Dyadic
MECHATRONICS CYLINDER

Mechatronics Cylinder

R Series Servo System

Operation Manual

Dyadic Systems Co.,Ltd.

MIRAI INTER-TECHNOLOGIES

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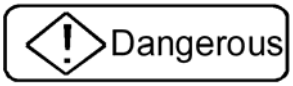
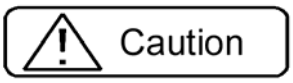
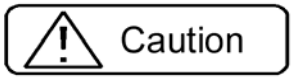
《For Safety》





If this product is to be used in any application which has a potentially serious effect on human life and health by the failure and/or accidental movement of this product, such as machines relating to Nuclear Power, Aerospace, Transportation, Medical and safety systems, etc., please consult us.
In case of incorrect handling, some level of damage to the product may occur. This damage may lead to poor product performance.



[General]

- Please do not use this product in explosive environments.
- Please do not move, work on wiring, or conduct any maintenance while the Power is ON. Wait several minutes after the Power is OFF to conduct any of the above tasks.
- Please have experts to do the job of transportation, installation, wiring, operation and maintenance, etc.
- Please use this product within the specifications.
- Please do not use damaged product.
- Any modification or reconstruction of the product by the customers voids warranty and transfers responsibility for all results to the customer.

[Mounting, Start Up]

- Please make sure that there is no Flammable material and/or product in the vicinity of the Mechatronics Cylinder.
- Please make sure that there is no obstruction to ventilation for cooling.
  Ensure appropriate assemblies guide any loading on the Mechatronics Cylinder. In case of direct coupling to the mechanism, please pay attention to the accuracy to minimize radial loading.
- Check that the direction of the movement is correct before mounting of our product.
- The Mechatronics Cylinder doesn't have mechanical protection for over load. Please provide mechanical over load protection.

[Wiring]

- Please make sure that the wiring is correct and completed with strong connections.
- Please do not bend, pull or pinch cables.
- Please make sure that the ground wires and terminals are grounded.

[Running]

- The Mechatronics Cylinder may run at high temperatures. Please do not touch with bare skin.
- The Mechatronics Cylinder has its own control built in. Please do not use other control.
- Please do not use our product without additional protection in the presence of water splashes, corrosive gas or material, or flammable material.

[Maintenance/Inspection]

- Please do not measure open circuit resistance.

[Storage]

- Please store the Mechatronics Cylinder in a cool, dry environment free of corrosive gas and liquids.

[Transportation/Receiving]

- Please pay extra caution for any damage during the transportation.
- Please check if the delivered product is the right one.

CE

This product complies with the following Safety regulations of the

EMC Directive 89/336/EEG

And amongst others the following harmonized standards

EN 60947-4-2:2000

[Class A ITE Notice]

Warning: This is a class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

Notes:
The RCB0411 type servo motor is not officially covered by the CE marking documentation.

Table of Contents

1. Initial set up

The MVST software is included in the PC-Tool CD (included with TBVST-EN-SET). MVST is used to set up the operating parameters for the R series and RC series Servo Systems. (Dyadic teach pendants can be used for programming after initial set up is completed.)
Please follow the initial set up procedure as per chapter 1.3 to set up.

Item	Default value
Motion pattern selection	No set up
Move stroke / Reduction ratio	No set up
Homing pattern	Current position home
Homing speed	(150 rpm)
Homing power	(85%)
Software limit	+/- 125 revolutions

1.1. Homing specifications

Homing will be automatically completed when the first position move command is received after power-up. Homing is automatic so there is no need for manual homing.
There are 5 types of homing patterns. Please select the appropriate type for your application. The set up is easily done using the MVST software.
(The default setting for homing is "the current position home".)
Following are examples of sensor selection for the external sensor homing patterns:

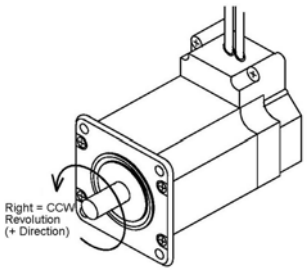
Sensor type	Specifications	NPN/PNP
Proximity sensor	DC 3 conductor type (Normally Closed)	Select depending on your choice for controller I/O
Photo micro sensor	Motion mode: ON at light received	Select depending on your choice for controller I/O

1.1.1 Current position homing

This pattern sets the current position (±2 pulses) to 0.
This homing pattern may be good for conveyor applications which don't need a home position.

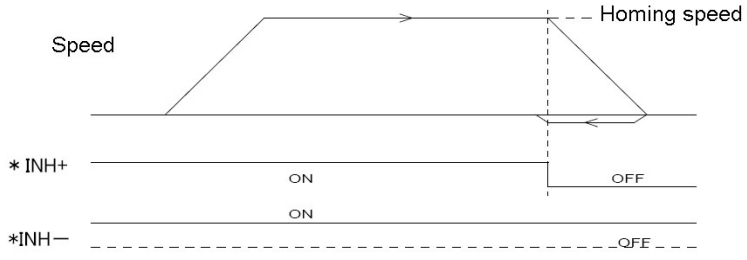
1.1.2. Homing by external signal (CCW approach)

This pattern sets the home position based on a 24VDC input. The servo motor rotates CCW (all directions facing the motor shaft) to approach the home point. The pattern details are as follows:
- External input signal *INH+ should be ON (*INH- tied high as well)
- At CSTR the motor will start to rotate CCW.
- When the external input signal turns OFF, the motor stops, then starts to revolve slowly in the opposite direction. When the external input signal edge from OFF to ON is detected, the motor stops and sets the 0 point (home).
- If the external input signal *INH+ is OFF from the beginning, the motor will rotate CW at low speed until the input signal rising edge is found to indicate home.

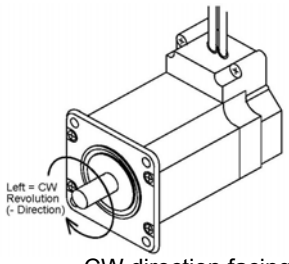


CCW direction facing the motor shaft.

*INH+ edge detection sequence



1.1.3. Homing by external signal (CW approach)

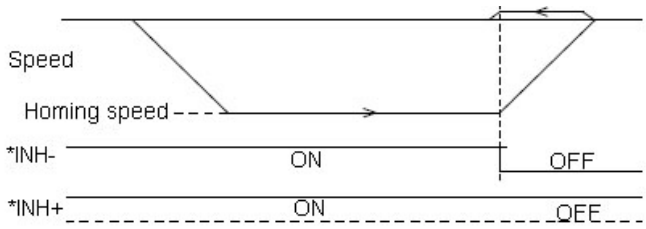


CW direction facing the motor shaft.

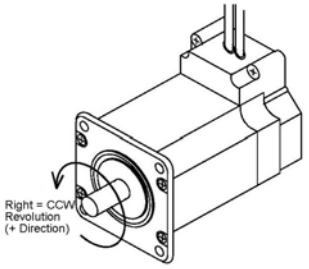
This pattern sets the home position based on a 24VDC input. The servo motor rotates CW (all directions facing the motor shaft) to approach the home point. The pattern details are as follows:

- External input signal *INH- should be ON (*INH+ tied high as well)
- At CSTR the motor will start to rotate CW.
- When the external input signal turns OFF, the motor stops, then starts to revolve slowly in the opposite direction. When the external input signal edge from OFF to ON is detected, the motor stops and sets the 0 point (home).
- If the external input signal *INH- is OFF from the beginning, the motor will rotate CCW at low speed until the input signal rising edge is found to indicate home.

*INH- edge detection sequence

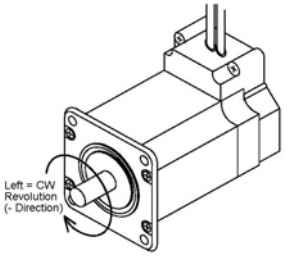


1.1.4. Homing by mechanical stop (CCW Motor Revolution)



In this mode the servo motor turns CCW (all directions facing the motor shaft) until it encounters a mechanical stop, then returns from the stop by 120° (default value). This position becomes the home position (coordinate 0). Please note that the return angle of 120° will be smaller if mechanical reduction is used. The return distance can also be changed via the “Turnover Distance” value in TBVST. Speed, acceleration, and torque used for the homing move can be set as needed.

1.1.5. Homing by mechanical stop (CW Motor Revolution)



CW direction facing the motor shaft (also called -).

In this mode the servo motor turns CW (all directions facing the motor shaft) until it encounters a mechanical stop, then returns from the stop by 120° (default value). This position becomes the home position (coordinate 0). Please note that the return angle of 120° will be smaller if mechanical reduction is used. The return distance can also be changed via the “Turnover Distance value in TBVST. Speed, acceleration, and torque used for the homing move can be set as needed.

1.2. Motion specifications

Using the TBVST visual programming software the following motion modes can be selected for each of the 16 moves the controller can store:

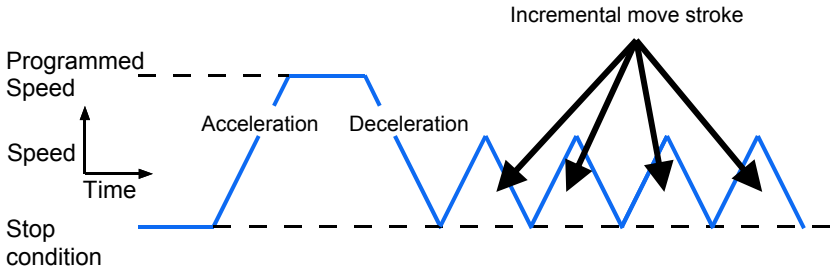
1) Absolute motions (default)
2) Incremental (Relative) motions
3) Continuous revolution motions

1.2.1 Normal (Absolute) motions

The following items are programmable:
“Target position”, “Max. speed”, “Acceleration”, PFIN Window (“At Position Width”).

1.2.2 Incremental (Relative) motions

This mode will run the servo motor by a pre-programmed increment. This can be run as many times as desired if the system has been set up as a “Rotary System” using MVST.



(1) When an incremental (or relative) move is commanded the target position for the motor is immediately updated. If another incremental move is sent before the previous move is finished the target position is simply updated again and the motion will continue to the new target. For motions in the same direction the target is updated from the previous target when a new incremental move is sent during rotation. This function is often used to drive the servo system like a “step-and-direction” controller in which each step repeats a move of a certain distance. Speed will be according to the target speed for the motion.

(2) If an incremental move command is sent during a continuous revolution motion (in the same direction), the incremental move distance will be added to the current position of the servo motor to establish the target position. Speed, accel/decel, and other move parameters will be taken from the new incremental move.

1.2.3 Continuous revolution motions

This mode allows a motion to run in one direction endlessly at a programmed speed. The direction can be CCW or CW (all directions facing the motor shaft). Individual moves are set to produce continuous revolution using the Position Data Save Window in TBVST if the system type has been identified as “Rotary” using MVST (see section 1.3.3).

1.3. Initial setup of the servo motor

When Dyadic servo motors are purchased, the following accessories may be necessary:

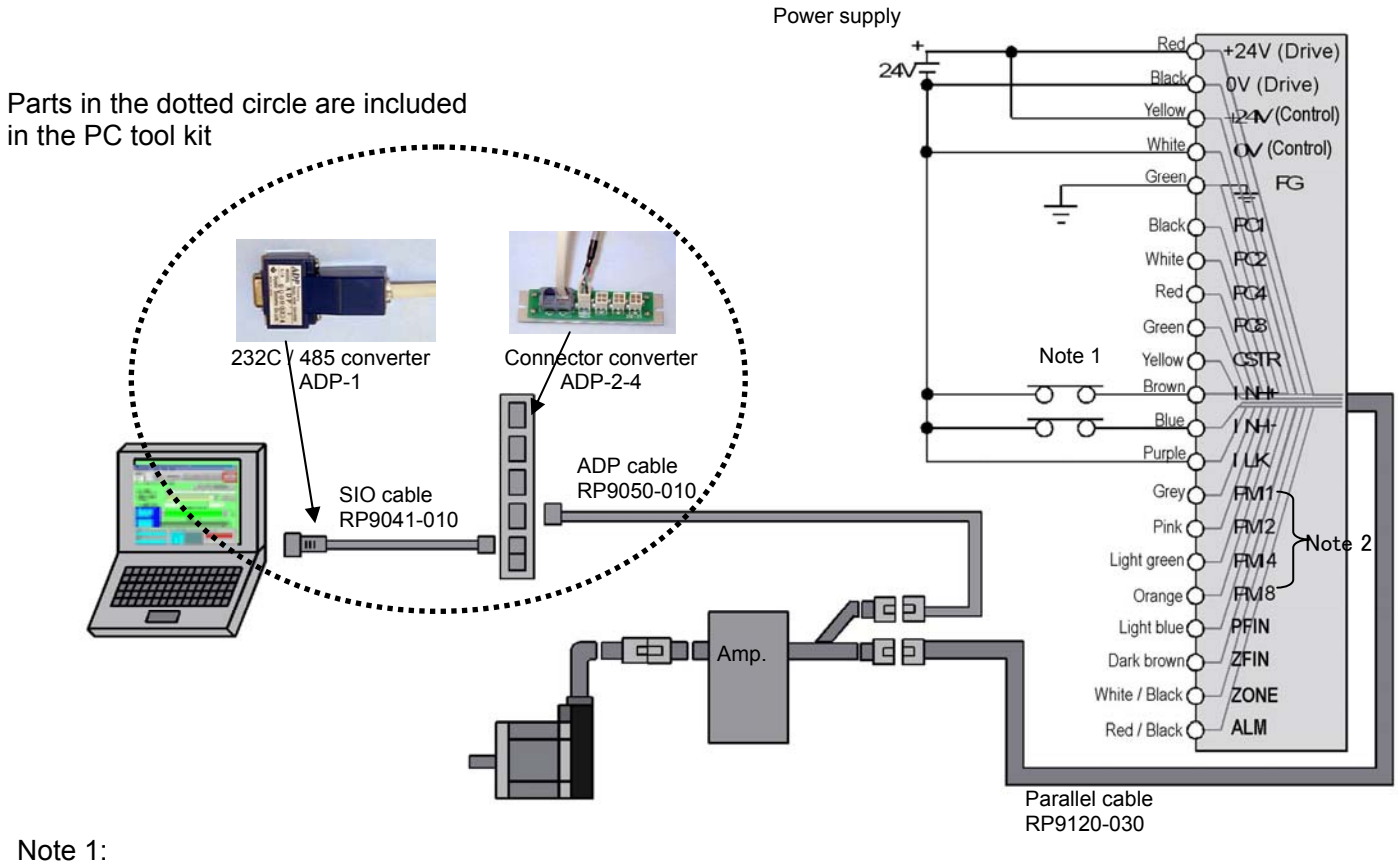
1) Servo motor (servo amplifier comes with the servo motor)
2) PC Programming Kit (code: TBVST-CTC-EN-SET). Please note that the MVST visual setup tool will be installed along with TBVST.
3) Parallel (Power & I/O) connection cable (code: RP9120-XXX)

The following items should be provided by the user:

4) 24VDC power supply (3 amps or greater)
5) PC (Windows 95, 98, 2000, NT, XP – Vista works but is not recommended)

1.3.1 Connections

Please install the programming software (TBVST-CTC-EN), then connect as shown:



Note 1:
Needed for homing by external input.

Note 2:
RCB0411 units do not have these outputs.

1.3.2 Initial set up by Servo Motor Initial set up software

After installing the TBVST software (please note that “Info Pack CD” doesn’t contain software.), run the MVST set up software from the TBVST Termi-BUS Tool kit folder of the Start Menu. The following sequence of screens would be used to set up a screw-driven system.

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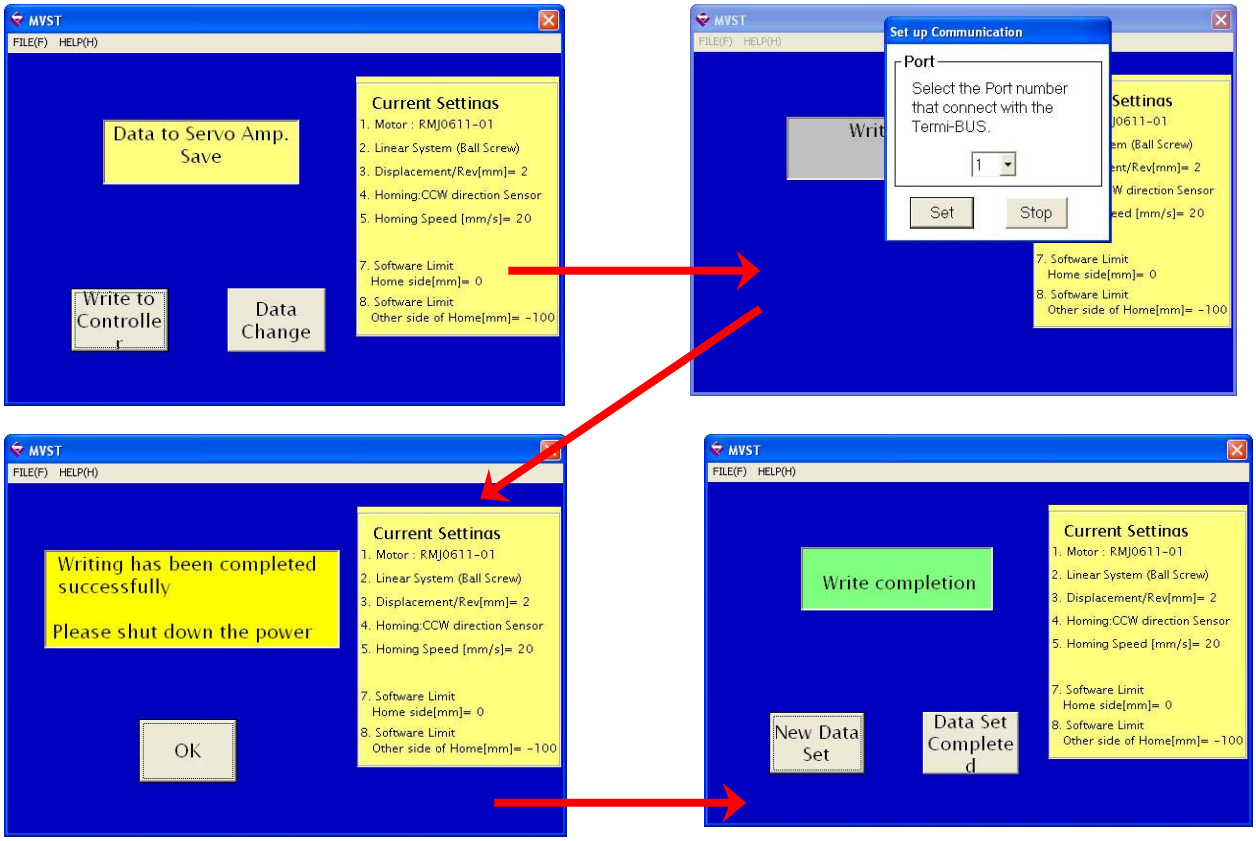


Note: Please cycle power to the servo controller to finalize setup changes.

1.3.3 Endless Rotation mode Setup

The endless rotation mode can be set up from the “Position Data Save Window” of the TBVST software if the system has first been identified as rotary using MVST.

Please select the Position No. and proceed as follows:

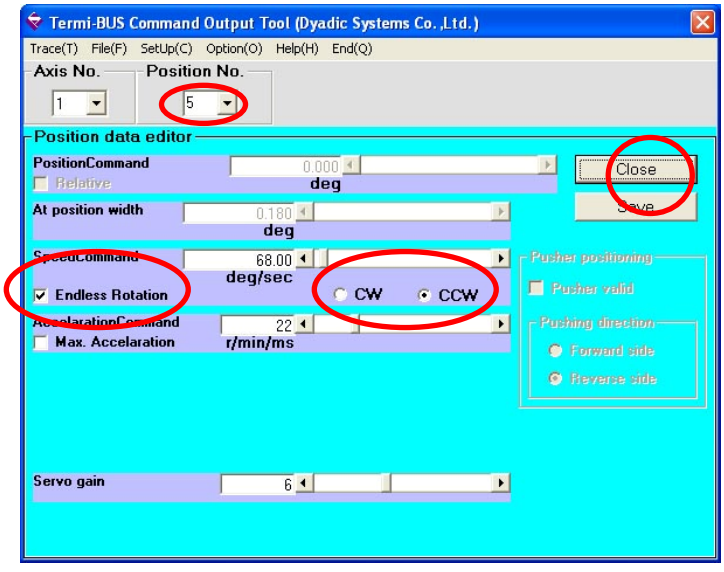
(1) select endless revolution command
(2) select revolution direction (CW or CCW)
(3) select revolution speed
(4) Click [save]

Notes:

-directions are facing the shaft

-an endless rotation move can be stopped as follows:

(1) program a certain position number with endless rotation and speed of 0 rpm and execute this position number to stop the revolution
(2) program a certain position number with a relative move of 0° and execute this position number to stop the revolution
(3) turn the ILK (E-Stop) input signal OFF

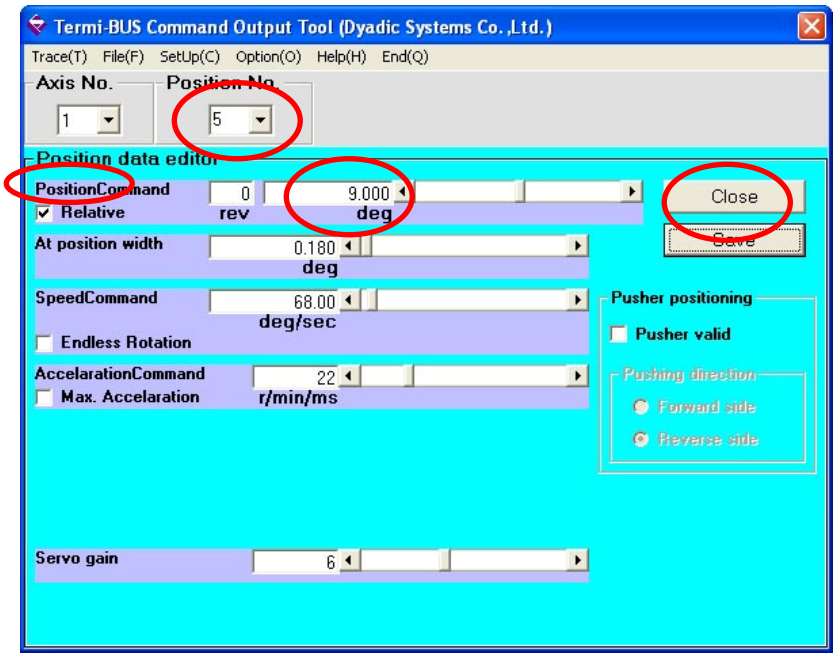


1.3.4 Relative Move Setup

This operation is done in the “position data save window” of TBVST. Please select the position No. and operate as follows:

(1) click the “Relative” check box
(2) Set the move distance in revolutions and degrees
(3) Click [save]

Please note that the above example pertains to systems identified as “Rotary” using MVST. Linear systems will use linear units for identifying position and speed.



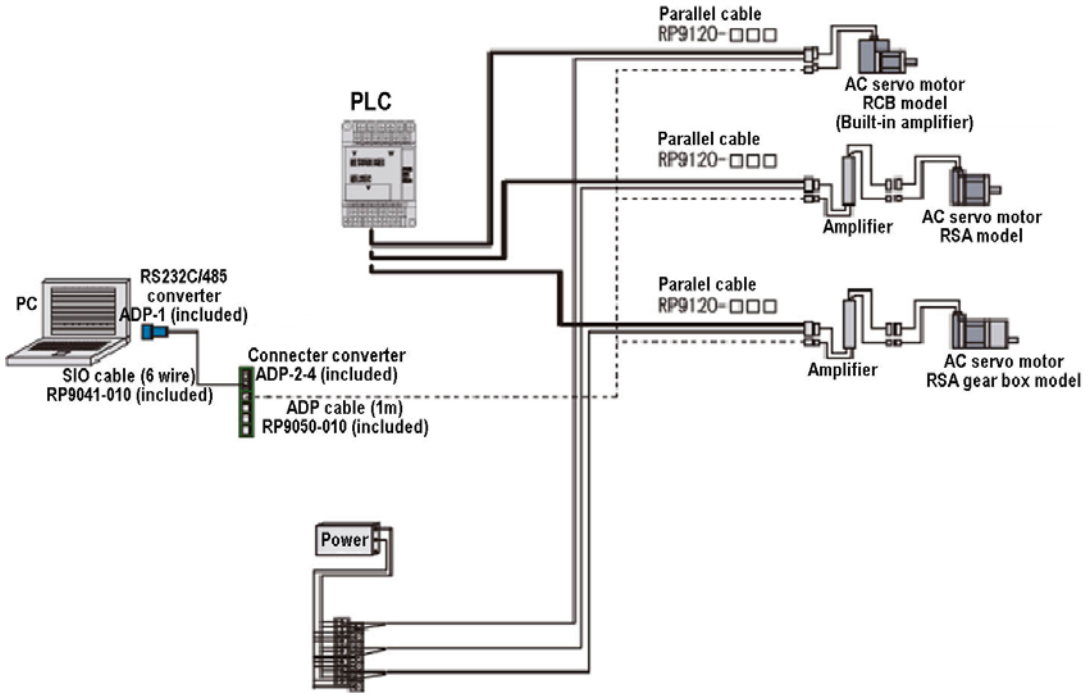
2. Summary

R Series servo systems are programmed using an interface which is common with other Dyadic Mechatronics Cylinders so that they can be easily set up and interfaced to other systems.

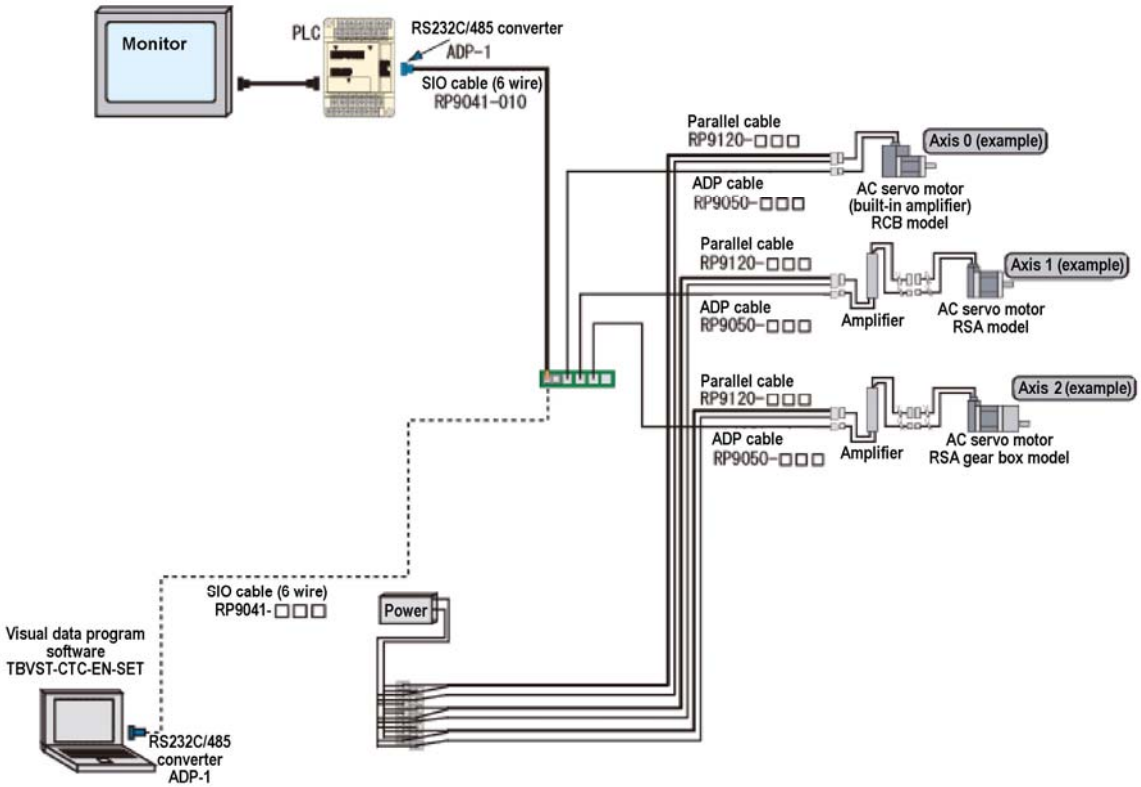
2.1. Features

(1) R Series servo systems consist of a motor and servo amplifier with actuator controller included. Packing more features into the servo amplifier enables an overall reduction in system size.
(2) Control for point-to—point moves is handled by the servo controller. In this way the primary control system (such as the PLC) can focus on logic and the R Series controller takes care of each move as commanded.

(3) Simple I/O interface to PLC (see system schematic example below).
The PLC commands the servo motor to execute moves by sending only the position number inputs and the trigger signal (CSTR). Even multi-axis systems are very simple as follows:



(4) Serial interface to other control systems (see system example below)
Operation of the servo system can be controlled directly through RS485. CC-Link and DeviceNet gateways are also available. As shown in the following figure, systems with up to 16 axes per node can be built:



(5) High speed positioning
Compared to traditional servo systems, it is possible to make mechanisms with high positioning speed for short strokes high cycle rate. This is because the R Series servo system can automatically adjust motion parameters to minimize acceleration and settling times.

(6) Stable position holding
Traditional servo motors often suffer from micro vibration when stopped, but Dyadic servo motors don't have this problem. Positions are held with high stability after stopping.

(7) Easy gain adjustment
There is only one type of gain setting. The gain adjustment is a simple selection of one number from 0 ~ F (16 points). This adjustment is very simple yet can still help create the best possible motion.

(8) Digital command input
The servo motor will make move to the desired position based on simple 24VDC inputs for position and move start.

(9) Over travel prevention
2 options are available:
-1- Movable stroke can be limited by external limit switch signals to INH+ and INH-.
-2- Stroke limits can be programmed in the software.

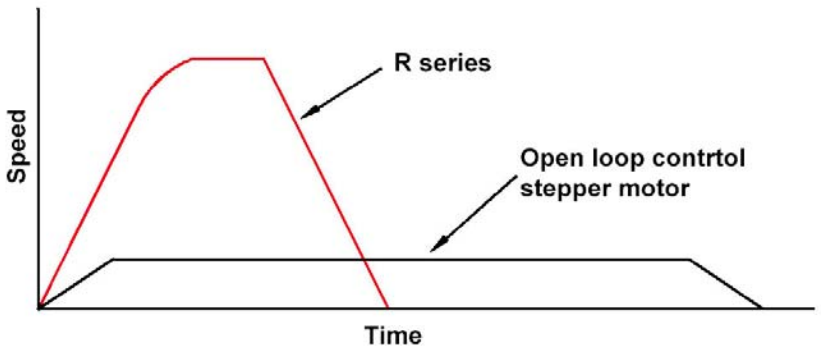
(10) Synchronized start (uses serial control)
Different commands can be started at the same time among multiple axes by the execution hold direct command function and/or execution start command.

(11) Automatic homing function
The servo motor has several homing patterns, and the pre-set pattern will be automatically executed with the first position move command after power up.

2.2. Differences from other motors

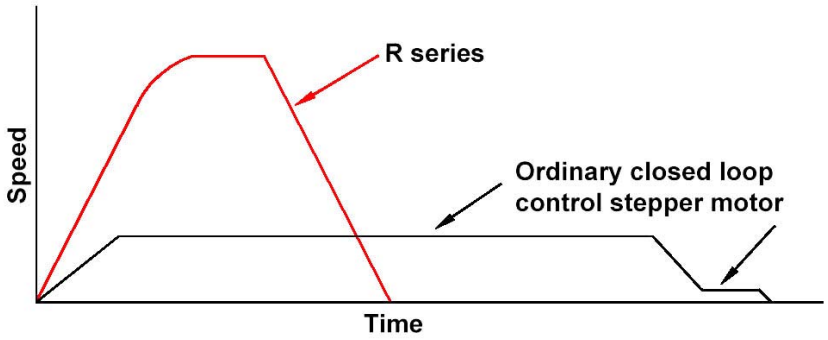
2.2.1 Differences from Open Loop Stepper Motors

(1) Mechatronics Cylinder Servo Motors don't lose positioning pulses, so positioning is very reliable.
(2) Mechatronics Cylinder Servo Motors generate the best pulse pattern for the motor capability and the application in the amplifier, therefore pulse generators are not needed and the motion parameters are easy to set. Even the speed/acceleration change during the motion is stable.
(3) Open loop stepper motors typically use only 50% of their torque capability to avoid pulse loss, however Mechatronics Cylinder R Series servo motors can use 100% capability.
(4) Mechatronics Cylinder Servo Motors are able to achieve high speed. (Max. speed: 4500r/min or60kpps)
(5) In addition to stable position holding, R Series Servo Motors are able to return to the target position automatically if moved away by an external force.
(6) Drive and control power are separates so that even if the motor power is OFF the controller will continue to monitor the current position of the system and allow the motor to continue the move after the power is back up.
(7) Due to its high performance, the motor size can be smaller than other stepper motors.
(8) The graph at right compares a Mechatronics Cylinder servo motor to an equivalently sized motor running 24VDC:



2.2.2 Comparison with other ordinary closed loop stepper motor

(1) R Series motors constantly monitor the current motion to adjust for optimum performance. Other ordinary motors use similar control to open loop stepper motors during the motion and adjust the position at the end of the move so that the position matches the target.

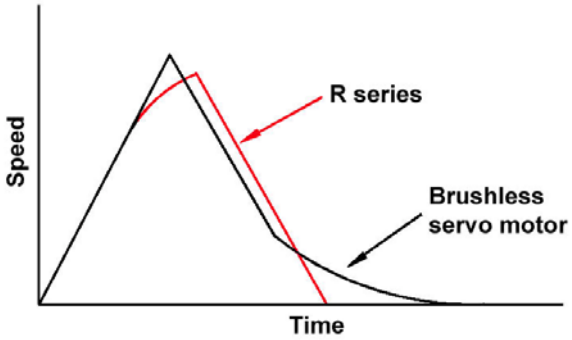


(2) The graph at right compares a Mechatronics Cylinder servo motor to an equivalently sized closed-loop stepper motor running 24VDC.

2.2.3 Comparison with brushless servo motor

(1) R Series motors have stable holding torque with no vibration during while stopped.

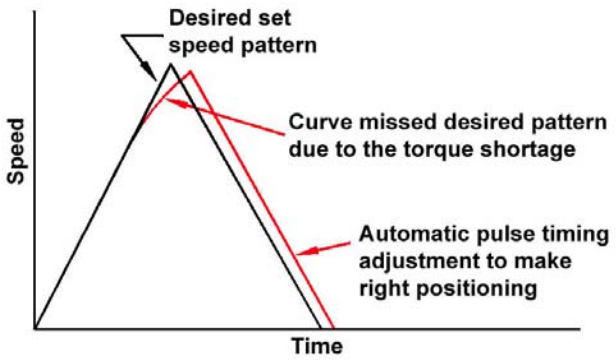
(2) Due to the above advantage and the high torque available at low speed the R Series servo motors can execute some moves faster than brushless servo motors.



(3) The high torque and shorter stopping time available to R series servo motors at low speed means that these motors are suitable for applications which require frequent short stroke movements. Indexing systems are a good example of this type of move.

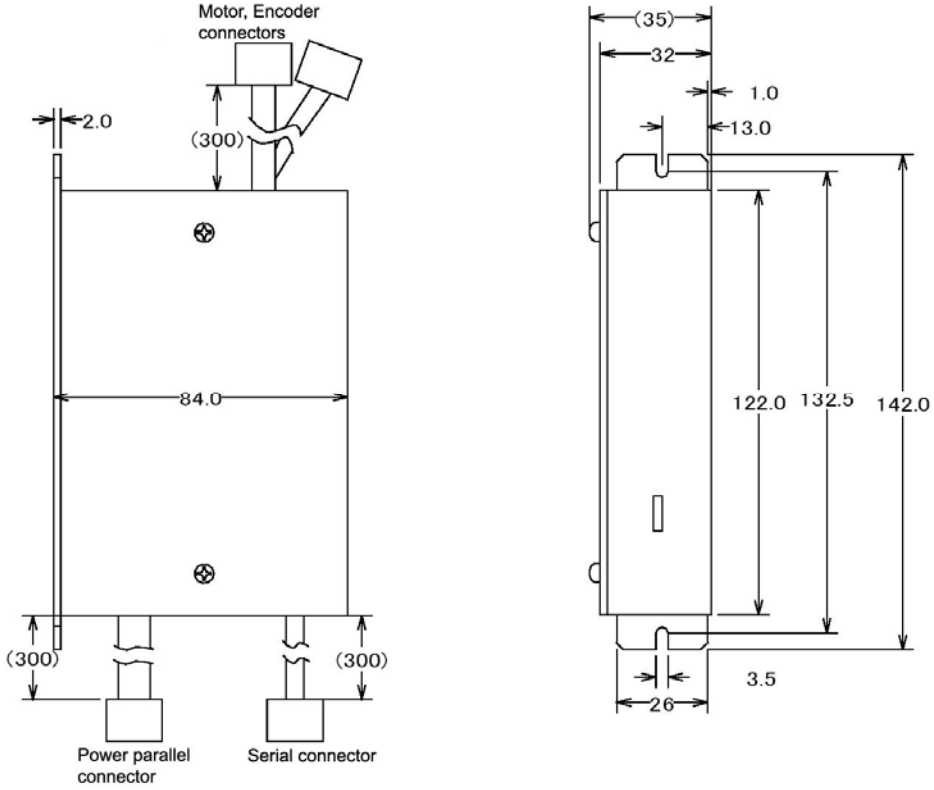
(4) R series motors have only one servo gain parameter and it is not sensitive to the load condition, therefore fine adjustment is not necessary and optimum setup is very quick.

(5) Even if torque shortage causes the R Series motor to misses the target motion pattern, the motor will adjust pulse timing automatically to arrive at the target programmed position correctly without overshoot.

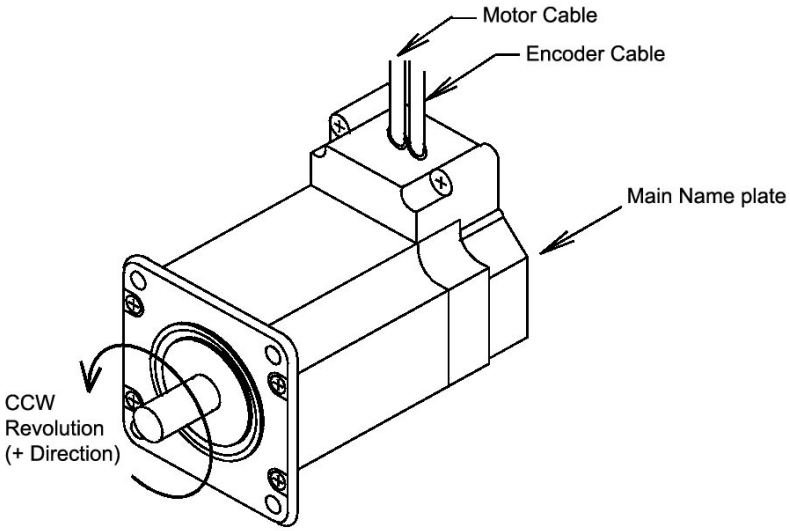


2.3 Names of parts

(1) Servo Amplifier



(2) Servo Motor



3. Safety Notes

(1) Please use the following Voltage:
Control Power Source: DC +24V+/-10% (Max. 0.2 Amps)
Drive Power Source: DC +24V+/-10% (Max. 3 Amps or 2 Amps depending on the model)

In case of supplying both control power and drive power from the same power source, please make sure its power capacity is sufficient; otherwise a communication error may occur.

Power limits may be lowered if necessary to reduce output torque and power draw.

The capacity of the power supply can be selected according to the number of systems which will be in use at any given time, rather than the total number of systems connected.

(2) Many amplifiers for Mechatronics Cylinder products are different and work only for the specified Mechatronics Cylinder. Please use R series amplifier for R series servo motor.

(3) R Series servo motors don't include holding brakes, therefore please include a mechanical brake for vertical use or please use R Series servo motors within the unbalanced load capacity.

(4) Please double-check your wiring before power-up. Incorrect wiring may cause damage to the product.

(5) Please change wiring with power disconnected.

(6) Please consider motor heat, condensation, vibration and shock when design the mounting.

(7) If electrical noise leaks into the signal wires, servo motors may vibration or make unexpected movement. These guidelines can help eliminate electrical noise:

- separate high powered wires and low powered wires.
- try to make wires short as possible.
- avoid use of power input line filter in the motor circuit.

(8) Please do not try voltage durability test, mega-ohm test and noise test.

(9) Please hold connectors when removing the cables.

(10) Please select cables appropriate for your motion. High-flex cables are available.

4. Start Up

4.1. Preparations

Please check as follows:

(1) Check that the product matches your order.

(2) Check the appearance of the product to see if there has been any damage during transportation.

(3) Check the product for loose screws.

4.2. Installation

4.2.1. Installation of servo motor

Poor installation will shorten the life of the servo motor. Please consider the following:

(1) Location

Mechatronics Cylinders are designed for use in IP-40 environments as follows:

① No corrosive gas, no explosive gas

② Good ventilation without dust or high moisture

③ Ambient temperature 0 ~ 55 degrees C

④ Ambient humidity is 20-80% without condensation

⑤ Easy to inspect and maintain

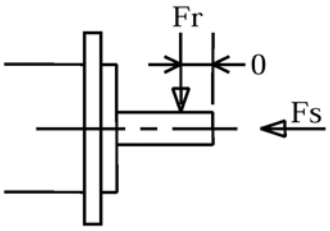
⑥ No contact with water and/or oil.

(2) Servo motors should be installed with 4 screws on the front flange with the locating diameter used to ensure accurate mounting. Please refer to section 5.4 for dimensions.

(3) Please make sure the servo motor is properly centered with other mechanical bearings/shafts. If the centering is poor, vibration and short life will result.

① Shocks on the shaft end of the servo motor must be less than 10G and less than 2 times.

② Thrust load and radial load on the shaft of the servo motor must be smaller than the specs indicated in Section 5.



(4) Use the shaft flat to mate the motor with pulleys and gears. Do not press fit onto the motor shaft.

4.2.2 Installation of servo amplifier

(1) Poor installation will shorten the life of the servo motor. Please consider the following:

(2) Location

① Ambient temperature should be lower than 40° C. Keep the amplifier away from radiant heat.

② If hot objects must be close to the amplifier, please arrange an alternate solution to keep the temperature of the amplifier lower than 40° C.

③ Max vibration for the servo amplifier is 0.5G.

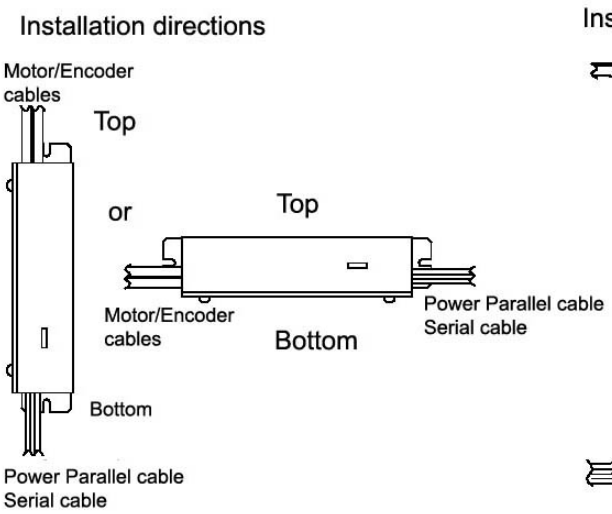
④ Ensure corrosive gas does not come into contact with the amplifier. Over time this will cause premature failure of the electronics.

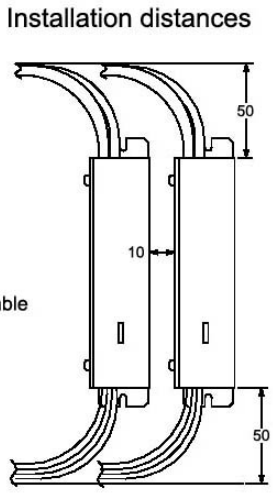
⑤ Max ambient humidity is 20-80% without condensation

⑤ Avoid use in areas with dust and metal particulate

(3) Installation Directions

Use mounting bracket slots with 2 pcs of M3 screws to install firmly. The installation layout is as follows:





Notes: Keep 10mm or more between amplifiers, and have enough space for cables (50mm or greater).

4.3. Wiring

There are 2 types of control methods (serial control and control through 24VDC I/O) as explained in Chapter 2.1. Please refer to section 4.4 for wiring. Refer to section 8 for the necessary cables and section 6 for the 24VDC and serial interface circuits.

4.3.1. Wiring

(1) For noise prevention

① Mount I/O terminals and noise filters close to the amplifier with short wire length.

② Install surge protection devices if relay or solenoid coils are used.

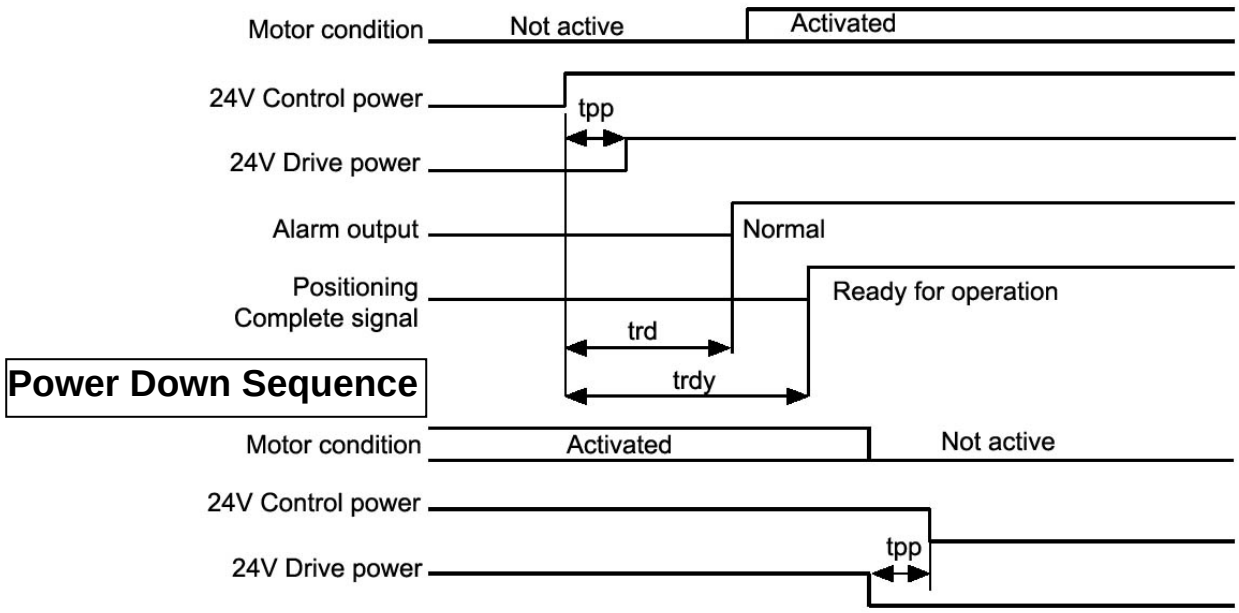
③ Avoid putting the power lines of R Series servos in the same conduit as the power line for other systems. Power lines and signal lines should be separated by 30 cm or more.

(2) Sequences for Power-Up and Power-Down

① If an alarm condition occurs in the servo controller it will be necessary to shut down power to at least the controller to reset the alarm. Shutting down drive (motor) power as well at this time is fine.

② Specific sequences for power up and down are as follows:

Power Up Sequence



Name	Time	Note
Tpp	0 msec Min.	Control power ON => Drive power ON Drive power OFF => Control power OFF
Trd	50 msec Max.	Control power ON => ALM signal establishment time
trdy	250 msec (Standard)	Control power ON => Operation ready

(4) Wiring of inputs and outputs

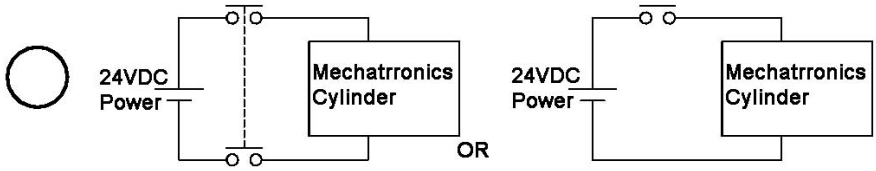
① For serial control through RS232C, Dyadic's "ADP-1" RS232C/RS485 converter is necessary to connect the PLC to the servo amplifier. Please refer to section 8.3.

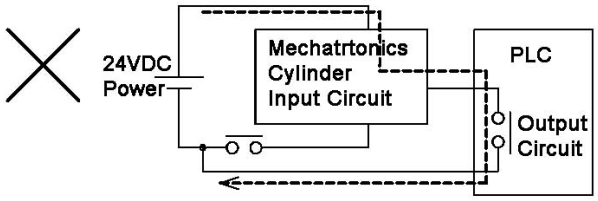
② If the serial (SIO) cable has to be wired outside of the control box, please make an extension cable suitable for wiring outside of a grounded electrical enclosure.

③ Provide power as necessary to the INH+, INH- and ILK inputs of the servo amp even when controlling the amp serially. Without these I/O, the system may not work properly.

4.3.2. Wiring notes for power shut down

If 24VDC power to the R Series servo system is wired for remote shut down, ensure the OVDC line is not being disconnected before the 24VDC line.





If the Mechatronics Cylinder is shut down on the 0V side only, there is high probability of I/O circuit damage to the servo controller.

4.3.3. In case of ground of +24V

When operating through the serial interface, do not wire 24VDC to ground if there is any risk as shown in the following figure.
The power to the R Series servo system is 24VDC. The common (0V side or 24G) of the 24V power is grounded in the internal control circuit of the servo amplifier. The serial interface runs from 5VDC and the 0VDC side of the serisl interface power is also connected to ground (5G). Therefore there is a risk of electrical short with the ground of your PC or PLC.

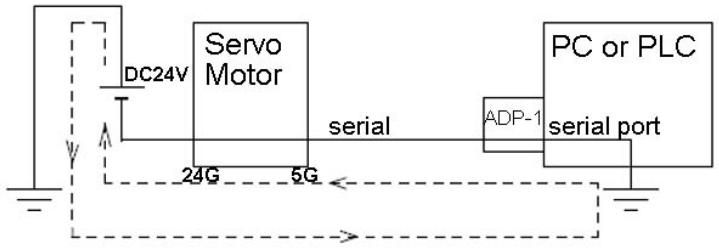


Figure 1-1 Example of electrical power short circuit

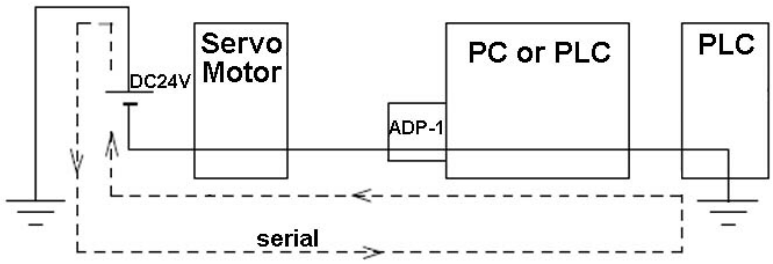


Figure 1-2 Example of electrical power short circuit

4.3.4. I/O Circuit of mechatronics cylinder

PNP Type

Ensure all I/O of the Mechatronics Cylinder are connected to either 0VDC or 24VDC±10%. Connection to any voltage in between these values may result in damage to the input or output.

The input circuits of the Mechatronics Cylinder are designed as non-isolated dedicated source drive circuits as described below. Therefore it is necessary to short (ON) with +24V terminal, or open (OFF) with +24V terminal by using a source-type output circuit.

As shown below, **the input circuit will receive over current and the internal circuit will be damaged if a PNP input is driven by a sinking output circuit or connected with 0V directly**.

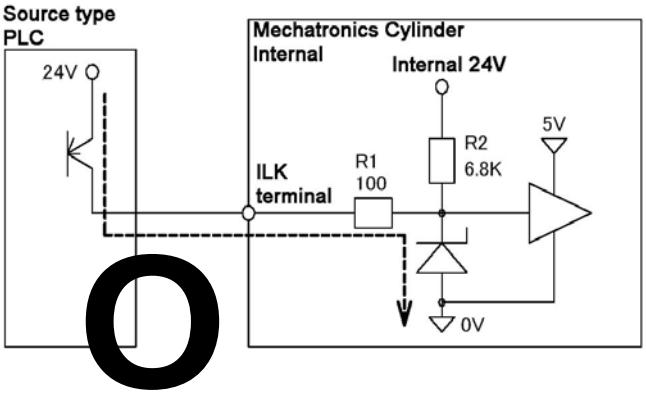


Fig. 2 PNP Input Circuit of Mechatrinics

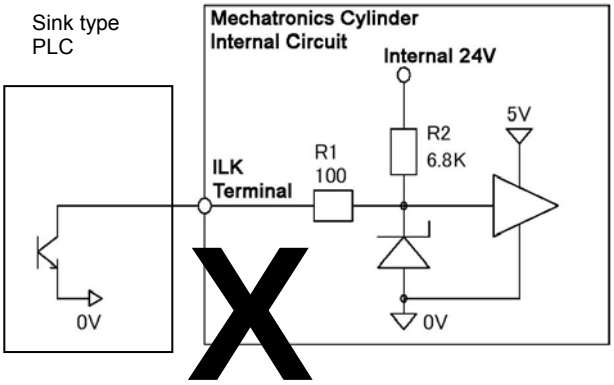


Fig. 3 Internal circuit (PNP) damage example

4.3.5. When using outputs to drive loads:

The output circuits of the Mechatronics Cylinder are open collector outputs as shown below. Therefore when driving an external load (such as a coil), please use an external surge diode or solid state relay. Surge voltage can damage the output circuit.

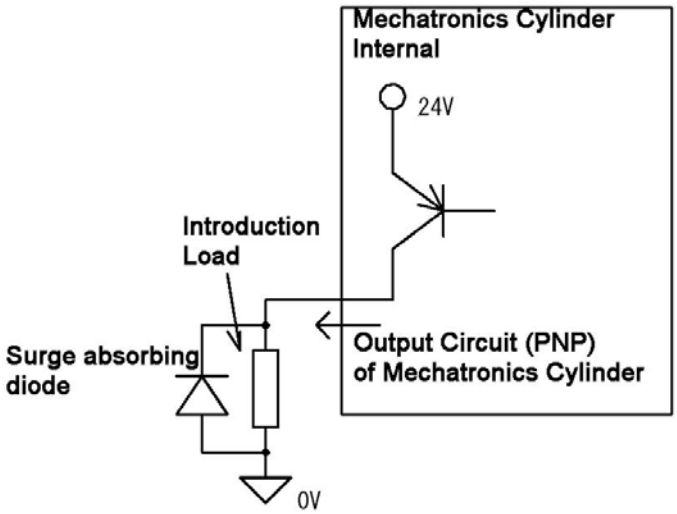


Fig. 4 Output circuit of Mechatronics cylinder

4.4. Wiring schematics

Please refer to section 8.5 for pin numbers of the power & IO and serial cables.

RSA-PNP model, wiring notes

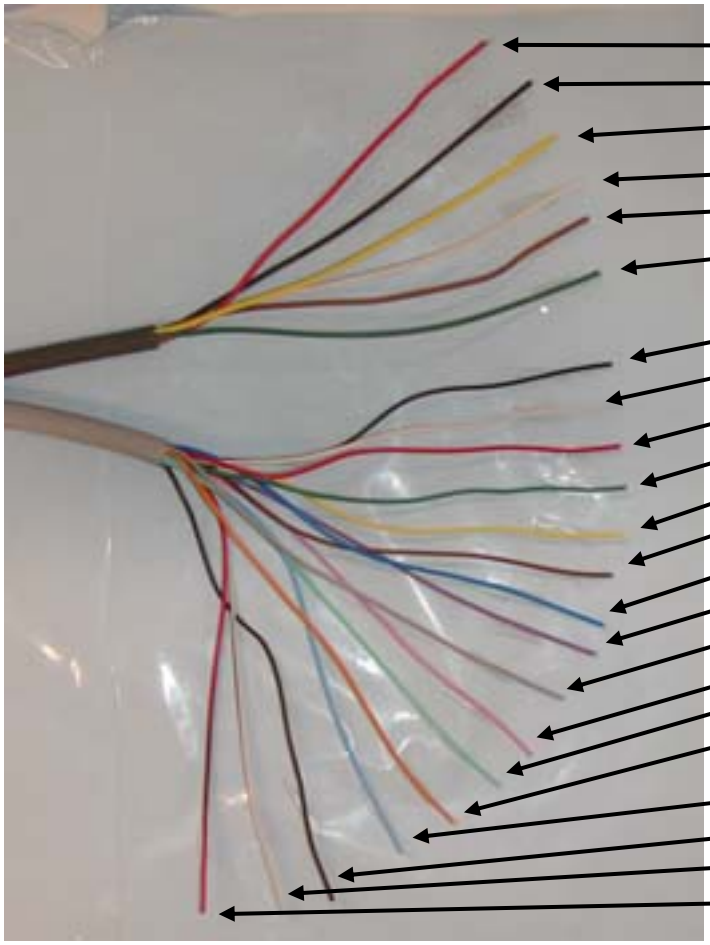
4.4.1. Preparation of the Parallel (Power & I/O) Cable

The parallel cable includes the power supply cable and signal cable required to run the Mechatronics Cylinder from a PLC and/or switches. The cable is assembled with a single connector on one end and flying leads on the other end. To prepare the flying leads, determine the required cable lengths considering the distance between the R Series servo controller, power supply, PLC and switches, then cut the cable to size. Strip the cable and install wiring tips as necessary according to the wire color list.

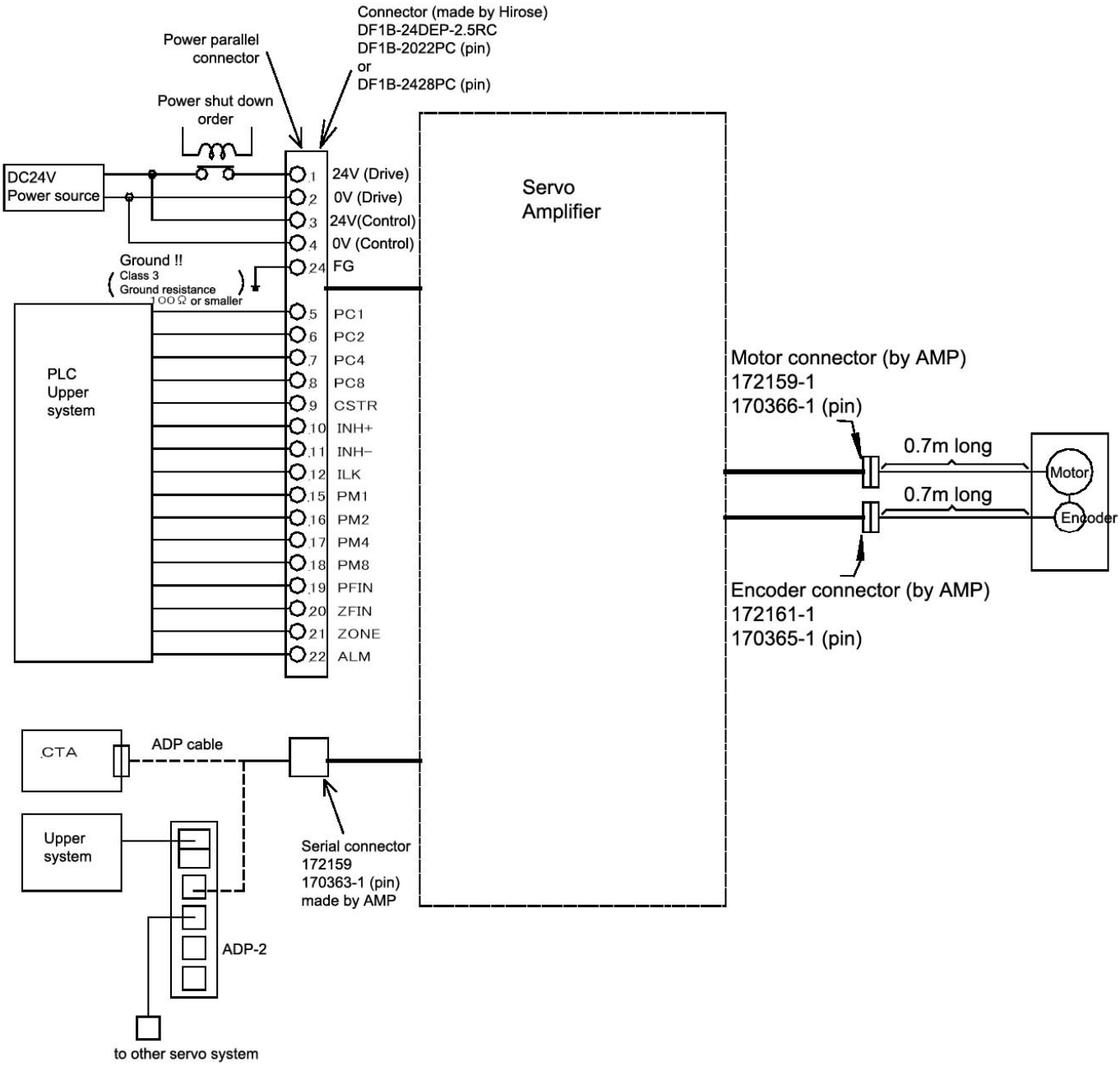
PNP Type

For simple wiring (PC or Pendant operation): Wire only the power wires (Red: 24VDC for motor, Black: 0V for motor, Yellow: +24V for control, White: 0V for control) and the ILK (Purple: +24V)

R Series Models



External wiring schematics



(Note 1) The "ADP-1" RS232C/RS485 converter is required between the control system and servo amplifier when interfacing with RS232C. (Please refer to section 8.3 for more information)
The ADP-1 converter circuit is not needed to interface to RS-485.

(Note 2) ①It is recommended to provide remote power-down capability to the motor and controller in order to reset alarm conditions.
②A TV rated relay (TV-8) is recommended for remote power control.

(Note 3) The power supply should be provided by the user.

(Note 4) It is recommended to acquire all cables from Dyadic to avoid potential system damage.

(Note 5) **The servo motor and connectors are not water-proof. For liquid-contact applications, please provide appropriate protection.**

(Note 6) **Connect the ILK (and possibly INH+ and INH-) input wires to +24V even if using serial control.**

4.5. Trial run

Please follow the trial procedures as below to avoid unexpected circumstances.

Disconnect the motor from mechanical parts such as couplings, belts and gears to try first.

(1) Please execute a trial run of the motor without load.
(2) Mount the motor in the machine, and then double-check the wiring.
① If using multiple motors connected in a serial network:
Assign a unique axis number to each axis including R Series motors, Mechatronics Cylinders and other Dyadic servo products. See the TBVST manual for more information on changing axis numbers.
② If connecting serially to one servo motor at a time there is no need to change axis numbers.
(3) Check that each axis can be operated independently:
Home and jog each servo motor from TBVST or the Dyadic Teach Pendant.
Run each motor to the pre-programmed motions you have created.

5. Hardware Specifications

Please refer to section 6 regarding serial and 24VDC interfacing to control systems.

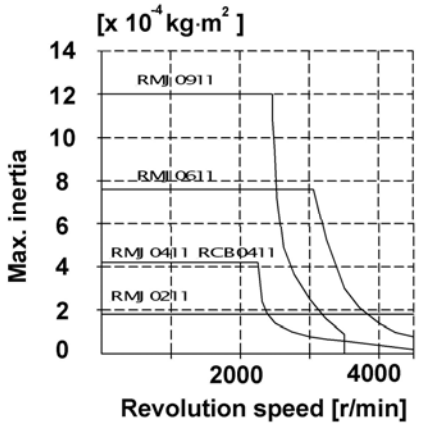
5.1. System Specifications

Motor system models			RSA0211	RCB0411	RSA0411	RSA0611	RSA0911
Motor model			RMJ0211	Built-in amp.	RMJ0411	RMJ0611	RMJ0911
Amplifier model			RAD0211		RAD0111	RAD0311	RAD1311
Output (equivalent to Brushless Motor) * Note 1		W	20	50	50	90	60
Max. speed (mm/s)		r /min	4500	4500	4500	4500	3500
Max. Torque		N·m	0.11	0.3	0.3	0.6	0.9
Rotary Inertia		$Kg·m^2$	0.018×10^{-4}	0.076×10^{-4}	0.076×10^{-4}	0.115×10^{-4}	0.188×10^{-4}
Max. Load Inertia Capacity Limit * Note 2		$Kg·m^2$	Please refer the graph of Speed- Max. Load Inertia Capacity				
Friction Load Capacity		N·m	0.03	0.083	0.083	0.229	0.36
Unbalance Load Capacity *Note 3		N·m	0.03	0.075	0.075	0.229	0.36
Position Speed Detector			Incremental encoder 200 P/R (4 transfer times 800 P/R)				
Input Power Source	Drive Power		DC24V±10% (max. 2.0 A)			DC24V±10% (max. 3.0 A)	
	Control Power		DC24V±10% (max. 0.2 A)				
Input /Output signal	Parallel input signal	Signal names	**DC24V type DI/DO Interface (Connector PIO),** Target position numbers (4bit binary: PC1, PC2, PC4, PC8), +/- direction revolution inhibit (INH+, INH-), Start (CSTR), Axis Movement Interlock (ILK)				
		Input Current	Max. 4mA / port				
	Parallel output signal	Signal names	**DC24V type DI/DO Interface (Connector PIO),** Completed position numbers (4bit binary: PM1, PM2, PM4, PM8, **RCB04 doesn't have completed position numbers**), Positioning completion (PFIN), Alarm (ALM), Zone signal (ZONE), Homing completion (ZFIN)				
		Output Current	Max. 10mA / port				
	Serial signal		**Serial Interface (Connector SIO)** +5V, 0V, S+, S-				
Protection			Bank data error, Encoder stop judge error, Encoder counter fault, Homing speed set over, Over speed, Uncontrollable run, Drive power over voltage, Regenerative voltage fault, Deviation counter fault, Overload, Encoder wire disconnected (RCB04 doesn't have this function), E^2PROM check sum error				
LED display			RDY(ready)、ALM(alarm)	No display	RDY(ready)、ALM(alarm)		
Amplifier ambient conditions * Note 4*	Operation Temperature		0 ～ 55 ℃	0 ～ 40 ℃	0 ～ 55 ℃		
	Storage temperature		－20 ～ 60℃				
	Operation/Storage moisture		20～80%RH or lower, non condensing				
Amplifier structure			Base mounting	Motor + built-in amplifier	Base mounting		
Amp / Motor weight		g	Approx. 250/500	Approx. 550(Incl. motor)	Approx. 400/500	Approx. 400/650	Approx. 400/850
Motor insulation class			Class B	Class E			
Motor protection type			IP40				
Radial load capacity		N (Kgf)	19.6 (2) or smaller			49 (5) or smaller	
Thrust load capacity		N (Kgf)	4.9 (0.5) or smaller	9.8 (1) or smaller		19.6 (2) or smaller	
Operation ambient conditions	Operation Temperature		0～40℃				
	Storage temperature		－20～60℃				
	Operation/Storage moisture		90%RH or lower（non condensing）				
	Vibration/Shock		2.5G / 10G (2 times)				
Motor mounting			Flange mounting				

Note 1: Data of triangle curve speed of 1,000r/min max.

Note 2: In case of lower positioning current limitation set, the value of unbalance load capacity will be reduced as well. In case of vertical use, this data is the Max. vertical load capacity.

Note 4: Max. energy loss of the amplifier is 15W.

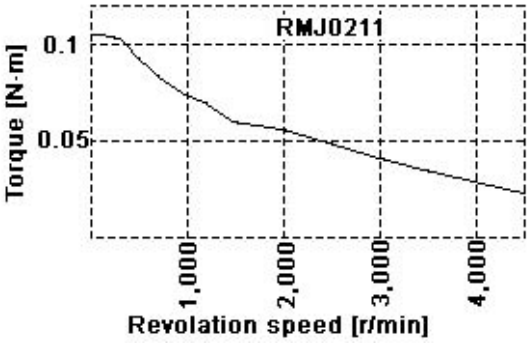


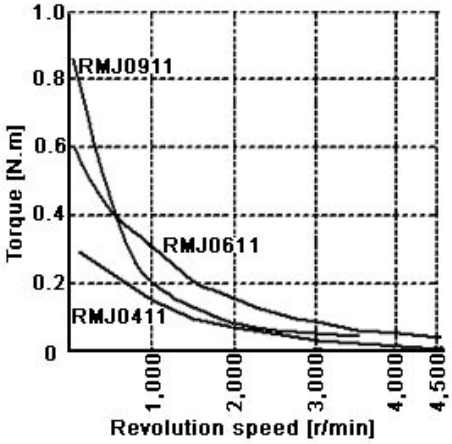
5.2. System Specifications of Geared motor

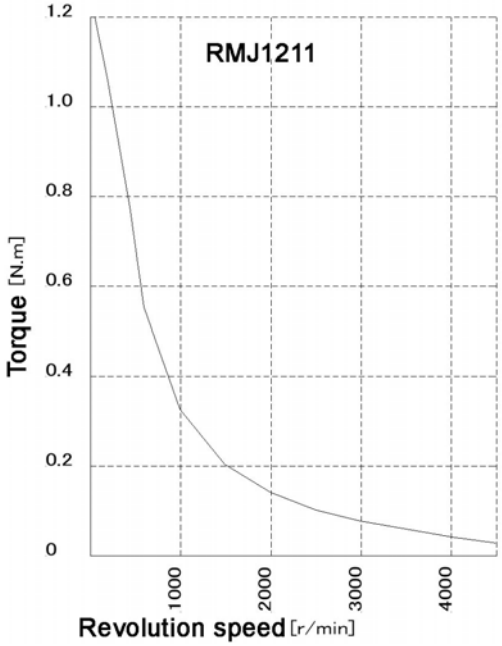
Motor system models			RSA0611-G1	RSA0611-G2
Motor model			RMJ0611-G1	RMJ0611-G2
Amplifier model			RAD0311	RAD0311
Max. speed		r /min	600	300
Reduction ratio			1/5	1/10
Torque allowance		N·m	1.5	2.5
Rotary Inertia		$Kg·m^2$	0.14×10^{-4}	0.14×10^{-4}
Position Speed Detector			Incremental encoder 1000 P/R (4 transfer times 4000 P/R)	Incremental encoder 2000 P/R (4 transfer times 8000 P/R)
Input Power Source	Drive Power		DC24V±10% (max. 3.0 A)	
	Control Power		DC24V±10% (max. 0.2 A)	
Input /Output signal	Parallel input signal	Signal names	DC24V type DI/DO Interface (Connector PIO), Target position numbers (4bit binary: PC1, PC2, PC4, PC8), +/- direction revolution inhibit (INH+, INH-), Start (CSTR), Axis Movement Interlock (ILK)	
		Input Current	Max. 4mA / port	
	Parallel output signal	Signal names	DC24V type DI/DO Interface (Connector PIO), Completed position numbers (4bit binary: PM1, PM2, PM4, PM8), Positioning completion (PFIN), Alarm (ALM), Zone signal (ZONE), Homing completion (ZFIN)	
		Output Current	Max. 10mA / port	
	Serial signal		Serial Interface (Connector SIO) +5V, 0V, S+, S-	
Protection			Bank data error, Encoder stop judge error, Encoder counter fault, Homing speed set over, Over speed, Uncontrollable run, Drive power over voltage, Regenerative voltage fault, Deviation counter fault, Overload, Encoder wire disconnected, E^2PROM check sum error	
LED display			RDY (ready)、ALM (alarm)	
Amplifier ambient conditions	Operation Temp.		0 ～ 55 ℃	
	Storage temperature		－20 ～ 60℃	
	Ope./Storage moisture		20～80%RH or lower, non condensing	
	Vibration/Shock		0.5G / 2G or smaller (2 times)	
Amplifier structure			Base mounting	
Amp / Motor weight		g	Approx. 400/900	Approx. 400/900
Motor insulation class			Class E	
Motor protection type			IP40	
Radial load capacity * Note 1		N (Kgf)	49（5）or smaller	
Thrust load capacity		N (Kgf)	29.4（3）or smaller	
Operation ambient conditions	Operation Temperature		0～40℃	
	Storage temperature		－20～60℃	
	Ope./Storage moisture		90%RH or lower（non condensing）	
	Vibration/Shock * Note 2		2.5G / 10G (2 times)	
Motor mounting			Flange mounting	

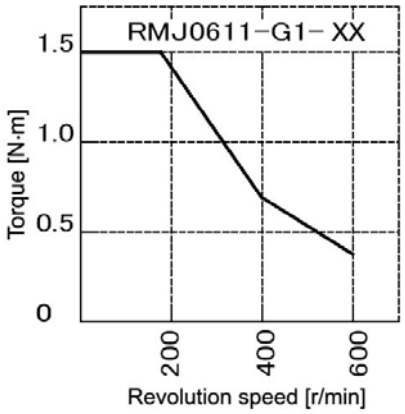
Note 1: Load point of Radial Load Data is the shaft front end.
Note 2: This is the data that the servo motor is mounted horizontally. The shock is made vertically to the motor.
Note 3: In case of such applications to repeat the revolution of CW and CW and/or large acceleration and/or deceleration, please contact us.

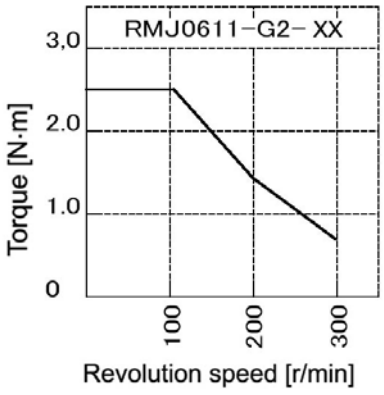
5.3. T-N Curves

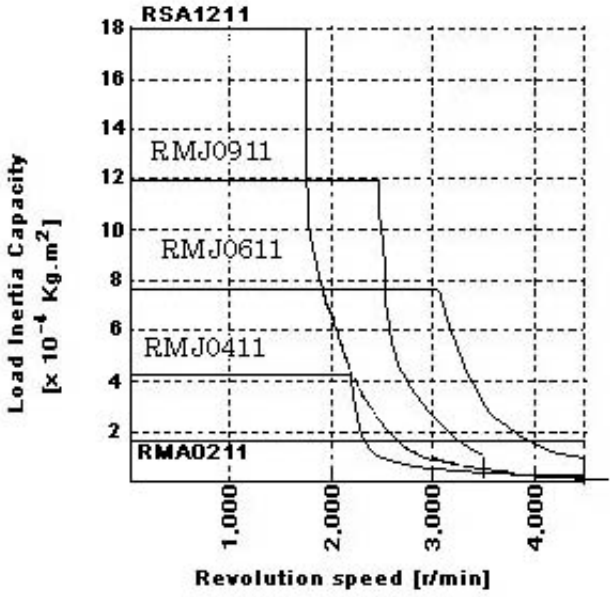

RMJ0211
Torque [N·m]
0.1
0.05
1,000
2,000
3,000
4,000
Revolation speed [r/min]


RMJ0911
RMJ0611
RMJ0411
Torque [N.m]
1.0
0.8
0.6
0.4
0.2
0
1,000
2,000
3,000
4,000
4,500
Revolution speed [r/min]


RMJ1211
Torque [N.m]
1.2
1.0
0.8
0.6
0.4
0.2
0
1000
2000
3000
4000
Revolution speed [r/min]

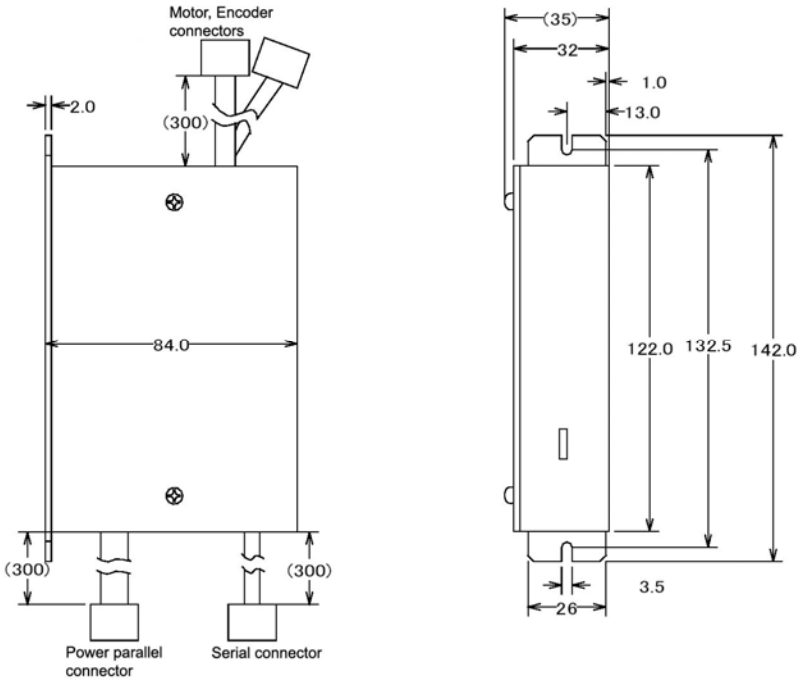

RMJ0611-G1- XX
Torque [N·m]
1.5
1.0
0.5
0
200
400
600
Revolution speed [r/min]


RMJ0611-G2- XX
Torque [N·m]
3,0
2.0
1.0
0
100
200
300
Revolution speed [r/min]

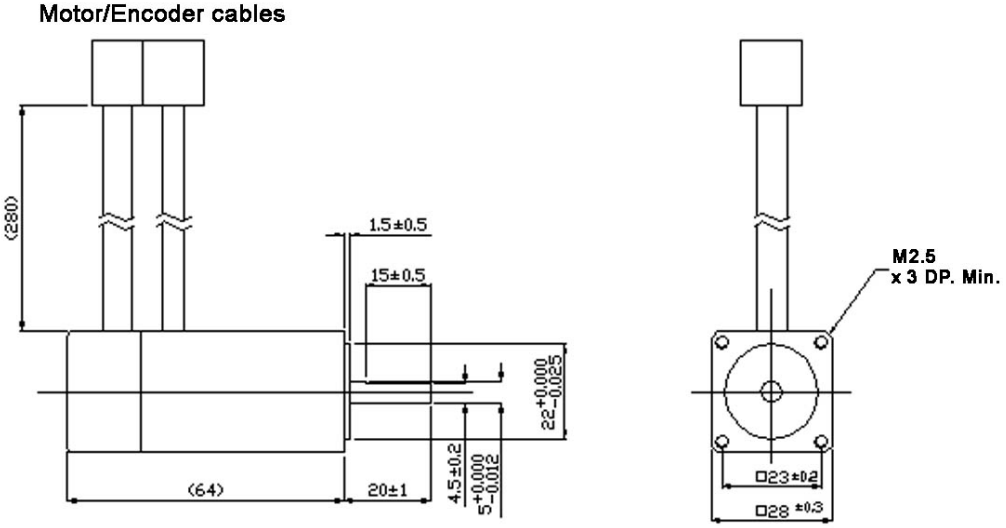

RSA1211
RMJ0911
RMJ0611
RMJ0411
RMA0211
18
16
14
12
10
8
6
4
2
1,000
2,000
3,000
4,000
Load Inertia Capacity
[x 10-4 Kg.m2]
Revolution speed [r/min]

5.4. Dimensions

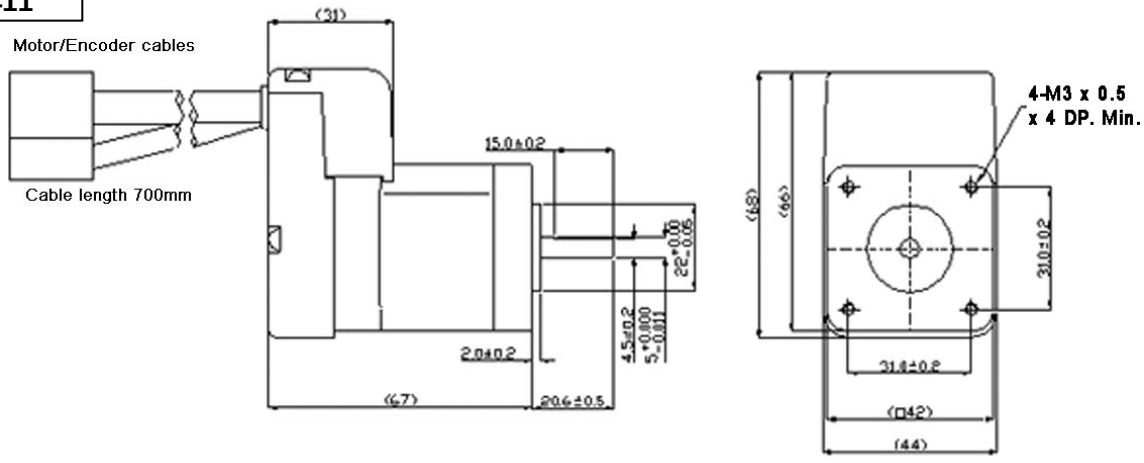
(1) Servo amplifier
RAD xx 11



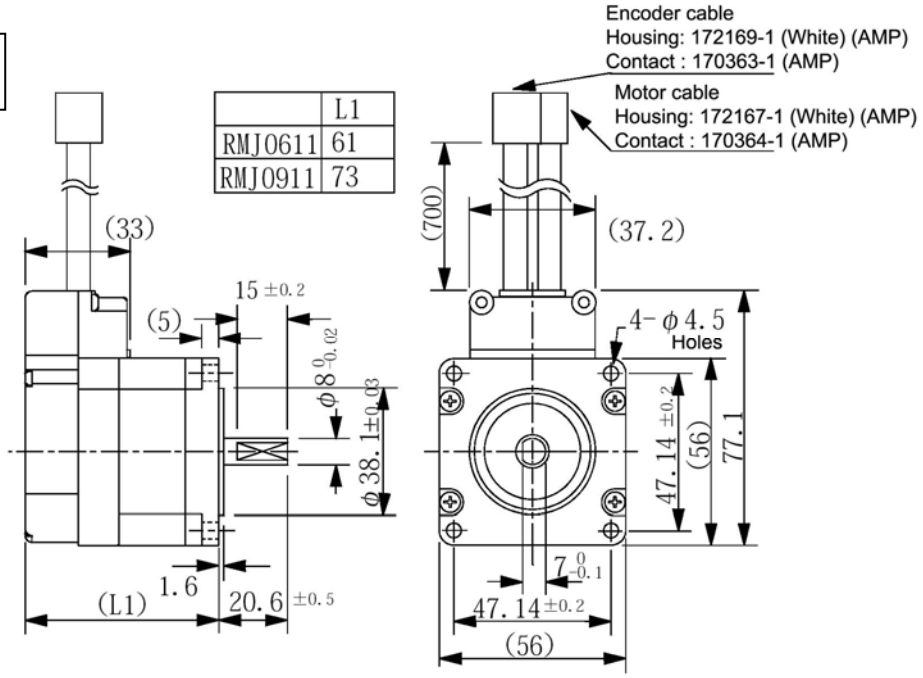
(2) Motor RMJ0211



(3) Motor RMJ0411



(4) Motor RMJ0611 RMJ0911



	L1
RMJ0611	61
RMJ0911	73

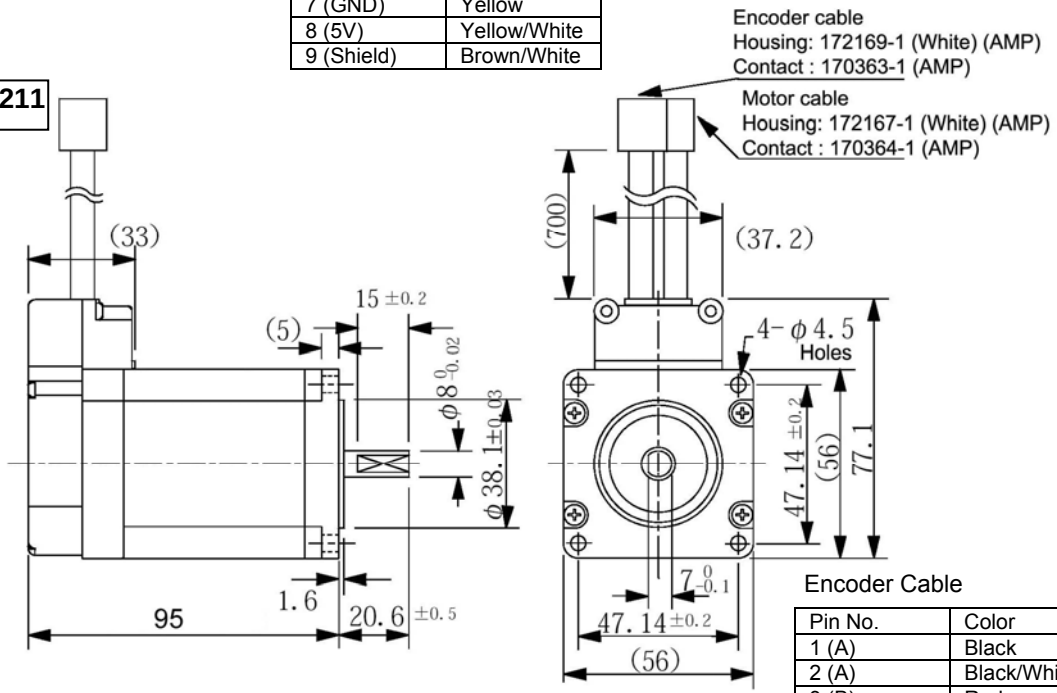
Motor Cable

Pin No.	Color
1 (A)	Red
2 (A)	Blue
3 (B)	Yellow
4 (B)	Green

Encoder Cable

Pin No.	Color
1 (A)	Black
2 (A)	Black/White
3 (B)	Red
4 (B)	Red/White
5 (C)	Green
6 (C)	Green/White
7 (GND)	Yellow
8 (5V)	Yellow/White
9 (Shield)	Brown/White

(5) Motor RMJ1211



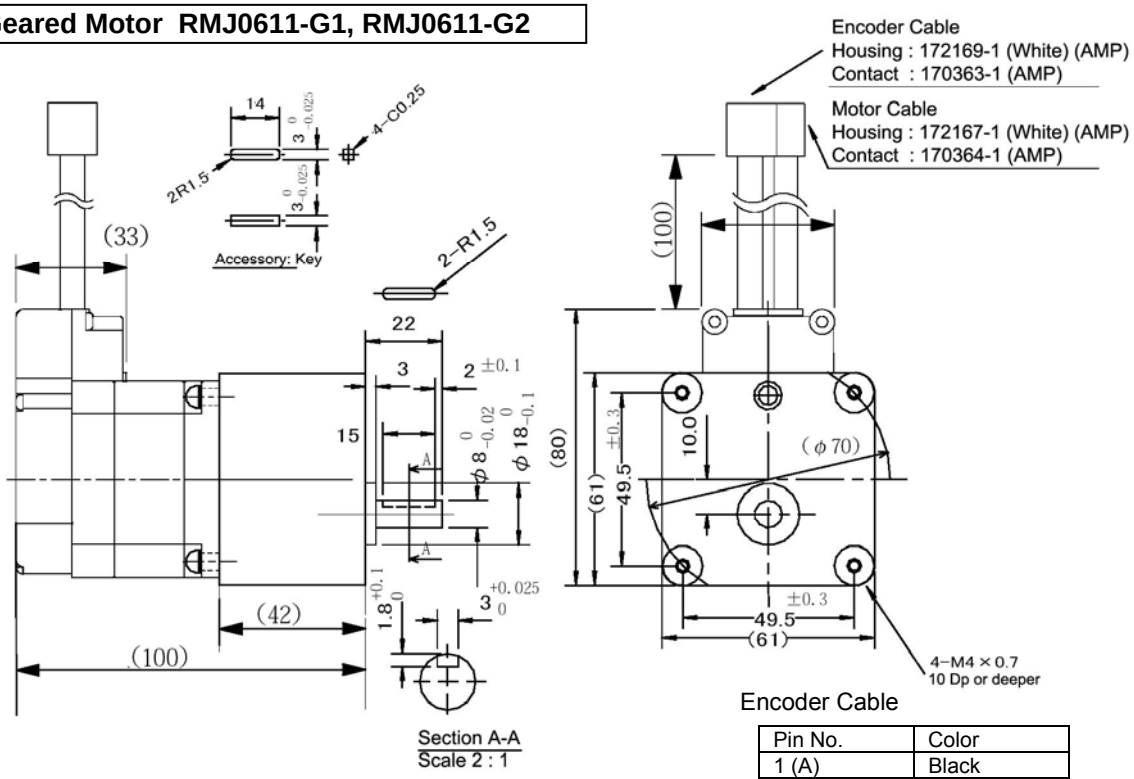
Motor Cable

Pin No.	Color
1 (A)	Red
2 (A)	Blue
3 (B)	Yellow
4 (B)	Green

Encoder Cable

Pin No.	Color
1 (A)	Black
2 (A)	Black/White
3 (B)	Red
4 (B)	Red/White
5 (C)	Green
6 (C)	Green/White
7 (GND)	Yellow
8 (5V)	Yellow/White
9 (Shield)	Brown/White

(6) Geared Motor RMJ0611-G1, RMJ0611-G2



Motor Cable

Pin No.	Color
1 (A)	Red
2 (A)	Blue
3 (B)	Yellow
4 (B)	Green

Encoder Cable

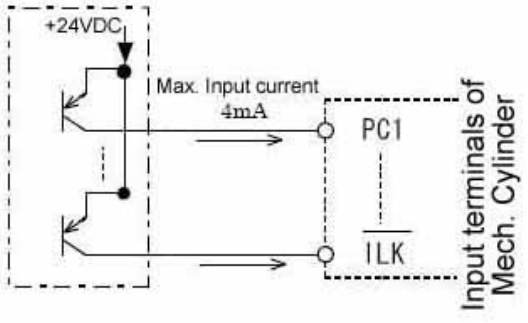
Pin No.	Color
1 (A)	Black
2 (A)	Black/White
3 (B)	Red
4 (B)	Red/White
5 (C)	Green
6 (C)	Green/White
7 (GND)	Yellow
8 (5V)	Yellow/White
9 (Shield)	Brown/White

6. Interface Specifications

6.1. Internal Circuitry of Serial and 24VDC I/O

(1) Input circuits

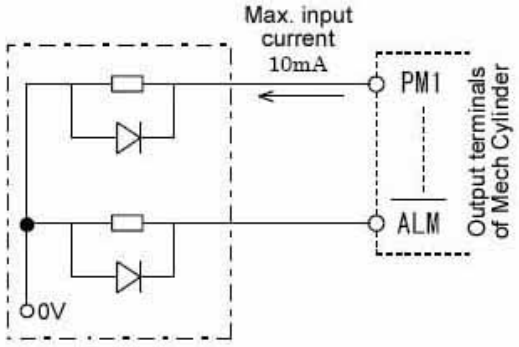
Signal ON is created by applying +24V to the input, OFF is created by opening the input circuit.
The max capacity for the input circuit is 24VDC, 4mA.



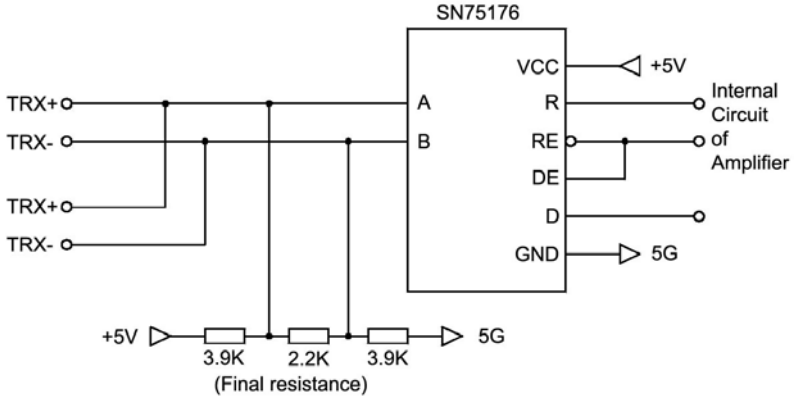
(2) Output circuits

Each output will supply 24VDC when it is in the ON condition. In the OFF condition the output will open the circuit.
The max capacity for the output circuit is 24VDC, 10mA.

(Note: Please design the input circuit such that the current will be less than 4mA for each port.)



(3) SIO Circuit



6.2. PIO Specifications

6.2.1. Input signals

Input signal ON: +24VDC applied to input from external source
Input signal OFF: No connection to input (open circuit)

No.	Symbol	Functions
1	+24V	Motor Power 24VDC, larger gauge cable (higher current)
2	0V	Motor Power 0V, larger gauge cable (higher current)
3	+24V	Controller (Amp) Power 24VDC, smaller gauge cable (lower current)
4	0V	Controller (Amp) Power 0V, smaller gauge cable (lower current)
5	PC1	Input signal of Position registration number: Position number is sum of PC1 to PC8. ON means 1, OFF means 0
6	PC2	Input signal of Position registration number: Position number is sum of PC1 to PC8. ON means 2, OFF means 0
7	PC4	Input signal of Position registration number: Position number is sum of PC1 to PC8. ON means 4, OFF means 0
8	PC8	Input signal of Position registration number: Position number is sum of PC1 to PC8. ON means 8, OFF means 0
9	CSTR	Strobe input – Interrogate PC Inputs and initiate designated motion 1. At the rising (OFF=>ON) edge, the controller reads the sum of PC1~8, then it will move the cylinder to the saved target position for the designated move. If the home position is unknown (such as after power-up) the servo controller will run the homing routine first, then move to the target position. 2. CSTR resets the PFIN output so PFIN will not come on at the end of the move if CSTR does not turn off first.
10	INH+	24VDC Homing Input (CCW Approach) This input sets the 0 point on the rising edge of the signal. See section 1.1.2 for details. The INH+ input can be used to augment the software limits and provide an end of stroke signal. This function is disabled by default but can be enabled in the Setup menu of the TBVST software.
11	INH-	24VDC Homing Input (CW Approach) This input sets the 0 point on the rising edge of the signal. See section 1.1.3 for details. The INH- input can be used to augment the software limits and provide an end of stroke signal. This function is disabled by default but can be enabled in the Setup menu of the TBVST software.
12	ILK	Motion Interlock input – Must be ON (24VDC Input) to allow motion **Pause Mode** If the ILK signal turns OFF during motion the current position will be taken as the temporary target position (the original target position is still stored) and the motor will hold this position with appropriate power. When the ILK signal comes back ON the motion will immediately resume to the original target position (unless a CSTR pulse to the controller has sent a new move command while the ILK signal was OFF). **Cancellation Mode** If the ILK signal turns OFF during motion the current position will be taken as the target and the motor will hold this position with full power. When the ILK signal comes back ON there will be no motion until a new move is sent using the CSTR input.
13	NC	No connection
14	NC	No connection

6.2.2. Explanations of Input signals

[+24V]
Power supply for drive and control circuits. +5V control power is created from this +24V power internally. Alarms are reset by cycling controller power OFF/ON after the alarm cause is resolved.

[0V]
Ground side of circuit for motor and control power. Common with the serial interface ground.

[PC1] [PC2] [PC4] [PC8]
These are the destination position number inputs. When the input signal edge of CSTR changes (OFF => ON), the destination position numbers inputs are checked (their bit weight is 2^0 for PC1, 2^1 for PC2, 2^2 for PC4 and 2^3 for PC8). Please note that the inputs of PC1 to PC8 must be ready when the CSTR signal changes from OFF to ON. If the input conditions of PC1 to PC8 change after the rising edge of the CSTR input, there won't be any influence to the motion (when the cylinder is configured in Normal Mode – see the TBVST manual for the special case of Air Cylinder Replacement modes).
If the application requires only 2 positions, only one of the position number inputs is needed.
For example:
[PC1] input can select position numbers 0 and 1.
[PC2] input can select position numbers 0 and 2.
[PC4] input can select position numbers 0 and 4.
[PC8] input can select position numbers 0 and 8.

[CSTR]
This is a strobe input. When CSTR goes high (OFF => ON), the destination position numbers (PC1, 2, 4, and 8) are read in 4-bit binary and summed to determine which motion to run. Due to the internal filter, the CSTR signal must be ON for 4ms or longer. If this signal edge is detected before homing has been completed (when ZFIN output is turned OFF), the homing operation will be executed automatically, after which the actuator will immediately run the requested motion.
The CSTR and PC1, 2, 4, and 8 inputs can theoretically be turned on at the same time, however, some PLCs may have slight delays in the response of their outputs, in which case the PC1, 2, 4, and 8 inputs may not finish switching before the rising edge of the CSTR input is registered. To be safe it is recommended to switch the PC1 to 8 inputs at least 4ms before the CSTR input is turned ON.
When the CSTR signal is turned ON, the PFIN signal will be turned OFF. If the CSTR signal is kept ON when the actuator has reached its destination, the PFIN signal won't turn ON. Please keep the CSTR signal ON for at least 4ms and turn it off before the actuator finishes its move.

[ILK]
The ILK input will either cancel or pause the motion of the actuator when the input circuit opens. The teach pendant or PC Tool software can change this behavior. The default setting is the "Pause" mode. The ILK input should be always turned ON for normal operation.

Details for the Pause mode (Default):
If the ILK signal is turned OFF during motion, the actuator will start to decelerate (at maximum or programmed decel) then stop. This stop position is designated as the temporary destination position but the original destination position is still stored.
When the ILK signal turns back ON, the temporary destination position is deleted, and the original destination position is set to the current destination. The moves restarts to the original destination position.
If a new position command is executed (using PC1, 2, 4, 8 and CSTR) while the ILK signal is turned OFF, the actuator will move to the new position after the ILK signal is turned back ON.
If the ILK signal is turned OFF and the actuator stops, the PFIN signal stays OFF, however, the PFIN signal will turn ON after the ILK signal resumes (ON) and the actuator reaches the destination position.

Details for the Cancellation Mode:
If a new MOVE command is entered when the ILK signal is turned OFF and the actuator stops, the new MOVE will not run.
If the ILK signal is turned OFF and the actuator stops, the PFIN signal is turned ON. The PFIN

signal stays ON when the ILK signal is turned back ON.

6.2.2.1 Air Replaceable Modes

The 24VDC I/O can be configured for different operation in “Normal”, “Air replaceable 1”, or “Air Replaceable 2” modes using the TBVST software. In normal mode the cylinder uses the PC1, 2, 4, and 8 inputs in BCD combination to run 16 different motions and needs a CSTR pulse to initiate each move. In the “Air Replaceable” modes the cylinder can run up to 3 motions as commanded by the PC1, PC2, or PC4 inputs. The different modes control whether the inputs must be maintained during motion, or can be pulsed. Please see the TBVST manual for more information on the “Air Replaceable” modes.

6.2.3 Output signals

The ON state of output signals means the internal circuit has closed to provide +24VDC to the output conductor. In the OFF state the circuit opens. The capacity of each output circuit is 24VDC, 10mA max.

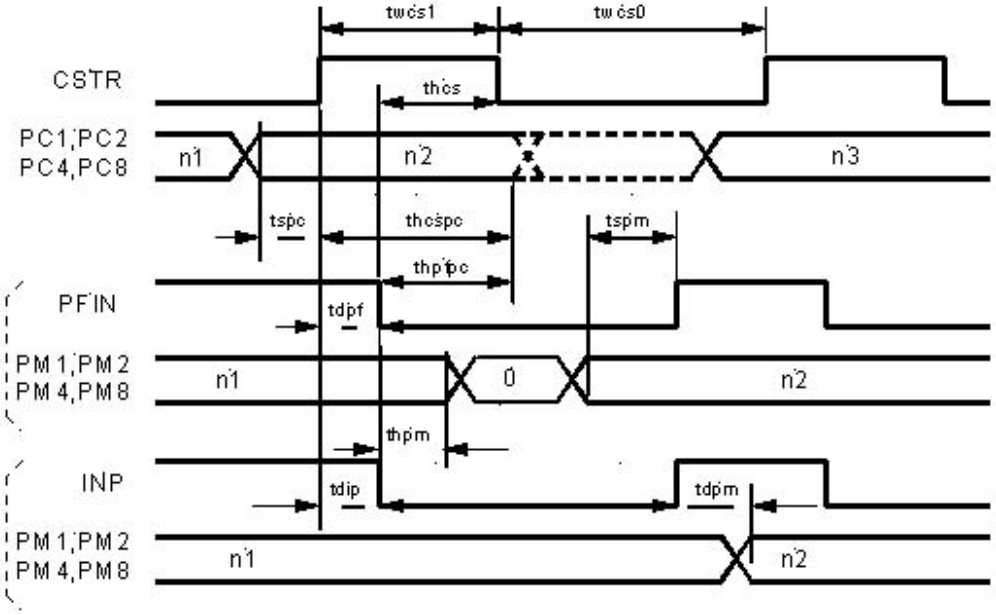
No.	Symbol	Functions
15	PM1	Completion signal output: Total of PM1 to PM8 ON means 1, OFF means 0
16	PM2	Completion signal output: Total of PM1 to PM8 ON means 2, OFF means 0
17	PM4	Completion signal output: Total of PM1 to PM8 ON means 4, OFF means 0
18	PM8	Completion signal output: Total of PM1 to PM8 ON means 8, OFF means 0
19	PFIN	Position completion output ① ON: The output goes high when the Mechatronics Cylinder has moved to within the position width tolerance of the target position. Please note that PFIN signal won't be turned ON until CSTR signal is turned OFF. ②OFF: The output goes low when motion to a new target position is initiated. Notes: -The tolerance used to determine when the PFIN output goes high is set by the "At Position Width" variable in the programming device. -This output will not operate properly if the "CSTR" signal is left high. The CSTR signal should be pulsed OFF-ON-OFF to initiate motion, and therefore is expected to be OFF when motion finishes.
20	ZFIN	Homing completion output ① ON: The output will be ON after homing completion. ② OFF: The output is OFF after the Mechatronics Cylinder is first powered up and /or when an encoder-related alarm occurs. ZFIN won't be turned ON until the homing is completed.
21	ZONE	Zone signal output ① ON: The output will be ON when the position of the axis is within the range programmed to be the "Zone". ②OFF: The output will be OFF if the axis has not been homed or if the rod is outside the programmed zone.
22	ALM	Controller alarm output ① ON: The output will be ON during normal operation. ②OFF: The output will be OFF in case of Alarm occurs.

6.2.4. Explanations of Output signals

[PFIN]
Positioning completion output
This is the position completion signal.
The output first goes high after the power supply is turned ON and the servo amplifier is ready for operation.
The PFIN signal will be turned OFF when the CSTR signal is turned ON to command a move. PFIN will be turned back ON when the current actuator position is within the range of the “At Position Width” parameter (set in the programming package) from the programmed destination position if the CSTR signal has been turned OFF.
The PFIN signal will also be turned OFF if the actuator is beyond the software stroke limit.
[ZFIN]
This is the homing completion output.
This output will be low when the power is turned ON and if any error/alarm relating to the encoder has occurred.
This output will be high after the homing operation is completed.
The ZFIN signal won’t be turned OFF during operation except in case of position feedback errors or control power shut down.
[ZONE]
This output signal will be high when the actuator position is within the zone boundaries set in the programming software or teach pendant.
This output will be low before homing completion (when the ZFIN output signal is OFF) and when the actuator is outside of the programmed ZONE range.
The ZONE output won’t be affected by alarm conditions.
[ALM]
This is the alarm output and this output signal will be high when the operation is under normal conditions. This output signal will be low when an error has occurred. Alarm codes can be read from the pendant or software and referenced in section 9.

6.2.5. Timing

Following is a timing chart of the operation from 24VDC parallel interface connection (PIO connection):

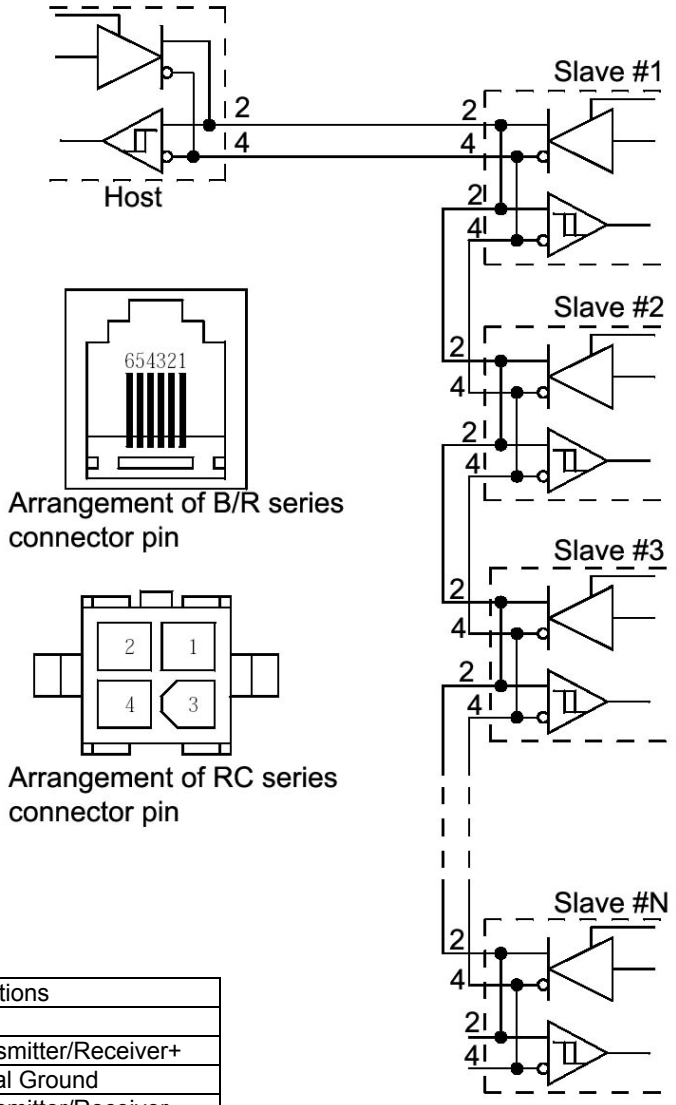


Name	Min. value	Max. value	Descriptions
twcs1	4 msec		CSTR ON shortest timing duration
twcs0	4 msec		CSTR OFF shortest timing duration
Thcs	0 msec		PFIN OFF=>CSTR holding time
Tspc	0 msec		CSTR ON=>PC1~PC8 set up time
Thcspc	4 msec		CSTR ON=>PC1~PC8 holding time
Thpfpc	0 msec		PFIN OFF=>PC1~PC8 holding time
Tdpf		4 msec	CSTR ON=>PFIN OFF delay time
Tspm	0 msec		PFIN ON=>PM1~PM8 set up time
Thpm		4 msec	PFIN OFF=>PM1~PM8 0 Output delay time
Tdip		4 msec	CSTR ON=>INP OFF delay time
Tdpm		4 msec	INP ON=> PM1 ~ PM8 establishment delay time

(Note 1) The above timing assumes an output circuit load of 10K Ω or less.

6.3. SIO (Serial Input Output) Specifications

Electrical specification	Follow RS485
Transfer speed	Selectable in the range of 9.6 kbps ~ 115.2 kbps (After break command, the speed to be 9.6kbps)
Synchronizing method	Micro timing adjusting method
Data (1 character) length	8 bit
Parity	None
Start/Stop bit	1 bit
Xon/Xoff	None
Pallet length	16 characters (Structure: STX + data 12 characters + check sum 2 characters + ETX)
Connection type	BUS connection (multi point connections: Max 16 axes)



No.	Name	Functions
1	+5V	
2	TRx+	Transmitter/Receiver+
3	5G	Signal Ground
4	TRx-	Transmitter/Receiver-
5	SYN	Reserved
6	+5V	

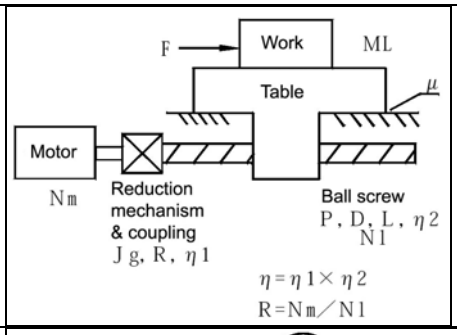
7. Servo Sizing Worksheet

Please review items (1) ~ (3) below to summarize the requirements for your system.
Refer to section 5 or contact your supplier to select the motor that fits your system.

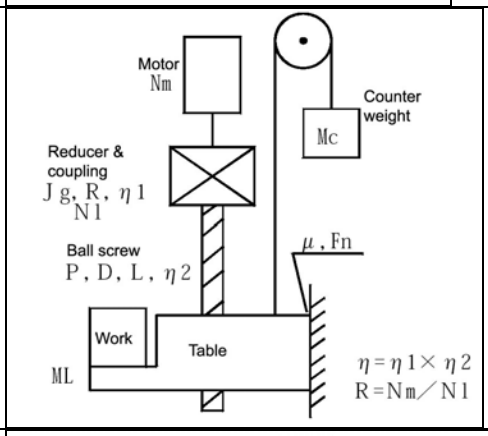
(1) Mechanical factors

Please select your mechanical drive type from following ① to ⑦ and fill in the parameters.

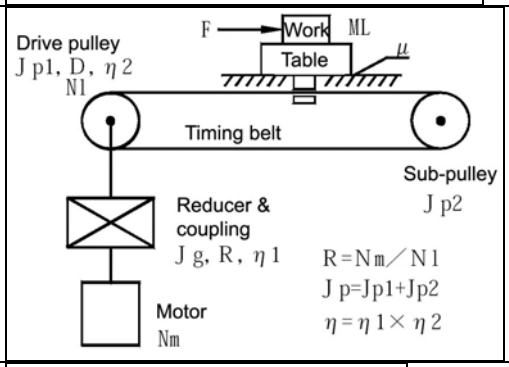
① Ball screw-Horizontal use			
Carriage weight	ML		Kgs
External force	F		N
Table guide friction rate	μ		-
Total efficiency	ŋ		-
Reduction rate	R		-
Reducer + coupling inertia	Jg		Kgs·cm^2
Ball screw pitch	P		mm/rev
Ball screw diameter	D		mm
Ball screw length	L		mm



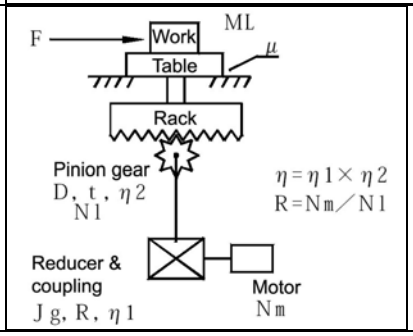
② Ball screw-Vertical use			
Carriage weight	ML		Kgs
Counter weight	Mc		Kgs
Table guide pre pressure	Fn		N
Table guide friction rate	μ		-
Total efficiency	ŋ		-
Reduction rate	R		-
Reducer + coupling inertia	Jg		Kgs·cm^2
Ball screw pitch	P		mm/rev
Ball screw diameter	D		mm
Ball screw length	L		mm



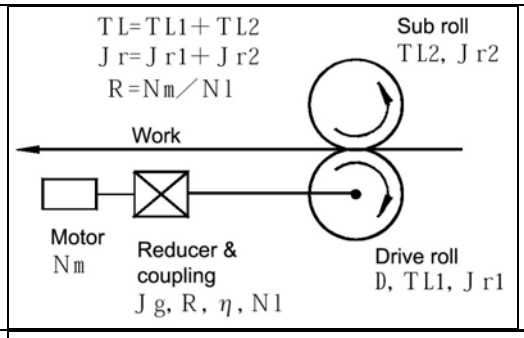
③ Timing belt			
Carriage weight	ML		Kgs
External weight	F		N
Table guide friction rate	μ		-
Total efficiency	ŋ		-
Reduction rate	R		-
Reducer + coupling inertia	Jg		Kgs·cm^2
Drive + Sub-pulley inertia	Jp		Kgs·cm^2
Pulley pitch diameter	D		mm



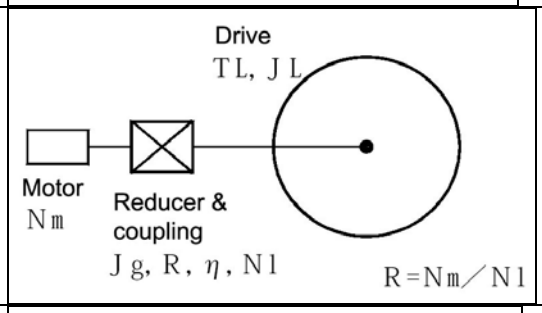
④ Rack & Pinion			
Carriage weight	ML		Kgs
External weight	F		N
Table guide friction rate	μ		-
Total efficiency	ŋ		-
Reduction rate	R		-
Reducer + coupling inertia	*Jg*		*Kgs·cm^2*
Pinion gear pitch diameter	*D*		*mm*
Pinion gear teeth thickness	*t*		*mm*



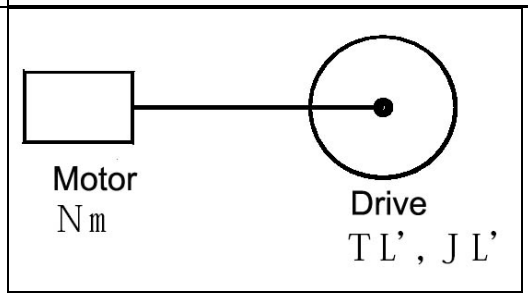
⑤ **Roll feeding**			
Drive + Sub drive roller inertia	Jr		Kgs·cm^2
Tension	F		N
Roll revolution friction torque	TL		Nm
Drive roll diameter	D		mm
Total efficiency	ŋ		-
Reduction rate	R		-
Reducer + coupling inertia	Jg		-



⑥**Rotary**			
Drive inertia	Jr		Kgs·cm^2
External torque	F		N
Total efficiency	ŋ		-
Reduction rate	R		-
Reducer + coupling inertia	Jg		-



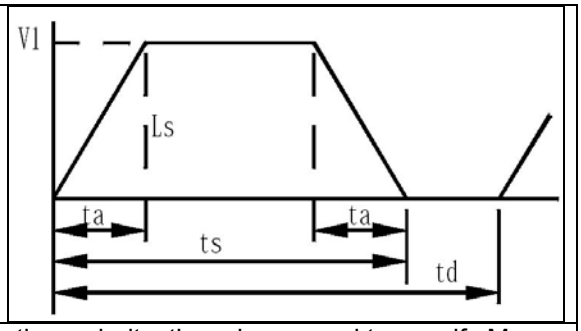
⑦**Other**			
Motor axis conversion load inertia	JL'		Kgs·cm^2
Motor axis conversion load torque	Tl'		Nm
Motor positioning revolution angle	Lm		rad
Motor revolution speed	Nm		r/min
Cycle time	td		sec
Positioning time	ts		sec
Acceleration/Deceleration time	ta		sec



Notes: Nm Motor output shaft speed
Nl Speed of sub drive shaft
ŋ1, ŋ2, ・・・・ Efficiency of individual drive transmission mechanism
Reducer & coupling inertia Jg are input shaft conversion value

(2) Duty cycle

Drive			
Positioning distance	Ls		m
Max. speed	Vl		m/sec
Motor shaft			
Positioning distance	θ		(x2π)rad
Max. speed	Vl		M/sec
Positioning time	ts		Sec
Cycle time	td		Sec
Acceleration/Deceleration time	ta		sec



Please fill specifications of drive or motor shaft. In case of positioning time priority, there is no need to specify Max. speed nor Acceleration.

(3) Environment

Please specify ambient temperature and other conditions.

8. Important Accessories

8.1. PC Tool (Model: TBVST-CTC-EN-SET)

The PC Tool Kit is used for programming Dyadic servo products, and comes with everything needed to connect to and program 1 axis.

(1) Code: TBVST-CTC-EN-SET
Following items are in the package:

①	Visual data programming software	TBVST-EN	To install in PC
②	Spreadsheet style data programming software (Expert Mode)	CTA-1EX	To install in PC
③	Servo motor setup programming software	MVST	To install in PC
④	RS232/RS485 converter	ADP-1	To connect with the serial port of PC
⑤	Connector converter	ADP-2-4	To translate cables
⑥	ADP cable (1m)	RP9050-010	To connect between amplifier and ADP-2-4
⑦	SIO cable (1m)	RP9041-010	To connect between ADP-1 and ADP-2-4

(2) Installation
The TBVST programming software is used to program Mechatronics Cylinders via simple software screens which allows for actuator jogging and other programming. Compatible Operating Systems include: WINDOWS 95, 98, 2000, NT 4.0, XP, (Vista may require extra work for installation)

When the CD is inserted into your PC, the main menu pops up automatically as shown at right:

Please click the appropriate button to install.
Refer to individual manuals for details of operation.

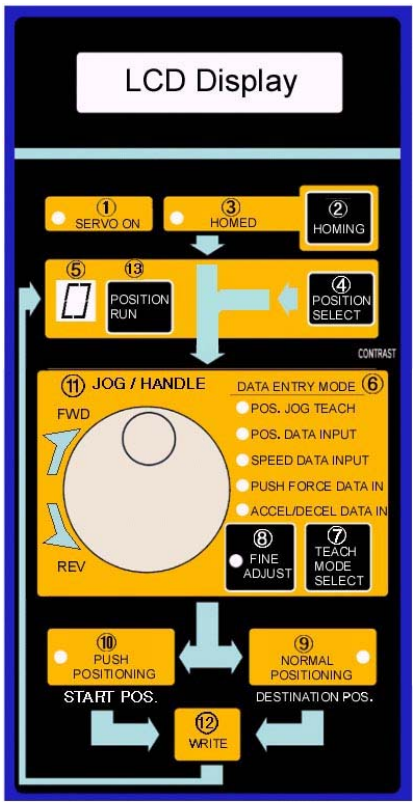
8.2. Teach Pendant (Model: CTA-23EN-SET)

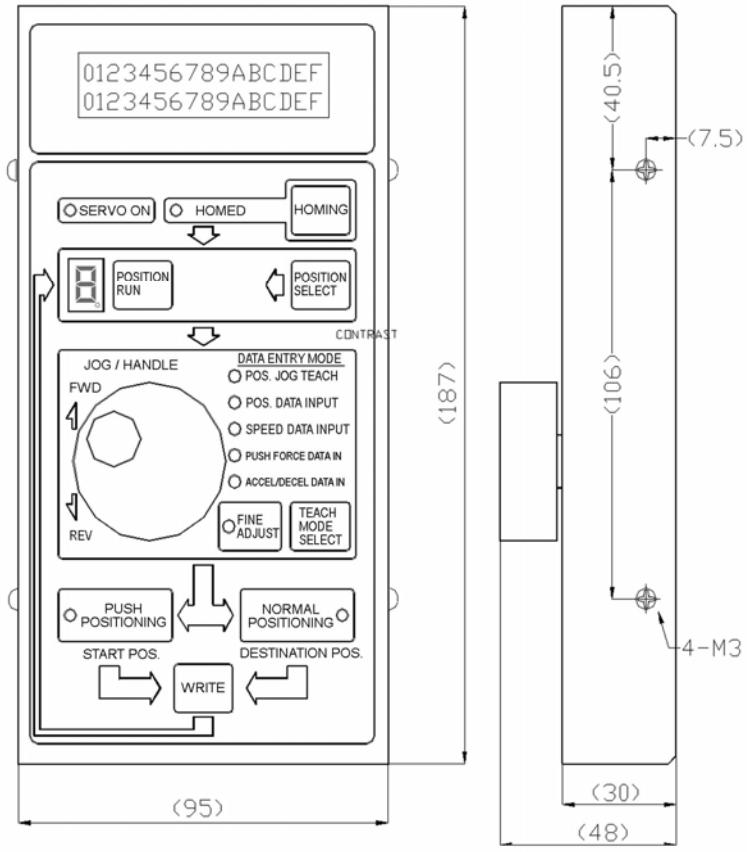
The Teach Pendant allows the user to program up to 16 motions, each of which include position, speed, acceleration parameters and more simply by following the arrows on the panel. The Pendant also allows the user to jog the actuator and run the saved motions.

(1) Code: CTA-23-EN-SET

① Teaching Pendant	:	CTA-23EN	(Jog and program motions for actuator)
② ADP Cable (1m)	:	RP9050-010	(connect servo controller to CTA-23)

(2) Panel and dimensions





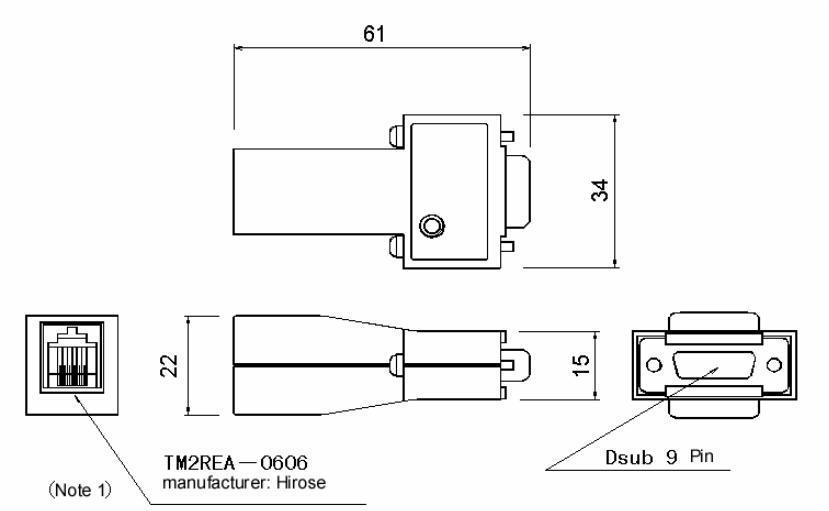
(3) Please refer to the teach pendant manual for details of operation.

8.3. RS232C/RS485 Junction Converter Circuit

(Model: ADP-1)

(1) Model No.: ADP-1

(2) Dimensions

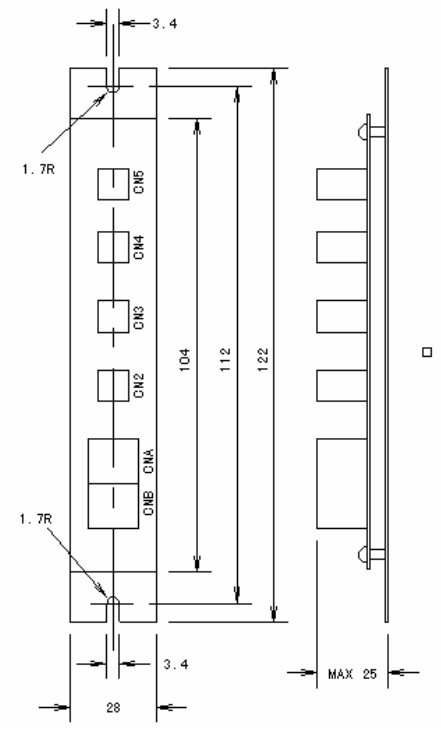


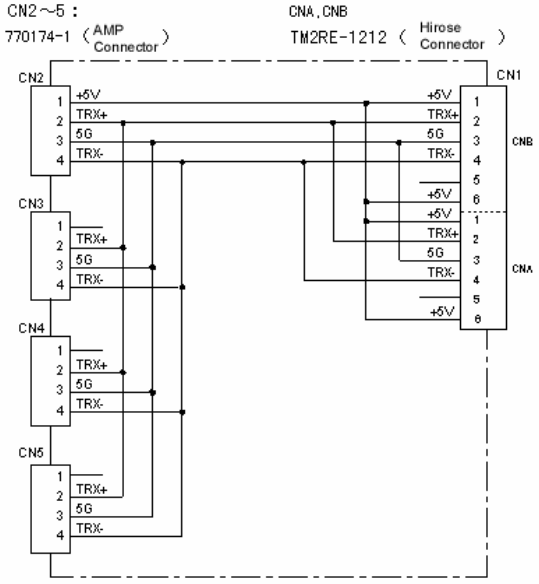
Please refer 5.4. wiring examples of outside connections for connector connection. Please use SIO cable (6 wires) for connector cable.

8.4. Connector Converter: ADP-2-4

(1) Model: ADP-2 and ADP-2-4

(2) Dimensions and circuit diagram

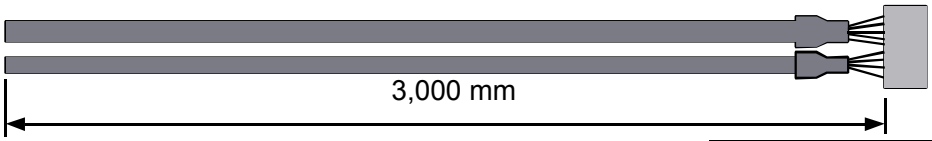




Note 1: For multi-axis systems use ADP-2-4.
Note 2: When using ADP-2-4, the CN2 must be used first.

8.5. Cables

(1) Parallel cable (Code: RP9120-030)

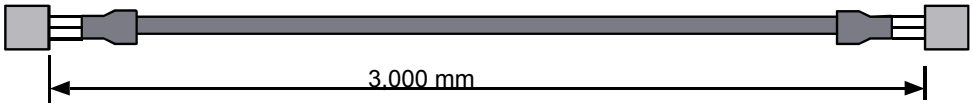


Connector	Made by Hirose
Socket	DF1B-24DES-2. 5RC
Pin	DF1B-2022SC (AWG22-20) DF1B-2428SC (AWG28-24)

5	PC1	Black	15	PM1	Grey
6	PC2	White	16	PM2	Pink
7	PC4	Red	17	PM4	Light Green
8	PC8	Green	18	PM8	Orange
9	CSTR	Yellow	19	PFIN	Light blue
10	NC	Brown	20	ZFIN	Dark Brown
11	NC	Blue	21	ZONE	White/Black
12	ILK	Purple	22	ALM	Red/Black

1	+24V	Red	4	0V	White
2	0V	Black	23	NC (No connection)	Brown
3	+24V	Yellow	24	Ground	Green

(2) Serial connection cable (Code: RP9050-010)



1	+5V	Red
2	TRx+	White
3	5V	Black
4	TRx-	Green

Connector	Made by AMP Co.
Socket	172167-1
Plug	170365-1

9. Maintenance & Inspection

(1) Please inspect products following the chart below.

	Check Up Items	Inspection Frequency	Points	Notes
Mechatronics Cylinder Actuator	Vibration and noise	Occasional	Sound level should not be bigger than usual	Compare with the conditions of normal operation
	Appearance	According to the condition	Clean with cloth and/or shop air	
Servo Amplifier	Parts clean up	Occasional	No major dust, dirt, oil, etc.	Clean with cloth and/or shop air
	Tightness of screws	Occasional	No loose screws	Tighten screws with proper torque

Notes: Ambient temperature should be within specification to ensure expected life.

(2) Warranty

Mirai Inter-Technologies will replace defective products with equivalent working units. This doesn't cover damage caused by the customer or incorrect orders by the customer.

(3) Gear head life

The gear head life of the gear motor, RMJ0611-G1 and RMJ0611-G2, can be estimated by the calculation as below:

$$L = La \times 3000 / N1 / G1 \times (Tk / Ts)^3 / F$$

L : Life (Hours)
La : 5000 (hours) (Rating life)
N1 : Application speed (r/min)
G1 : Gear ratio
Tk : Torque allowance (N · m) RMJ0611-G1=1.5, RMJ0611-G2 = 2.5
Ts : Application Torque (N · m)
F : Load factor One direction load : 1.0
Light shock load (with run-stop) : 1.5
Middle shock load (with instant start and stop) : 2.0

10. Fault Diagnosis

10.1. Fault Diagnosis by Alarm Codes

If an Alarm condition is detected, the Alarm code can be read using TBVST. The following chart should help to identify the cause of the problem.

Name of Alarm	Alarm Code	Conditions	Cause	Action
Bank 30 data error	B0	Occurs when wrong data was entered, or when power is turned ON, positioning command is executed.	Data beyond the expected range has been entered	Review all data to ensure it is within the expected range. If bad data cannot be found, download the appropriate factory default file from the File menu of TBVST (this will reset all data in your actuator).
Bank 31 data error	B1			
Encoder counter fault	B8, B9	Occurs when power is turned ON	Over load (inertia mismatch)	Make the load within the specified range
			Motor cable disconnected or bad connection	Check the wiring or replace motor
			Damaged motor	Replace product
			Damaged controller	Replace product
Time out of homing operation	BE	Occurs when homing	Motor cannot move if the ILK input does not have +24V,	Check the ILK +24V connection
Over speed	C0	Occurs when power is turned ON	Damaged controller	Replace controller
		Occurred during motor operation	Noise in encoder cable	Re-route encoder cable to separate from main circuit
Servo fault	C1	Occurs when power is turned ON	Damaged controller	Replace controller
		Occurred during motor operation	Encoder cable got noise	Re-route encoder cable to separate from main circuit
Main power over voltage	D0	Occurs when power is turned ON or during motor operation	Input voltage is too high	Make sure the input voltage is within the specs.
		Occurs when power is turned ON	Damaged controller	Replace controller
Regenerative Voltage fault	D1	Occurred during motor operation	Over load, possibly due to over-speeding	Eliminate over-speeding by any of the following: -reduce max target speed -reduce acceleration -reduce load
			Damaged controller	Replace controller
Deviation counter fault	D8	Occur during the motor operation	Over load	Check the actual load
			Motor is locked	Remove the cause of the jam

Over load	E0	Occurred when power was turned ON	Damaged controller	Replace product
		Occurred during the motor revolution operation	Over load	Check the actual load
Encoder signal wire disconnected (Both A, B phases)	E8	Occurred when power was turned ON	Encoder wire is disconnected or bad encoder connections	Check and repair the connections
			Damaged controller	Replace the controller
			Damaged encoder of the motor	Replace the motor
		Occur during the motor operation	Encoder wire is disconnected or bad encoder connections	Check and repair the connections
Encoder signal wire disconnected (A phase only)	E9	Occurred when power was turned ON	Encoder wire is disconnected or bad encoder connections	Check and repair the connections
			Damaged controller	Replace the controller
			Damaged encoder of the motor	Replace the motor
		Occur during the motor operation	Encoder wire is disconnected or bad encoder connections	Check and repair the connections
Encoder signal wire disconnected (B phase only)	EA	Occurred when power was turned ON	Encoder wire is disconnected or bad encoder connections	Check and repair the connections
			Damaged controller	Replace the controller
			Damaged encoder of the motor	Replace the motor
		Occur during the motor operation	Encoder wire is disconnected or bad encoder connections	Check and repair the connections
EEPROM Check Sum Error	F8	Occur when power was turned ON, or during the motor operation	Damaged control	-Download the factory default file using TBVST (this will reset all data in your controller) -Cycle power -If the same error occurs again, replace the controller.

10.2. Diagnosis by fault movement

In case of fault movement of Mechatronics Cylinder with no alarm display, please check the possible problem cause chart as below, then take actions to correct the problems.

Fault Operation	Possible Causes	How to check	Actions
Cylinder doesn't start	Power is not turned ON or not connected	- Check the power input voltage - Check the power wiring	Correct power circuit
	Loose connectors	Check connectors	Tighten connectors
	Wrong external wiring	Check external wiring	Correct external wiring
	Over load	Try to run Cylinder only without any load	Reduce load
	No movement command	Check position data	Correct position target data
	Servo OFF	Check "Servo ON" status using TBVST	Turn the servo ON (using TBVST)
Unstable Motor revolution	Wiring connections are not good	Check connections (Terminals, connectors, etc.) and wiring	Correct wiring
Motor vibrates	Servo Gain is too high	Reduce Gain	Reduce Gain
	Cable gets noise from other equipment	Move other equipment away	Move cables away from noise source and/or shield cables
Motor heats up	Ambient temperature is tool high	Check the ambient temperature	Lower down the ambient temperature below 40°C
	Motor is not clean	Check the appearance of the Motor	Remove dust, oil etc. on the surface of Cylinder
	Overload	Try to run Motor without any load	Reduce the load or replace it with bigger capacity motor
Abnormal noise	Bad mechanical mounting	Check the coupling between the motor and the mechanism. Loosen mount screws to check for non-concentric mounting.	Correct the joint, coupling and mounting
	Other machine /equipment is vibrating	Check the moving parts of other machine	Check with the manufacturer of other machine
	Defective motor	Replace with good motor	Replace with good motor
SIO communication is not valid	Communication method is not suitable	Check if output of main control system is RS485	If the main control system is RS232C, check the ADP-1 protocol converter.
	Output port setting is wrong		Correct output port number and setting
	Wrong axis numbers		Correct axis number
	Reply time of the amplifier is longer than receiving time of main control System (PC)	Check if longer receiving time of main control system (PC) helps to communicate	Set shorter reply time of the motor

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