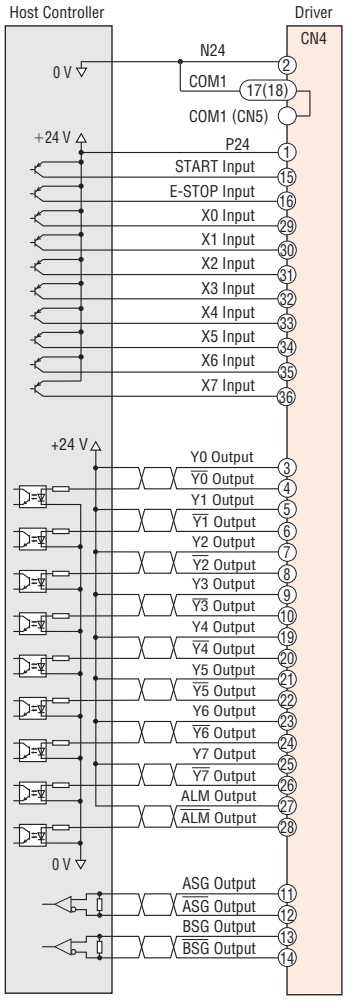
*2 The following signals can be assigned arbitrarily via program settings. Additionally, the input logic of each signal can be switched. ACL input, PAUSE input, MSTOP input, RESTART input

Connection Diagrams

● Current Source Input and Current Sink Output



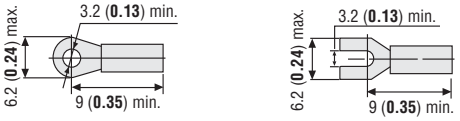
● Current Sink Input and Current Source Output



Notes on Wiring

- Use input signals at 24 VDC±10%.
- Use output signals at 30 VDC or below and at 4 to 8 mA.
- Use a shielded cable with a wire of a size ranging between AWG24 and AWG22 for the driver signal cable (I/O signals, limit sensors signals), and keep it as short as possible.
- When it is necessary to extend wiring distance between the motor and driver more than 0.4 m (1.31 ft.), the accessory extension cable or flexible extension cable must be used. Electromagnetic brake motor models [except motor frame size 42 mm (1.65 in.)] must use an electromagnetic brake extension cable or flexible extension cable (sold separately.) The frame size 42 mm (1.65 in.) models can use a standard extension cable even for electromagnetic brake motor models.
  Extension cables for electromagnetic brake motor ➜ Page C-297
  Always use the motor cable for industrial connector type motor (sold separately) for connection between the industrial connector type motor and the driver.
- Use the following cable for the power line
  Single-phase 100-115 VAC, Single-phase 200-230 VAC: 3-core cable of AWG18 or thicker
  Three-phase 200-230 VAC: 4-core cable of AWG18 or thicker
- Provide a minimum distance of 300 mm (1 ft.) between the control I/O signal line and power lines (AC lines, motor lines and other large-current circuits).
  Do not run the control I/O signal lines in the same duct as power lines or bundle them with power lines.
- To ground the driver, lead the ground conductor from the protective earth terminal (M4) and connect the ground conductor to provide a common ground point.

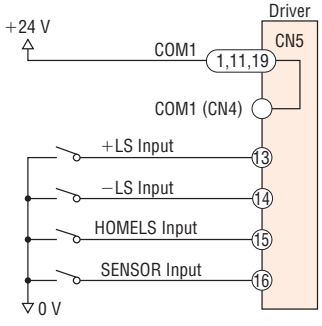
Recommended Crimp Terminals unit = mm (in.)



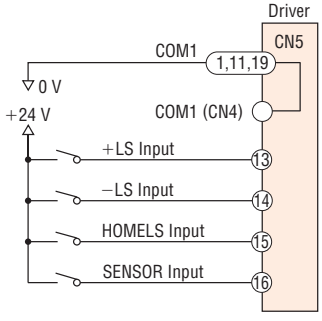
- Crimp terminals are not provided with the products. They must be purchased separately.

Limit Sensor (CN5)

● Current Source Input

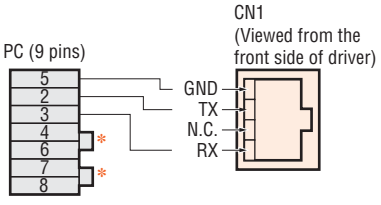


● Current Sink Input



Connecting the Driver with a Personal Computer (CN1)

Pin Assignments and Connecting



*Short pins 4 and 6 together, as well as pins 7 and 8 together

Communication Specifications

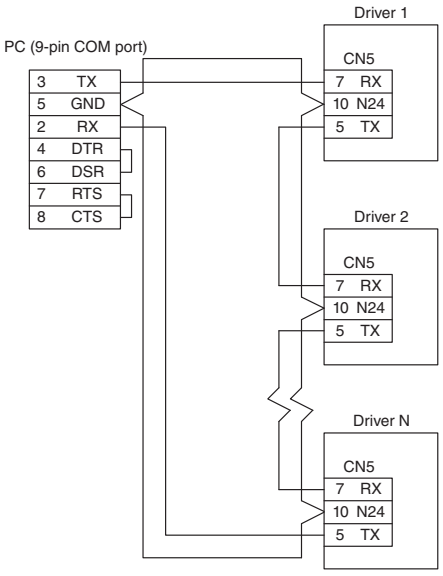
Item	Description
Electrical Characteristics	In conformance with RS-232C
Transmission Method	Start-stop asynchronous method, NRZ (non-return to Zero), full-duplex
Data Length	8 bits, 1 stop bit, no parity
Transmission Speed	9600 bps
Protocol	TTY (CR+LF)
Connector Specification	Modular (4 lines, 4 pins)

Notes:

- Confirm that 24 VDC is supplied to the driver's external power supply input terminals (P24 and N24).
- Use the RS-232C signal lines over the shortest possible distance. It is recommended that the signal lines be shielded to protect them from noise interference.
- The maximum distance between drivers when using a daisy chain connection should be 15 m (49.2 ft.).

●Description of Daisy Chain Connections

Use the RS-232C communication pins (TX, RX and N24) of the sensor connector (CN5) when connecting two or more drivers via a daisy chain (up to 36 drivers).



◇TX, RX

These communication terminals are used when implementing daisy chain connections.

Notes:

- Confirm that 24 VDC is supplied to the driver's external power supply input terminals (P24 and N24).
- Use the RS-232C signal lines over the shortest possible distance. It is recommended that the signal lines be shielded to protect them from noise interference.
- The maximum distance between drivers when using a daisy chain connection should be 15 m (49.2 ft.).
- Do not use the RS-232C communication port (CN1).

■Connecting the Electromagnetic Brake to a Power Supply

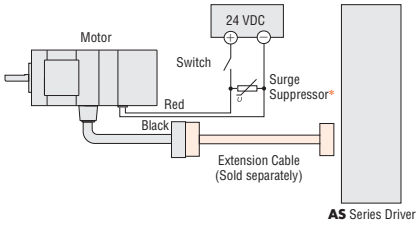
Connect the electromagnetic brake to the power supply using a cable of at least AWG24. The power supply input to the electromagnetic brake is 24 VDC ±5% 0.3 A minimum (**AS46**: 0.1 A minimum) and therefore must be independent of the driver's power supply for signal control.

Notes:

- Applying a voltage that exceeds the specifications will cause the electromagnetic brake to generate a great amount of heat, resulting in motor temperature rises and possible damage to the motor. Conversely, if voltage is too low, the electromagnetic brake may not release.
- To protect the switch contacts and prevent noise, always connect the surge suppressor.* (*The surge suppressor is included with electromagnetic brake motors.)
- To prevent noise, use a dedicated power supply for electromagnetic brake.
- Correct polarity (+ and −) must be ensured when connecting the electromagnetic brake leads of **AS** Series to the DC power supply. If polarity is incorrect, the electromagnetic brake will not operate.
- When using as a CE certified part, use a dedicated DC power supply for electromagnetic brake.

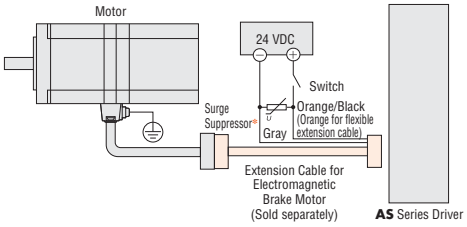
(1) **AS46**

The electromagnetic brake leads are linked to the connector on the motor [600 mm (23.6 in.)]. When connecting with the DC power supply, connect the red spiral lead wire to +24 V, and the black lead wire to the ground (GND). Use the extension cable or the flexible extension cable (both sold separately).



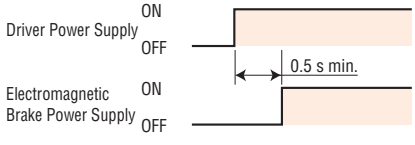
(2) **AS66**, **AS69**, **AS98**

The electromagnetic brake leads are linked to the connector on the driver connection side of extension cable for electromagnetic brake motor (sold separately). Be sure to use the accessory (sold separately) extension cable or flexible extension cable. Connect the orange/black spiral lead wire (orange for flexible extension cable)[60 mm (2.36 in.)] to +24 V, and the gray lead wire [60 mm (2.36 in.)] to the ground (GND).



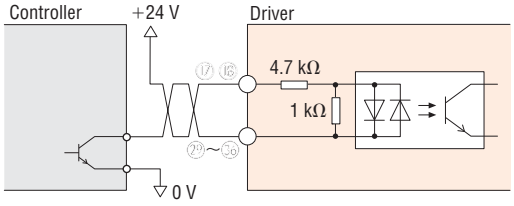
Timing Chart for Electromagnetic Brake Operation

To release the electromagnetic brake, wait at least 0.5 second after turning on the driver power supply.
The load may fall down.



●Description of Input Signals (CN4)

◇Input Circuit and Sample Connection



Note:
- Use input signals at 24 VDC±10%.

◇P24 Input, N24 Input

These inputs are for the external power supply required for the RS-232C communication, ASG and BSG outputs. Make sure to use a power supply of at least 24 VDC±10%, 0.05 A.
If the same power supply is going to be used for the RS-232C, ASG, BSG and other external I/O, make sure to use a power supply of at least 24 VDC±10%, 0.2 A.

◇START Input

This signal starts the program named "STARTUP."
OFF→ON edge to start "STARTUP" program.

◇E-STOP Input

This signal is used to forcibly stop the operation.
Set the stopping method using the ESTOPACT command.
Additionally, the input logic can be changed using the ESTOPLV command. (The factory setting of this command is normally open.)
OFF→ON edge to stop operation.

◇COM1 Input

This is an external power supply terminal for input signals.
This signal is internally connected to terminals COM1 of CN5.

◇X0 to X7 Inputs

The X0 thorough X7 inputs can be used as input ports for general signals. The status of each port can be read using an IN command or INx command.
The general signals assignable to the X0 through X7 inputs are listed below. Use a corresponding command to assign signal.

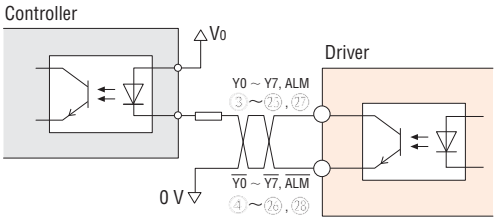
ACL input .....INACL command
PAUSE input .....INPAUSE command
MSTOP input .....INMSTOP command
RESTART input ...INRESTART command

◇ACL Input

This signal is used to reset the alarm that has been generated by the driver's protective function.
Input an ACL signal once after removing the cause that has triggered the protective function.

●Description of Output Signals (CN4)

◇Output Circuit and Sample Connection



Note:
- Use output signals at 30 VDC or below and at 4 to 8 mA.

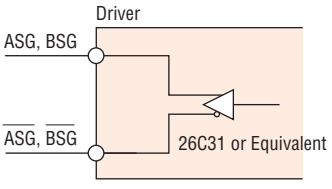
◇Y0 to Y7 Outputs

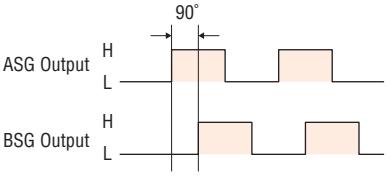
The Y0 through Y7 outputs can be used as output ports for general signals. The status of each port can be read using an OUT command or OUTx command.
The general signals assignable to the Y0 through Y7 outputs are listed below. Use the corresponding command to assign each signal.

END output .....OUTEND command
RUN output.....OUTRUN command
MOVE output .....OUTMOVE command
HOME-P output .....OUTHOMEP command
TIM output .....OUTTIM command
MBC output .....OUTMBC command

◇ASG Output, BSG Output

- Line driver output (26C31 or equivalent)





A counter or similar device can be connected to monitor the position of the motor. The pulse resolution is the same as the motor resolution at the time of power-on.
[Example: Resolution select switch (1000 P/R) → Output pulse number for each motor revolution (1000).] The phase difference between A and B is 90° in electrical angle.

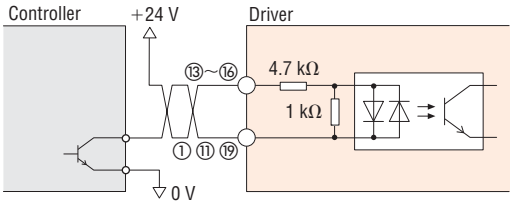
Notes:
- The pulse output accuracy is, regardless of resolution, within ±0.36° (repetition accuracy within ±0.09°).
- When the "Quadrature" signal output is used, 5 VDC or 24 VDC power supply is necessary. This signal is only for position verification when the motor has stopped. There is a 1 msec (maximum) time lag between real rotor motion and the output signals.

◇ALM Output

This signal is output when an alarm is generated by the driver's protective function.
The reason for triggering of the protective function can be identified through the blink count of the alarm LED, or ALM command.
To reset the ALM output, remove the cause of the alarm and then perform one of the following procedures after ensuring safety:
- Assign INACL then turn the ACL input to ON.
- Enter an ALMCLR command.
- Turn off the AC power, wait at least 10 seconds, then turn it back on.

●Description of Limit Sensors (CN5)

◇Input Circuit and Sample Connection



Note:

● Use input signals at 24 VDC±10%.

◇COM1 Input

This is a power supply input terminal for limit-sensor signals. The power supply voltage must be 24 VDC±10%.
This signal is internally connected to terminals COM1 of CN4.

◇COM2 Input

This is a power supply input terminal for limit-sensor signals.
Use it when sharing the input signal power supply among two or more drivers.

◇+LS Input, −LS Input

These signals are input from +LS and −LS.
The input logic can be changed using the OTLV command. (The factory setting of this command is normally open.) Input logic for the +LS input and −LS input cannot be set separately.

Continuous Operation and Positioning Operation

When a +LS or −LS is detected, the driver's protective function (overtravel) is activated. As a result, the ALM output is turned OFF and the motor stops.
Set the stopping method using the OTACT command.
To pull out of +LS or −LS, cancel the protective function by inputting an ACL signal once or by using the ALMCLR command. Then perform return to mechanical home or operate the motor in the direction opposite that of the limit sensor during continuous operation.

Return to Mechanical Home

When a +LS or −LS is detected, the motor operates in the direction opposite that of the detected limit.

◇HOMELS Input

This signal is input from HOMELS.
Connect the HOMELS when return to mechanical home is performed in 3-sensor mode.
When return to mechanical home is performed in 3-sensor mode, the HOMELS becomes the mechanical home. The input logic can be changed using the HOMELV command. (The factory setting of this command is normally open.)

◇SENSOR Input

This signal is input from SENSOR.
The input logic can be changed using the SENSORLV command. (The factory setting of this command is normally open.)

Return to Mechanical Home

This input is used when detecting the mechanical home at a specific point on the motor's output shaft or load shaft using a slotted disc, etc. The accuracy of return to mechanical home increases if this input is used in conjunction with the TIM. signal.

Continuous Operation

The motor can be stopped forcibly upon the detection of SENSOR.
Set the stopping method using the SENSORACT command.

Note:

● If the SENSOR input is used in return to mechanical home, it cannot be used during continuous operation.