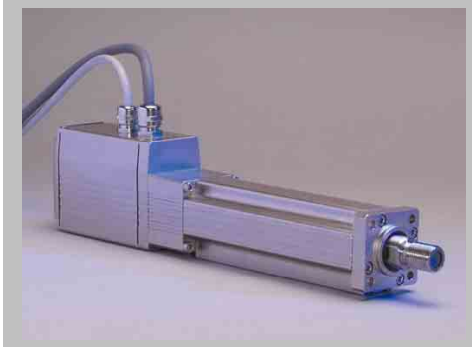
WITTENSTEIN

Ternary

TL linear system

TLSA 032, TLSA 046



TR rotary system

TRSA 032, TRSA 046

TL/TR Intelligent

Linear and Rotary

Motion Control
Products

STP edition

Operating Instruction

Doc No 1091-320449 Ver. 2.04

Safety notice

In this instruction manual, following ! WARNING and ! CAUTION are used to describe instructions for safe operation of Ternary Intelligent Servo system,

! WARNING Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.

! CAUTION Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

In some instances, items described in ! CAUTION may also result in a serious accident.

In either case, be sure to follow these important items.

! WARNING

General Matters

- Do not operate in an environment with explosive or flammable gasses, or near flammable materials.
- Do not use the product in a location where it may be exposed to splashes of water or oil, except that it is water-protected, or oil-protected. Failure to observe this warning may cause electric shock or fire.
- Do not remove, install, connect, or inspect while power is ON. Otherwise it may result in personal injury. Be sure to turn OFF power before inspection or maintenance.
- Installation, connection, inspection or maintenance should be done by an expert. Otherwise it may lead to fire.
- Do not reconstruct the actuator or cables. Otherwise actuator may run wrongly and may cause personal injury, electric shock, or fire.

Connection

- Do not tense or bend the cables too hard, or, do not put things on them. Otherwise cables may cause break-off and result in electric shock or fire, or, faulty operation of actuator to cause injury.

Operation

- Do not touch any moving parts of actuator during operation. Failure to observe this warning may result in personal injury.
- Turn OFF power immediately in case power failure happens during operation. Otherwise it may cause personal injury or damage to equipment, because of sudden, unexpected restart after power restoration.
- As this actuator is not equipped with brake system, output rod may come off and fall down due to gravity, when main power is OFF. If it is still necessary to keep its position after main power is off, please make arrangement with the machine to be connected.

! CAUTION

General matters

・Do not run the actuator beyond its capacity shown on the specification. Otherwise it may lead to personal injury or damage to product.

Installation

・Make sure to fix the actuator securely. Otherwise it may lead to injury or damage to the product.

・When wiring, be sure to follow the connection instructions. Otherwise personal injury or fire may result.

・Be sure to connect the actuator to a proper power supply for the specification. Using a wrong power supply may cause fire, damage to the actuator, or loss of performance.

・Do not wire main power supply directly with control power supply. Use a relay with main power supply side in order to shut down immediately in an emergency.

Operation

・To avoid inadvertent accidents, before connecting to the machine, run the actuator in test run without load. Otherwise it may lead to injury or damage to the system.

・Do not give higher load to the output rod of actuator than its max. permissible value when installation or during operation. Exceeding load may cause damage to the actuator earlier or loss of performance.

・For test run, be sure to set up parameters (such as strokes and positioning) appropriately in advance, and then run with lower speed and lower acceleration, in order not to damage the machine connected. If wrongly set, it may cause personal injury or damage to the system.

・ If the output rod of the actuator receives an external axial load higher than its output thrust capacity, actuator will not run. Be careful when disconnecting the load, as the actuator may run suddenly, which may cause personal injury or damage to the system.

・Depending on the operating conditions, the outside of actuator may get heated. Do not touch actuator during power is ON or soon after turning OFF power. Otherwise it may lead to burn.

・In order not to overload (or overheat) the actuator, make adjustment the load conditions, operation duty cycle, and cooling conditions, referring to the LED indicator at the back of actuator.

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1. BASIC CONCEPT OF ‘TERNARY ‘ MOTION CONTROL PRODUCTS

Ternary TR rotary servo system and linear servo cylinder system from WITTENSTEIN Motion Control are the intelligent function sub-units for the advanced mechatronics systems with unified utility scheme through rotary to linear motion. Employing the original software servo technology the very compact system size is realized. Especially, in case of 046 size class, an integrated function unit with a motor, a driving amplifier and a controller in one volume would realize a great convenience in an application. Further, thanks also to modern technology, the easy use scheme is realized. Thus we hope you will enjoy the future quality in servo technology.

Ternary series product offers;

1. *From rotary to linear motion function systems /units in one utility scheme*
2. *Intelligent event driven command (position, velocity, acc./deceleration & Force / torque) system, instead of conventional pulse series drive or analogue input*
3. *Easy data entry tools in soft and hard are prepared Commonly used serial and/or parallel buses are selectable economically*
4. *Easy servo parameter setting with one generalized parameter with 16 levels*
5. *PC and conventional hard/soft PLC controllers are selectable (namely PIO or SIO is selectable)*
6. *Motor, amplifier and controller integrated compact ‘all in one’ product is selectable*
7. *Higher protection level is available as optional*
8. *Maintenance free*
9. *Individual condition announcement on machine*

2. SELECTION GUIDE

At present, 46mm(046) and 32mm(032) width classes are available. With one unique way of utility, the rotary system and/or the linear system is selectable. Before installing one or some of these products, this booklet shows the easiest and the fastest way to realize the optimum mechatronics systems.

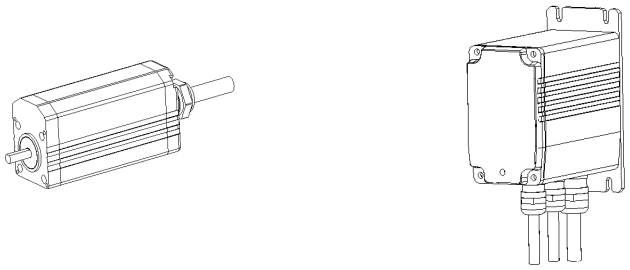


Fig. 2.1 As TRSA032, the motor TRMA032 and the separate amplifier / controller TCAA 046

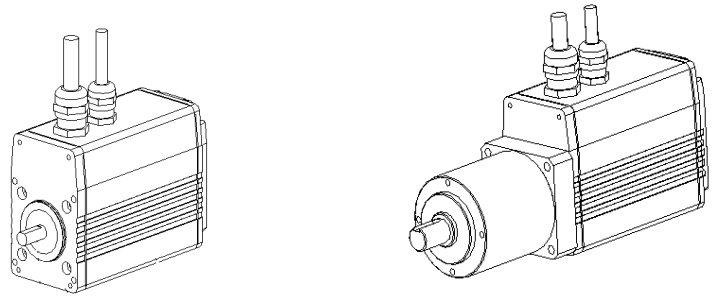


Fig. 2.2 TRBA046 integrated motor and amplifier/controller and TRSA046 the geared TRBA046

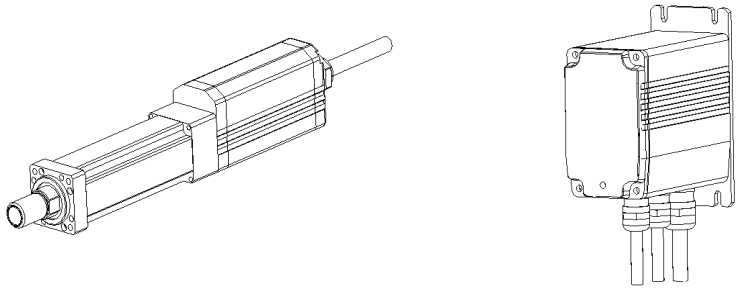


Fig. 2.3 As TLSA032, the linear motor TLMA032 and the separate amplifier/controller TCAA046

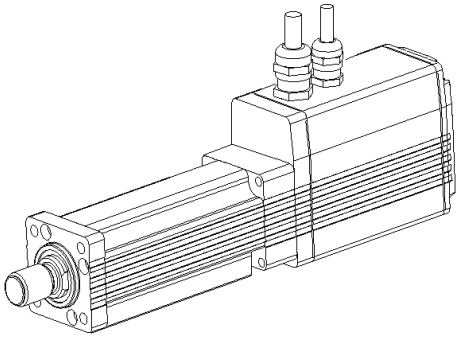


Fig. 2.4 TLSA046 integrated linear servo cylinder

2.1 System configuration

For instance, in the case of SIO connection, the Ternary rotary and linear motion control products could be connected together with several communication control apparatuses and data entry tools.

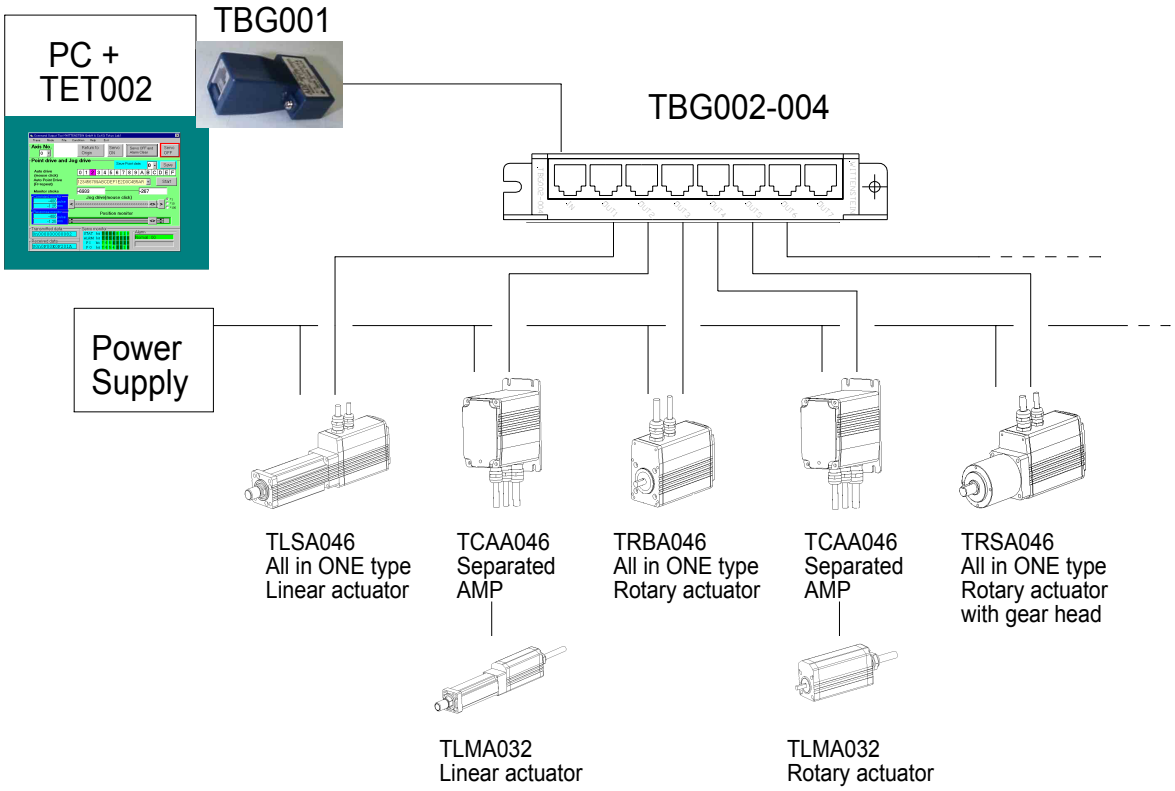


Fig. 2.5 System configuration under SIO

In the similar manner, under PIO the system could to be configured. Please refer detail the following chapters.

2.2 Product code

TLS A 046 A A A - 6 10 N 01 - 001

Type	TLM : Motor + Cylinder TRS : AMP + Motor(geared) TLS : AMP + Motor + Cylinder TRM: Motor(geared) TRB: Motor TCA: AMP
Version	A
Flange size	032 : 32mm 046 : 46mm
Motor	A : Standard
Encoder	A : 200P/R(Resolution=800)
Interface	A : RS485 + Sink type PIO B : RS485 + Source type PIO
Lead / Motor 1 rev.	X : Non Cylinder 3 : 3 mm (Flange size 046 only) 6 : 6 mm (Flange size 046 only) C : 12 mm (Flange size 032 only) P: 2.5 mm (Flange size 032 only)
Stroke of Cylinder	XX : Non Cylinder 02 : 25 mm 05 : 50 mm 07 : 75 mm 10 : 100 mm 15 : 150 mm (Flange size 046 only)
Brake	N : Non Brake B : With Brake
Gear ratio	01 : without Gear 05 : 1/ 5 (Flange size 046 only) 10 : 1/10 (Flange size 046 only) 25 : 1/25 (Flange size 046 only)
Design number	001 : High protection connector 002 : Standard connector

2.3 Option code

Code name (*1)	type	note
TBG001-001	Serial BUS convertor	RS232C(9p) / RS485(6P)
TBG002-003	SIO/PIO terminal	20P(standard type),6P(modular)X2,16P
TBG002-004	SIO terminal (for modular connector)	6P(modular)X8
TET001-002	Entry Tool (*2)	20P(standard type)
TET002-001	Software data entry tool	Software utility
TCC001-001-* **	Power cable (for high protect)	4P - free
TCC001-002-* **	Power cable (for high protect)	4P - 4P
TCC001-003-* **	Power cable (for standard connector)	4P - free
TCC001-004-* **	Power cable (for standard connector)	4P - 4P
TCC002-001-* **	Command cable (for standard)	6P - (4 lines) - 6P
TCC002-004-* **	Command cable (for high protection)	20P - (20 lines) - 20P Shield
TCC002-005-* **	Command cable (for highprotect)	20P - (4 lines) - 6P
TCC002-006-* **	Command cable (for standard)	20P - (20 lines) - 20P Shield
TCC002-007-* **	Command cable (for standard)	20P - (4 lines) - 6P
TCC002-008-* **	Command cable (High protect -> standaed)	20P - (20 lines) - 20P Shield
TCC003-001-* **	Motor and Encoder cable (for high protect)	16P - (13 lines) - 16P Shield
TCC003-002-* **	Motor and Encoder cable (for standard)	16P - (13 lines) - 16P Shield

(*1) Last three letters of the cable code mean the cable legth. Standard length are 010(1m), 020(2m) and 050(5m).
(*2) This is without cable. This needs extension cable(TCC002-006-*** or TCC002-008-***) to use.

3. TR INTELLIGENT ROTARY SERVO ACTUATOR

3.1 Specification and individual character

Table. 3.1 TRMA, TRBA and TRSA series rotary actuator specification

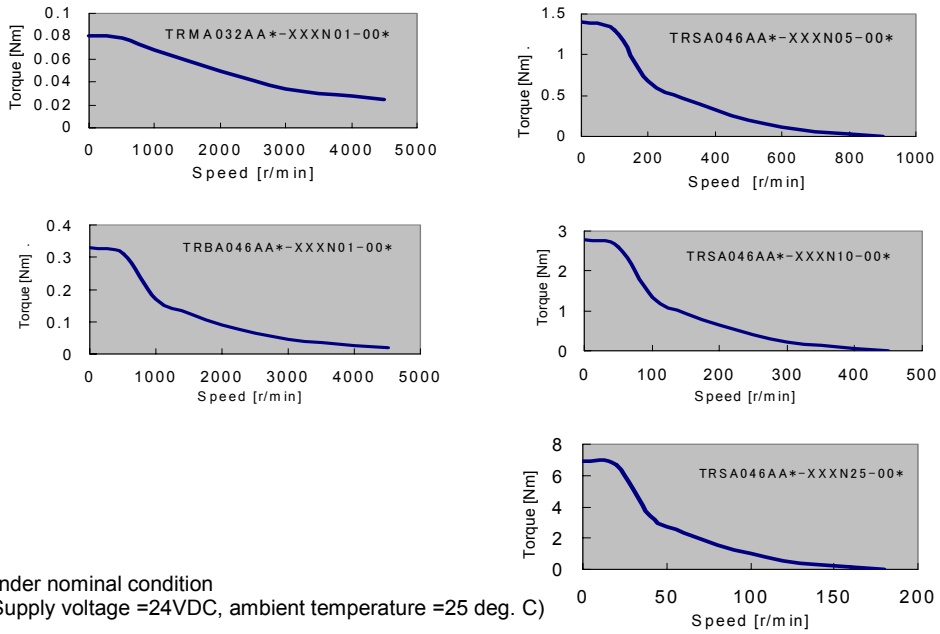
Type	Unit	TRMA032AA*-XXXN01-001	TRBA046AA*-XXXN01-001	TRSA046AA*-XXXN05-001	TRSA046AA*-XXXN10-001	TRSA046AA*-XXXN25-001
Max. Torque	Nm	0.08	0.33	1.4	2.8	6.9
Max. speed	r/min	4500		800	400	160
Gear ratio	-	-	-	5	10	25
Size (W X H X L) *1)	mm	32X46.5X87	46X72X104	50X72X167	50X72X167	50X72X182
Mechanical interface of shaft	-	Dia 5 D-cut	Dia 7 D-cut	Dia. 12 with key way		
Mass	Kg	0.4	0.75	1.5	1.5	1.7
Resolution	P/R	800		4000	8000	20000
Motor rotor moment of inertia	X 10^{-7} Kgm^2	18	83			
Moment of gear inertia at input	X 10^{-7} Kgm^2	-	-	59		55
Initialize executable Torque	Nm	0.04	0.14	0.63	1.26	3.15
Allowable radial force on output shaft *2)	N	50	70	650		
Protection level	-	IP65 *3)		IP64 *3)		
Ambient temperature	Deg C	Operating: 0 ~ +40 , Storage: -20 ~ +60				
Ambient humidity	%	Operating , Storage: 90%RH max. (No dew condensation)				
Electric unit	-	TCAA046AA*	installed, Integrated			
Supply power	-	24VDC +/- 10% , 1.5A				
Control command	-	Event driven control. position, speed, acceleration are controllable.				
Command interface	-	SIO (RS485) + PIO (A: SINK type or B: SOURCE type)				

*1) Frame size (W X H) X Length, without cable and cable clamp

*2) Radial force is loaded at middle point of output shaft

*3) This is body only. The connector are complied as option.

TRS speed vs. torque characteristic



Under nominal condition
(Supply voltage =24VDC, ambient temperature =25 deg. C)

Fig 3.1 Speed vs. Torque characteristic of TR series rotary actuator

3.2 Mechanical data

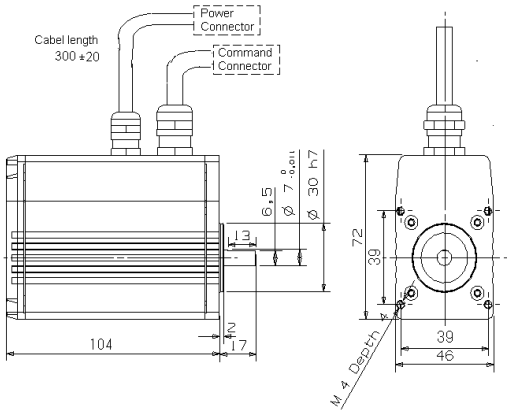
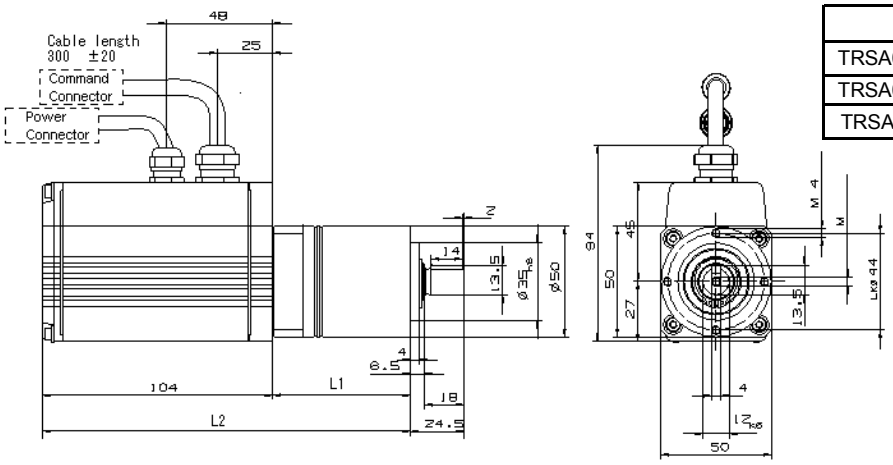


Fig. 3.2 TRBA046, integrated motor with electronics



Type	L1	L2
TRSA046AA*-XXXN05-00*	63	167
TRSA046AA*-XXXN10-00*	63	167
TRSA046AA*-XXXN25-00*	78	182

Fig. 3.3 TRSA046, integration of planetary gear with TRBA046

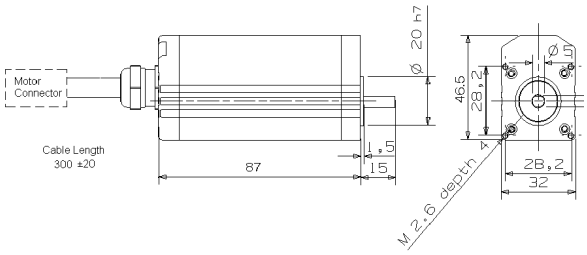


Fig. 3.4 TRMA032, rotary motor to be combined with electric TCAA046

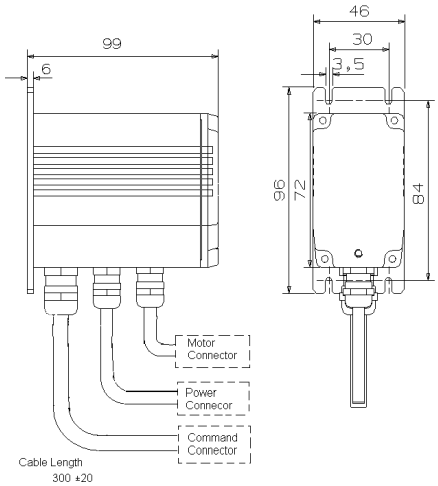
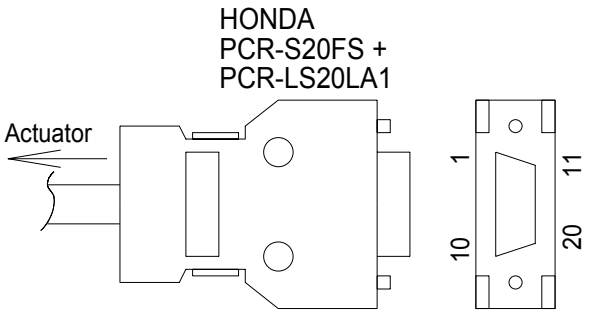


Fig. 3.5 TCAA046 amplifier/controller

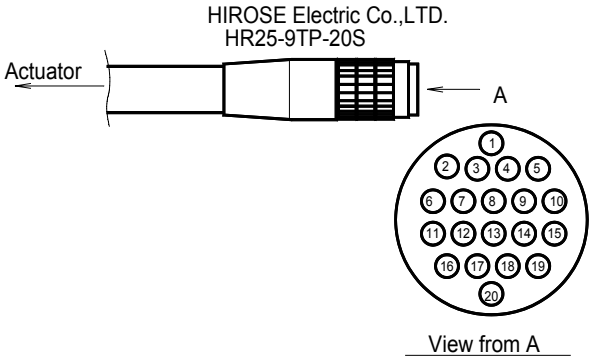
3.3 Connector

3.3.1 Command connector



Pin No.	Signal	Pin No.	Signal
1	+24V	11	OUT1
2	24G	12	OUT2
3	POS	13	OUT3
4	UP	14	OUT4
5	DOWN	15	*ALM
6	ACC	16	FG
7	IN1	17	+5V
8	IN2	18	TXD+
9	IN3	19	GND
10	IN4	20	TXD-

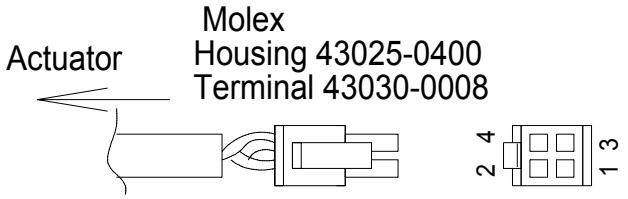
Fig 3.6 Standard type connector on Actuator (Design Number : 002)



Pin No.	Signal	Pin No.	Signal
1	+24V	11	OUT1
2	24G	12	OUT2
3	POS	13	OUT3
4	UP	14	OUT4
5	DOWN	15	*ALM
6	ACC	16	FG
7	IN1	17	+5V
8	IN2	18	TXD+
9	IN3	19	GND
10	IN4	20	TXD-

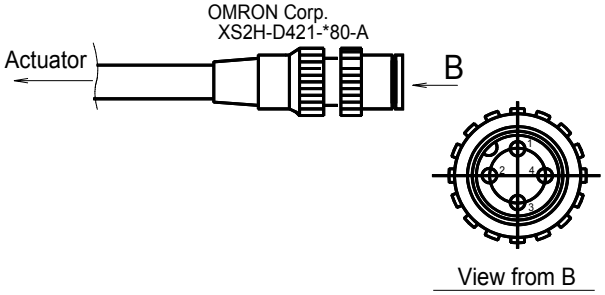
Fig 3.7 Higher protection type connector on Actuator (design Number : 001)

3.3.2 Power connector



Pin No.	Signal
1	Main +24V
2	24G
3	Ctrl. +24V
4	FG

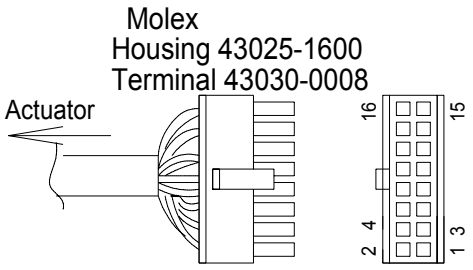
Fig 3.8 Standard type connector on Actuator (Design Number : 002)



Pin No.	Signal
1	Main +24V
2	24G
3	Ctrl. +24V
4	FG

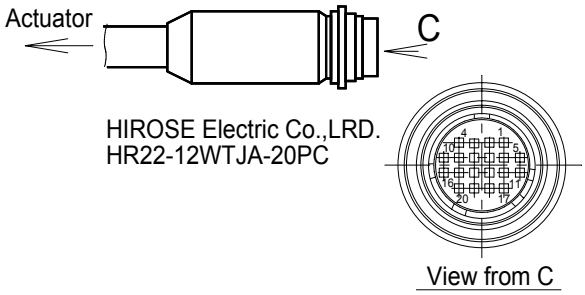
Fig 3.9 Higher protection type connector on Actuator (design Number : 001)

3.3.3 Motor & encoder connector



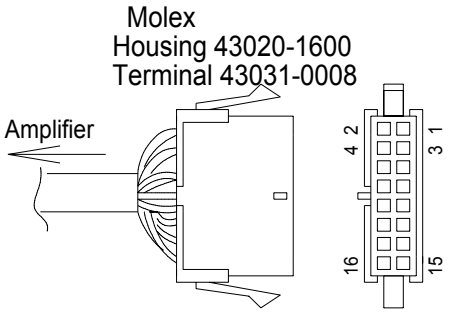
Pin No	Signal		Pin No	Signal	
1	A	Motor power	9	ENB	Encoder signal
2	*A		10	*ENB	
3	B		11	ENC	
4	*B		12	*ENC	
5	(for Brake option)		13	+5V	power
6			14	GND	
7	ENA	Encoder signal	15		
8	*ENA		16		

Fig 3.10 Standard type connector on Actuator (Design Number : 002)



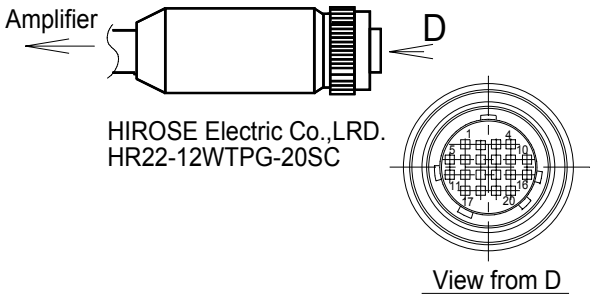
Pin No	Signal		Pin No.	Signal	
1	A	Motor power	11	ENC	Encoder signal
2	*A		12	*ENC	
3	B		13	+5V	power
4	*B		14	GND	
5	(for Brake option)		15		
6			16		
7	ENA	Encoder signal	17		
8	*ENA		18		
9	ENB		19		
10	*ENB		20		

Fig 3.11 Higher protection type connector on Actuator (design Number : 001)



Pin No	Signal		Pin No	Signal	
1	A	Motor power	9	ENB	Encoder signal
2	*A		10	*ENB	
3	B		11	ENC	
4	*B		12	*ENC	
5	(for Brake option)		13	+5V	power
6			14	GND	
7	ENA	Encoder signal	15		
8	*ENA		16		

Fig 3.12 Standard type connector on Amplifier (Design Number : 002)



Pin No	Signal		Pin No.	Signal	
1	A	Motor power	11	ENC	Encoder signal
2	*A		12	*ENC	
3	B		13	+5V	power
4	*B		14	GND	
5	(for Brake option)		15		
6			16		
7	ENA	Encoder signal	17		
8	*ENA		18		
9	ENB		19		
10	*ENB		20		

Fig 3.13 Higher protection type connector on Amplifier (design Number : 001)

3.4 Working coordinate system of TR series actuator

For every type of Ternary rotary actuator, The rotational direction for “COUNT UP” of internal pulse counter is defined as CCW direction from seeing output shaft as shown in Fig 3.14.

Fundamental pulse resolution of rotary actuator is 800 pulse/revolution. The movement of actuator is counted absolutely by internal counter at amplifier, and position is kept during logic power for amplifier is alive.

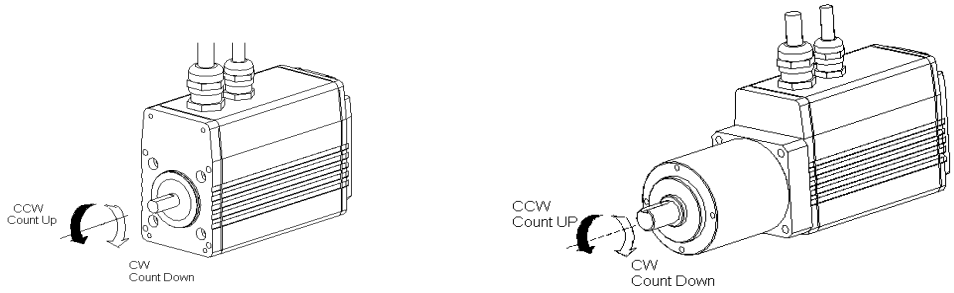


Fig. 3.14 Definition of drive direction

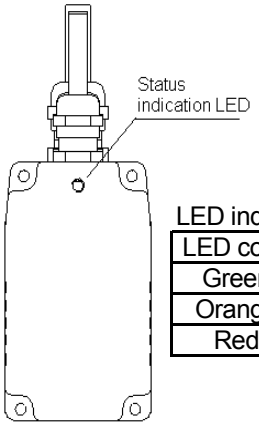
3.5 Initialize executable torque

When power is fed to Ternary actuator, Servo system execute initialize action for motor commutation. If large external torque due to gravity or friction is loaded on output shaft of Ternary rotary actuator at initialize action. Servo system may fail initialize and fall into alarm condition.

The “initialize executable torque” mentioned in rotary actuator specification (table 3.1) is showing allowable load torque to execute initialization normally for each type of actuator. Please obey these limitation at initialize action. After initialize is completed normally, actuator can carry full load in operation.

3.6 Status indicator

Ternary actuator indicates its internal status by lighting LED indicator located at backside of electric housing (See Fig 3.15) . Green and red color at LED shows normal condition and alarm condition respectively. In case of LED is lighting orange color, It shows actuator is in over heating condition caused by heavy loading. In such case, please decrease load or working duty .



LED indication

LED color	status
Green	Normal condition
Orange	Warning condition
Red	Alarm condition

Fig 3.15 Status indication LED

4. TL INTELLIGENT LINEAR SERVO ACTUATOR

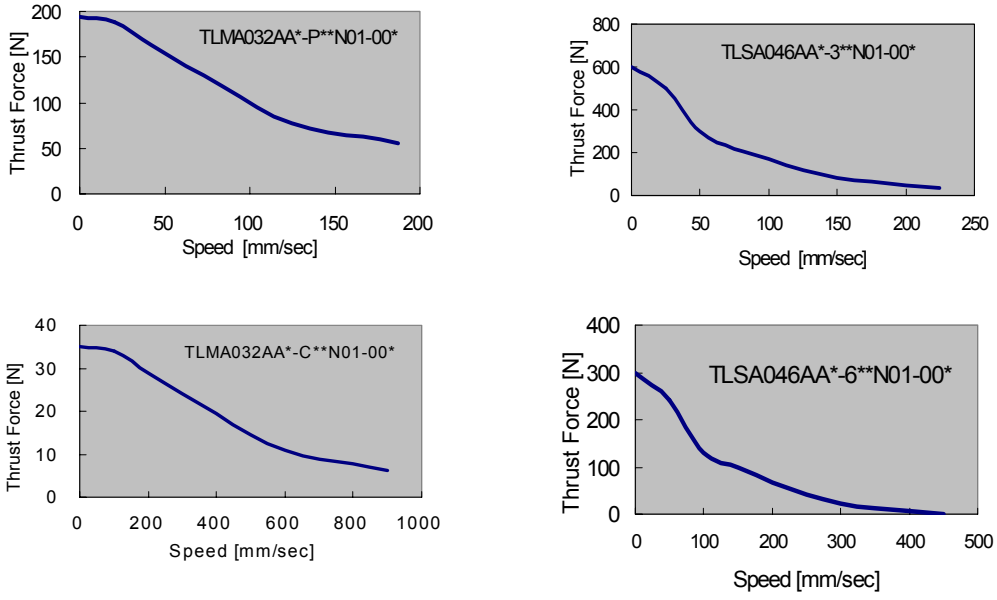
4.1 Specification and individual character

Table. 4.1 TL series actuator specification

type	Unit	TLMA032AA* - C**N01-00*	TLMA032AA* - P**N01-00*	TLSA046AA* - 6**N01-001*	TLSA046AA* - 3**N01-00*
Stroke	mm	50,75, (25,100)		50,75, (25,100,150)	
Max. Thrust force	N	35	190	300	600
Max. travel speed	mm / sec	900	185	450	225
Size	mm	Refer the dimension sheet			
Mass	Kg				
Mechanical interface of Rod	-	Dia.16, M14x1.5		Dia.20 , M16x1.5	
Drive mechanism	-	Ball screw and Nut			
Ball screw set	mm / rev	12	2.5	6	3
Resolution (lead / 800)	mm / pulse	0.015	0.003125	0.0075	0.00375
Allowable thrust force to execute initialize	N	13	70	105	210
Repeatability	mm	± 0.018	±0.004	± 0.009	± 0.0045
Lost motion	mm	0.02	0.05		
Protection level	-	IP65 *1)			
Ambient temperature	deg. C	Operating: 0 -- +40 , Strage: -20 -- +60			
Ambient humidity	%	Operation , Storage: 90%RH max. (No dew condensation)			
Electric unit	-	TCAA046AA*		installed, integrated	
Supply power	-	24VDC +/ - 10% , 1.5A			
Control command	-	Event driven control. position, speed, acceleration are controllable.			
Command interface	-	SIO (RS485) + PIO (A: SINK type or B: SOURCE type)			

*1) This is actuator body only. For the connector, higher protection type is available as option.

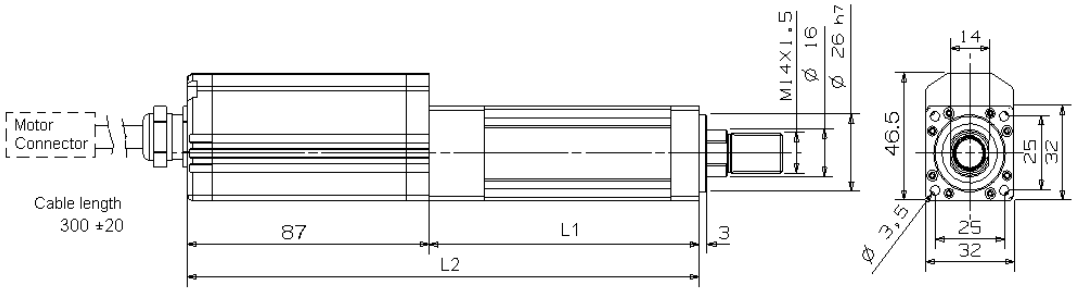
Speed vs. thrust characteristic



Under nominal condition
(Supply voltage =24VDC, ambient temperature =25 deg. C)

Fig.4.1 TLSA speed to thrust characteristic

4.2 Mechanical data



Type	Stroke [mm]	L1 [mm]	L2 [mm]	Mass [kg]
TLMA032AA*-P02N01-001	25	102	189	0.7
TLMA032AA*-P05N01-001	50	127	214	0.76
TLMA032AA*-P07N01-001	75	152	239	0.82
TLMA032AA*-P10N01-001	100	177	264	0.88
TLMA032AA*-C02N01-001	25	106	193	0.7
TLMA032AA*-C05N01-001	50	131	218	0.76
TLMA032AA*-C07N01-001	75	156	243	0.82
TLMA032AA*-C10N01-001	100	181	268	0.88

Fig. 4.2 TLMA 032, linear motor to be combined with electric TCAA046

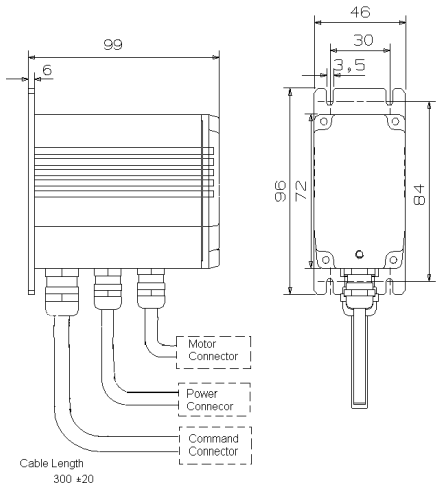
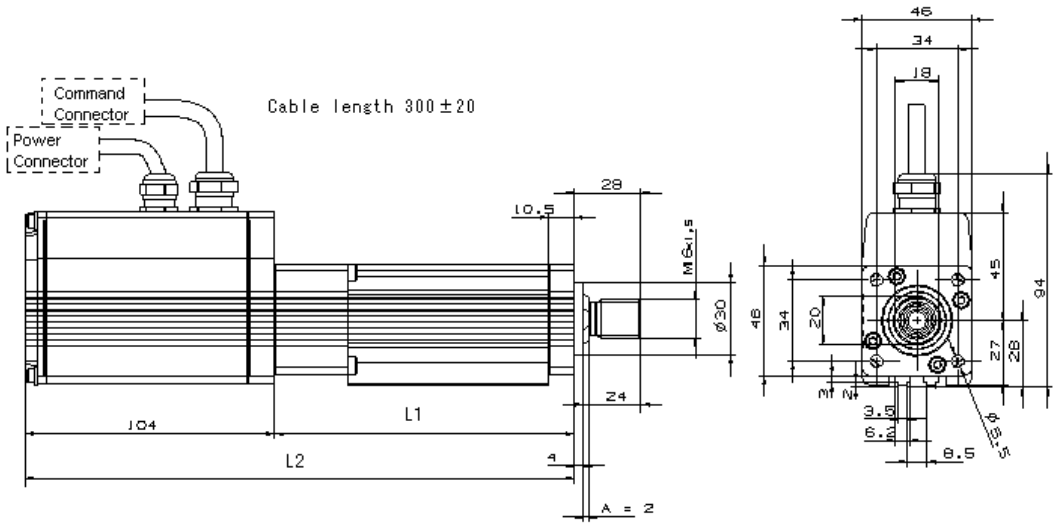


Fig 4.3 TCAA046 amplifier / controller



Type	Stroke [mm]	L1 [mm]	L2 [mm]	Mass [kg]
TLSA046AA*-302N01-001	25	117.5	221.5	1.37
TLSA046AA*-305N01-001	50	142.5	246.5	1.5
TLSA046AA*-307N01-001	75	167.5	271.5	1.63
TLSA046AA*-310N01-001	100	192.5	296.5	1.75
TLSA046AA*-315N01-001	150	242.5	346.5	2
TLSA046AA*-602N01-001	25	125.5	229.5	1.37
TLSA046AA*-605N01-001	50	150.5	254.5	1.5
TLSA046AA*-607N01-001	75	175.5	279.5	1.63
TLSA046AA*-610N01-001	100	200.5	304.5	1.75
TLSA046AA*-615N01-001	150	250.5	354.5	2

Fig. 4.4 TLSA 046, integrated linear with electronics

! WARNING *Do not operate in an environment with explosive or flammable gasses, or near flammable materials. Otherwise it may lead to fire or personal injury.

*Do not remove, install, connect, or inspect while power is ON. Otherwise it may result in personal injury.

*Installation, connection, inspection or maintenance should be done by an expert. Otherwise it may lead to personal injury, electric shock, or fire.

! CAUTION *Make sure to fix the actuator securely. Otherwise it may lead to injury or damage to the product.

!CAUTION *Do not give higher load to the output rod of actuator than its max. permissible value when installation or during operation. Exceeding load may cause damage to the actuator earlier or loss of performance.

4.3 Connector

See chapter 3.3. Connectors employed in TL series actuator are common with TR series.

4.4 Working coordinate system of TL series linear actuator

In the TL series linear actuator system, positioning data is managed by absolute coordinate system as shown in Fig 4.5. The zero position of absolute counter is defined at 1/4 distance of ball screw lead from physical bottom end of output rod pulling. The position of output rod within effective stroke is counted from zero point and controlled. The band areas with 1/4 length of lead pitch of ball screw at both side of effective stroke are stroke margin area to avoid collision to physical bottom end. Both end of effective stroke is protected by software limitation.

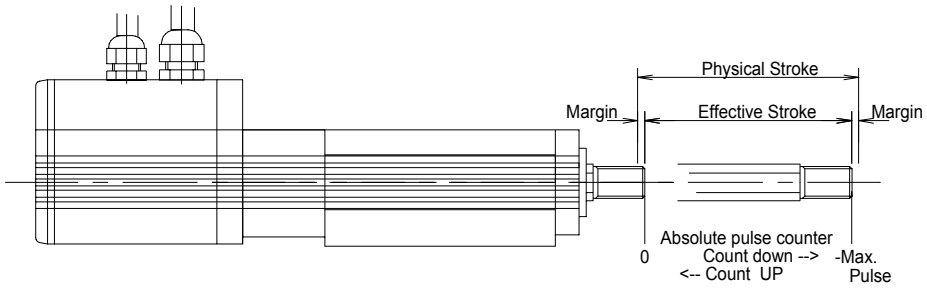


Fig 4.5 Coordinate system of TERNARY linear actuator

For every type of Ternary linear actuator, The direction for “COUNT UP” of internal pulse counter is defined as “Backward” (or pull) direction as shown in Fig 4.5. The movement of actuator is counted absolutely by internal counter at amplifier, and position is kept during logic power for amplifier is alive.

The relationship between output rod position and motor drive pulse (absolute counter data) is as follows.

Rod position = -1 * (Lead pitch of ball screw) * (counted pulse) / 800

where

Rod position is measured from absolute zero point in mm.

Equivalent lead pitch of ball screw is in mm, see linear actuator specification table 4.1

4.5 Allowable thrust force to execute initialize

When power is fed to Ternary actuator, Servo system execute initialize action for motor commutation. If large external force due to gravity or friction is loaded on output rod of Ternary linear actuator at initialize action. Servo system may fail initialize and fall into alarm condition.

The “Allowable thrust force to execute initialize” mentioned in linear actuator specification (table 4.1) is showing allowable load force to execute initialization normally for each type of actuator. Please obey these limitation at initialize action. After initialize is completed normally, actuator can carry full load in operation.

4.6 Allowable radial force on output rod

Fig 4.6 shows the allowable radial force at tip (interfacing thread) of output rod for each TL series linear actuator. The horizontal axis means the position of output rod, vertical axis shows the allowable radial force at each rod position. This allowable radial force is based on wearing of internal linear motion support.

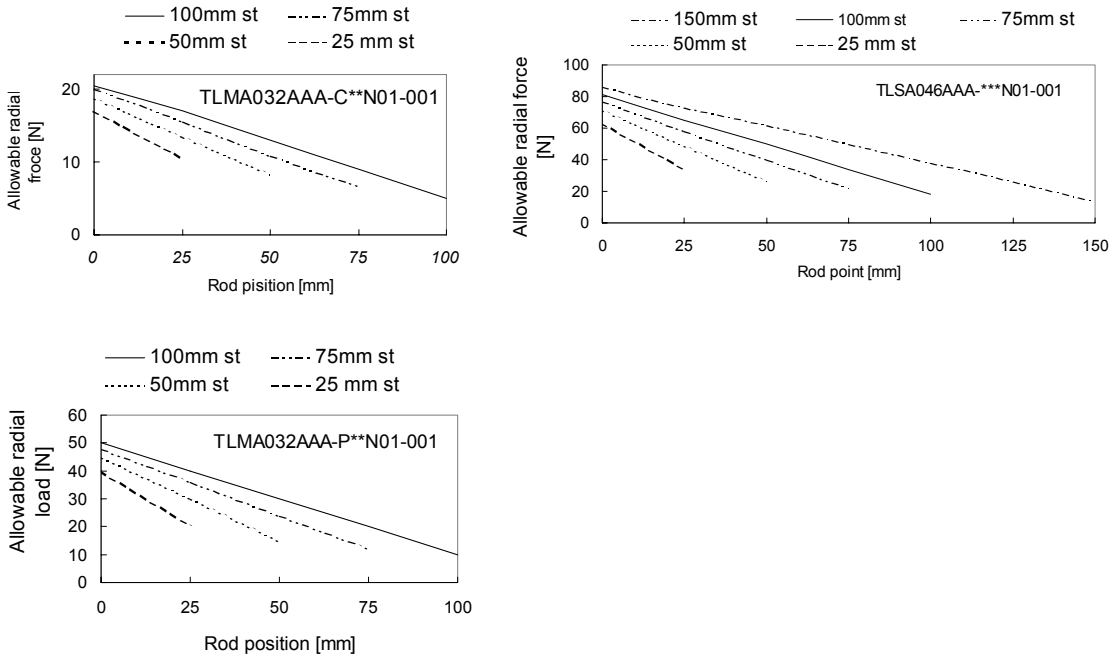


Fig. 4.6 Allowable radial force on output rod

Note Due to influence of external load or friction force of driven mechanism, Output thrust force and travel speed sometime are limited below specification.

4.7 Status indicator

For internal status indication for TL series actuator, Please refer chapter 3.7.

5. CONNECTION HARDWARE

5.1 Bus converter and I/O terminal

5.1.1 Serial BUS converter (TBG001-001)

For conventional PC connection, BUS-converter from RS232C to RS485 is prepared.

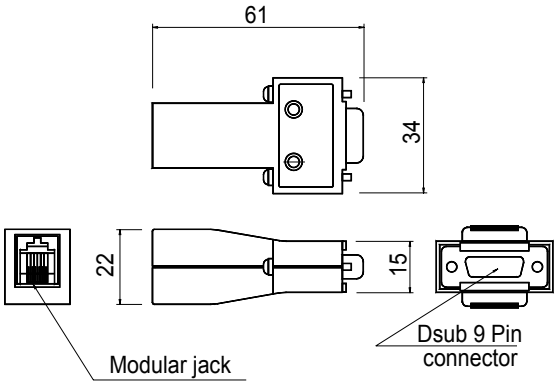


Fig. 5.1 Dimension of TBG001-001 converter

Using this serial BUS converter, host controller like PC or PLC with SIO module equipping conventional RS-232C can establish serial communication between Ternary actuators.

This converter can apply up to 16 axes Ternary actuators control on one RS232C port.

Logic power for this converter is required to be fed from only one of Ternary actuator (not from host controller). For details please refer chapter 5.1.3.

Fig 5.2 shows schematic internal circuit of TBG001-001.

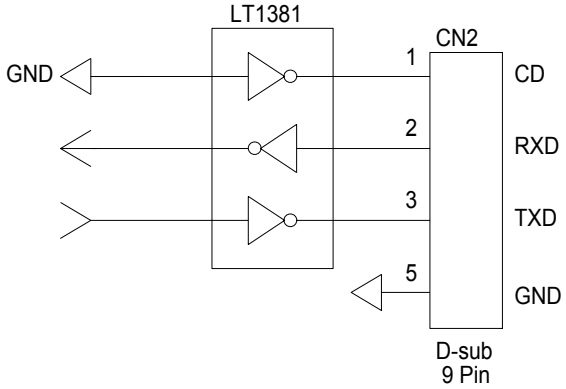
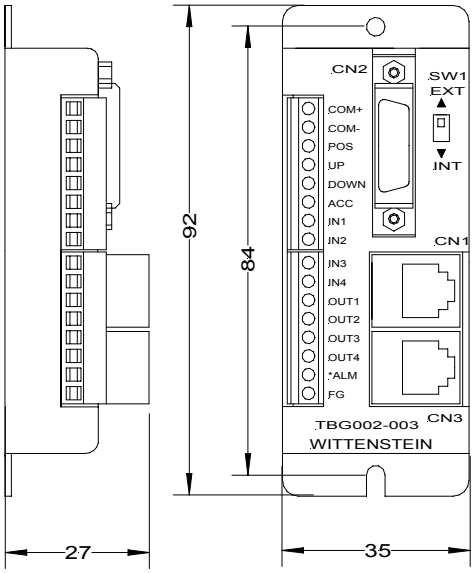


Fig 5.2 TBG001-001 internal connection

5.1.2 SIO / PIO terminal (TBG002-003)

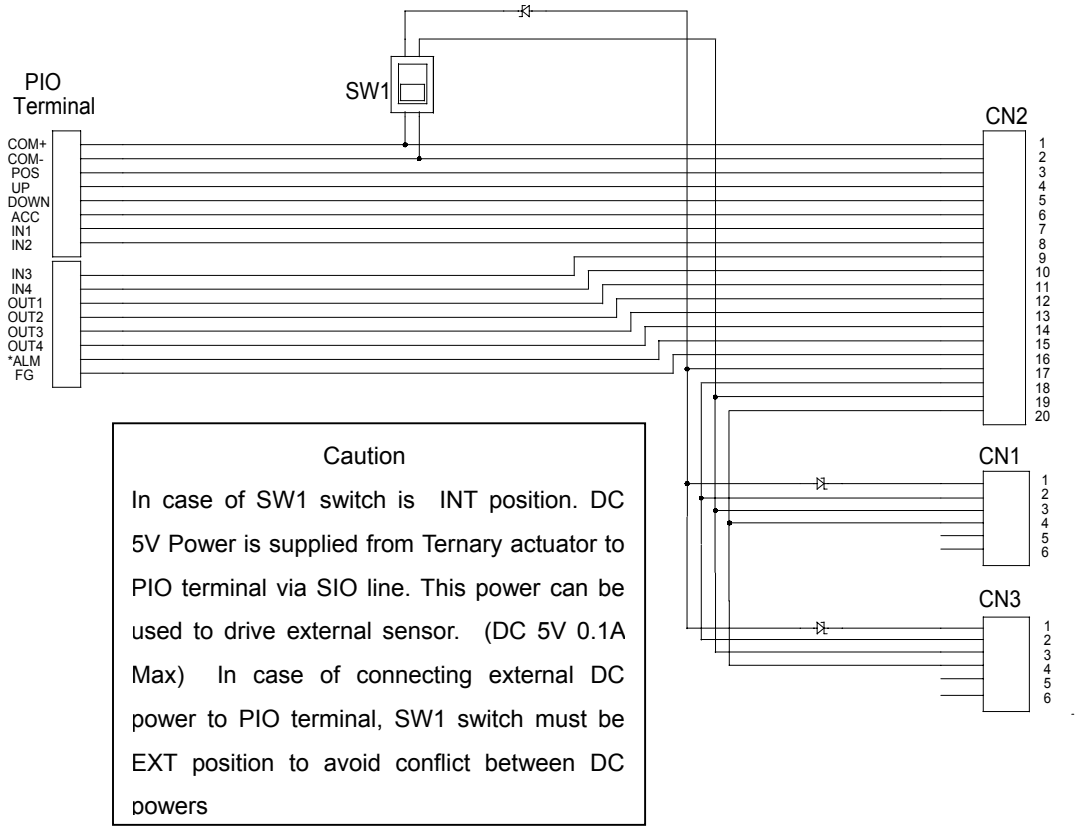
For in cabin use, TBG002-003 SIO/PIO terminal are prepared. Equipping with PIO terminals, This terminal can be use for connection with conventional PLC and external control signals.



Item		IN/OUT	Function
CN1		Any	Daisy chaining connection for SIO command line
CN3			
CN2		Output	Connect to Ternary actuator or AMP
SW1			DC power supply control *1)
PIO terminal	COM+	Output	DC power supply for external device, when SW1 are ON
	COM-		
	POS	Input	Position teaching mode select
	UP		Jog switch for position/Acceleration teaching control
	DOWN		
	ACC		Acceleration rate teaching mode select
	IN1		Position number assignment signal
	IN2		
	IN3		
	IN4		
	OUT1	Output	Position indicator
	OUT2		
	OUT3		
	OUT4		
	*ALM		Alarm signal output
	FG	Input	Frame ground

Note *1) See Caution in Fig 5.4

Fig. 5.3 TBG002-003 Terminal



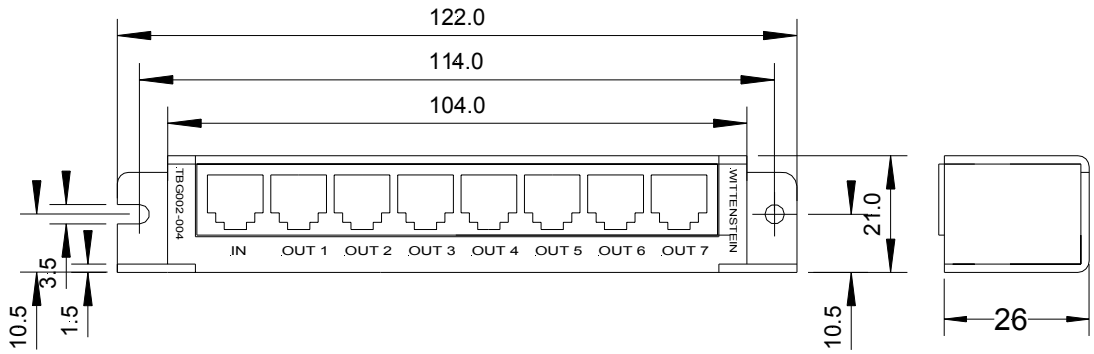
Caution

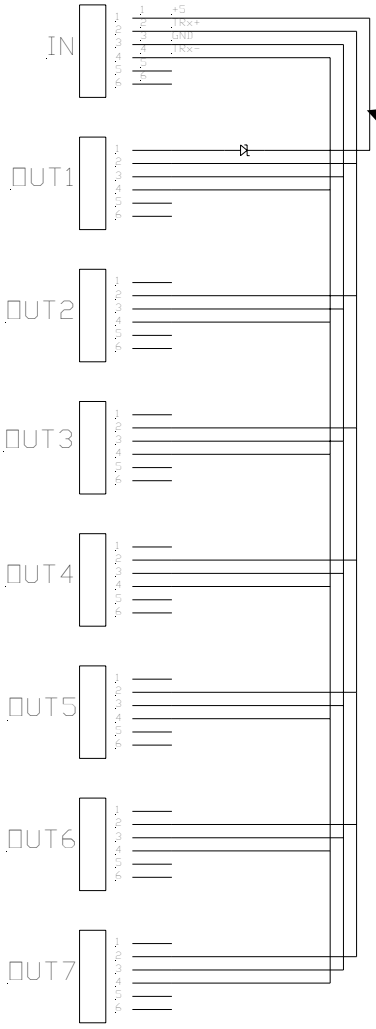
In case of SW1 switch is INT position. DC 5V Power is supplied from Ternary actuator to PIO terminal via SIO line. This power can be used to drive external sensor. (DC 5V 0.1A Max) In case of connecting external DC power to PIO terminal, SW1 switch must be EXT position to avoid conflict between DC powers

Fig 5.4 Internal connection of TBG002-003

5.1.3 SIO terminal (TBG002-004)

To connect up to 16 actuators under serial BUS chain, chaining terminal TBG002-004 is prepared for easy connection using modular cable.





DC 5V power is supplied from Actuator which connected to OUT1 connector

Connector	IN/OUT	Function
IN	IN	Uplink to controller
OUT1	OUT	OUT1 must be occupied to supply DC power to TGB001-001.
OUT2	OUT	Connect to Ternary actuator/AMP or next TBG002-004 terminal.
OUT3		
OUT4		
OUT5		
OUT6		
OUT7		

Fig. 5.5 TBG002-004

5.2 Easy entry tools

5.2.1 Entry tool TET001-002

Hardware teaching pendant TET001-002 shown in Fig 5.6 is an easy data entry tool for Ternary series actuators via PIO interface. By connecting command line from Ternary actuator to this teaching pendant, Position and velocity profile (acceleration rate) are available to set for up to 4 points. For the PIO circuit type of Ternary actuator, namely SINK and SOURCE type, TET001-002 can be selected its PIO type by switch located on top surface as shown in Fig 5.6.

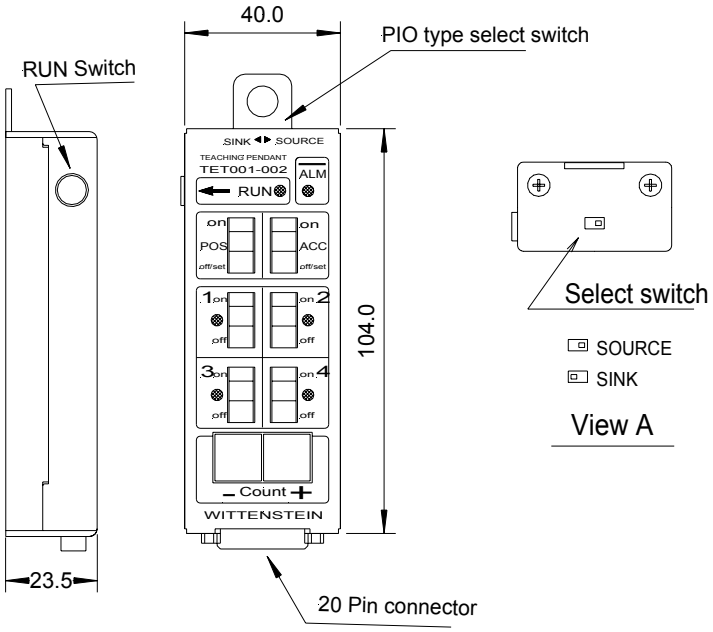


Fig 5.6 Teaching pendant TET001-002

5.2.2 Software tool TET002-001

Software data setting tool TET002-001 is WINDOWS based software tool for data configuration and evaluation of Ternary actuators via SIO interface. This tool can deal up to 16 axes Ternary actuator and 16 point of positioning data. Fig 5.7 shows user interfacing screen.

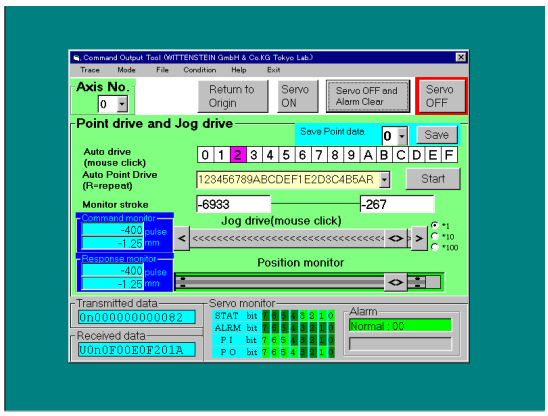
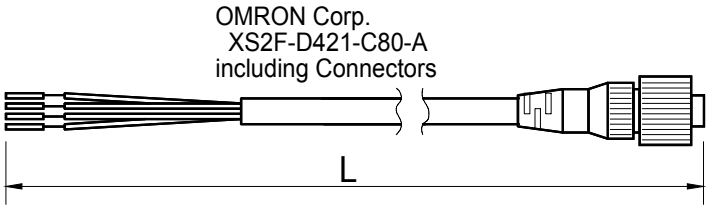


Fig 5.7 User interface screen of TET002-001 software tool

5.3 Cable and connectors

5.3.1 Power cables



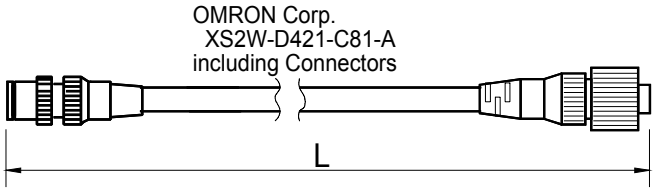
Power line connection

Wire color	Function	Connect to
Brown	Main power	DC24V
White	Common GND	24G
Blue	Control power	DC24V
Black	Flame GND	FG

Power cable

type	Length [m]
TCC001-001-010	1
TCC001-001-020	2
TCC001-001-050	5

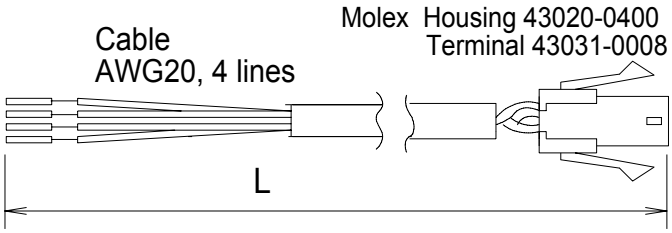
Fig 5.8 TCC001-001-*** : Power cable with high protection type connector



Power cable

type	Length [m]
TCC001-002-010	1
TCC001-002-020	2
TCC001-002-050	5

Fig 5.9 TCC001-002-*** : Extension cable for power line
with high protection type connector

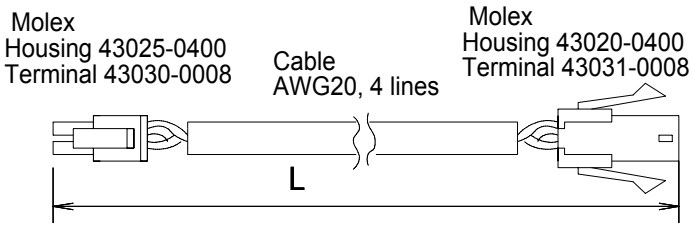


Power cable

type	Length [m]
TCC001-003-010	1
TCC001-003-020	2
TCC001-003-050	5

Note: For the wire color and function, see TCC001-001-***

Fig 5.10 TCC001-003-*** :Power cable with standard type connector

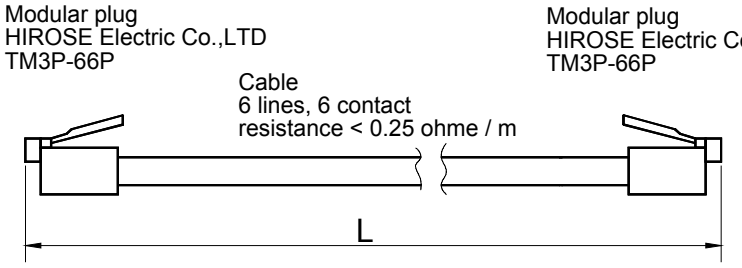


Power cable

type	Length [m]
TCC001-004-010	1
TCC001-004-020	2
TCC001-004-050	5

Fig 5.11 TCC001-004-*** :Extension cable for power line
with standard type connector

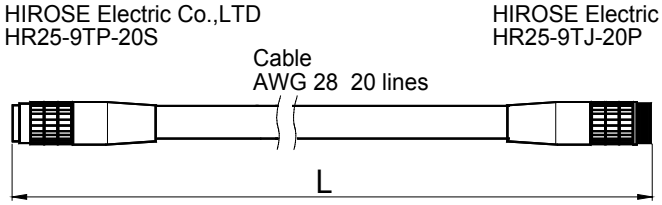
5.3.2 Command cables



Command cable

type	Length [m]
TCC002-001-010	1
TCC002-001-020	2
TCC002-001-050	5

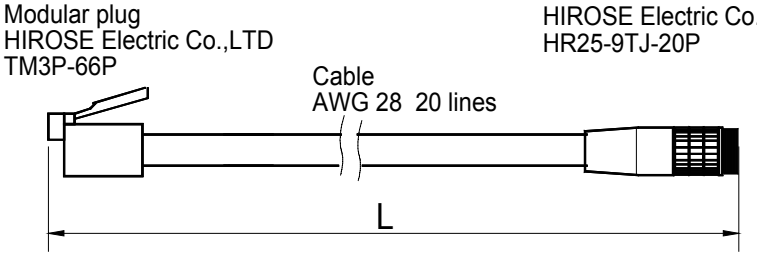
Fig 5.12 TCC002-001-*** :Daisy chaining cable for SIO line



Command cable

type	Length [m]
TCC002-004-010	1
TCC002-004-020	2
TCC002-004-050	5

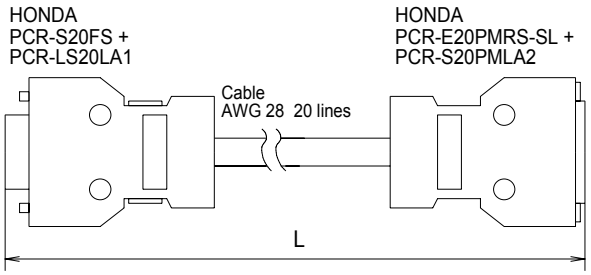
Fig 5.13 TCC002-004-*** : Extension cable with high protection connector



Command cable

type	Length [m]
TCC002-005-010	1
TCC002-005-020	2
TCC002-005-050	5

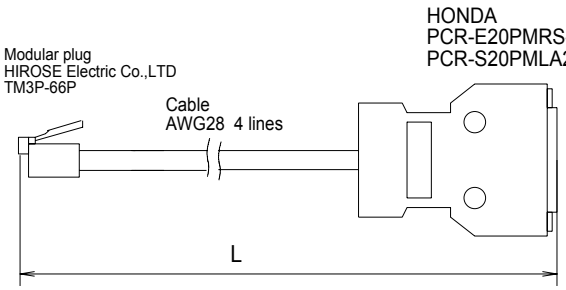
Fig 5.14 TCC002-005-*** : SIO line connection from high protection type cable



Command cable

type	Length [m]
TCC002-006-010	1
TCC002-006-020	2
TCC002-006-050	5

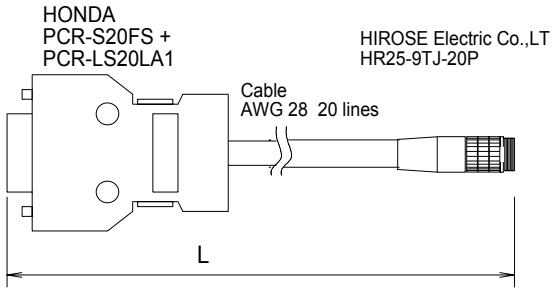
Fig 5.15 TCC002-006-*** : Standard type extension cable for command line



Command cable

type	Length [m]
TCC002-007-010	1
TCC002-007-020	2
TCC002-007-050	5

Fig 5.16 TCC002-007-*** : SIO line connection from standard cable

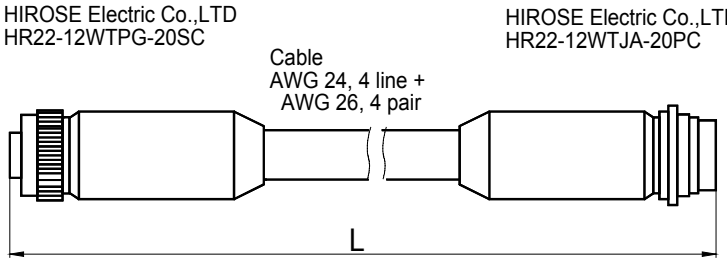


Command cable

type	Length [m]
TCC002-008-010	1
TCC002-008-020	2
TCC002-008-050	5

Fig 5.17 TCC002-008-*** :Connecter conversion between high protection and standard

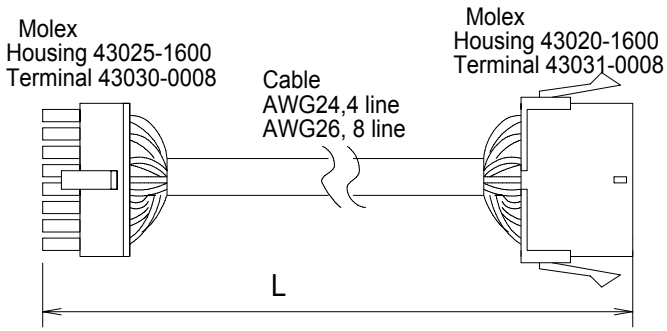
5.3.3 Motor + encoder line cable



Motor & encoder cable

type	Length [m]
TCC003-001-010	1
TCC003-001-020	2
TCC003-001-050	5

Fig 5.18 TCC003-001 : extension cable for motor + encoder line with high protection type connector



Motor & encoder cable

type	Length [m]
TCC003-002-010	1
TCC003-002-020	2
TCC003-002-050	5

Fig 5.19 TCC003-002 : extension cable for motor + encoder line with standard type connector

6. SYSTEM CONFIGURATION GUIDE

6.1 Outline

1) **Ternary** product can store the positioning data (position, velocity, acceleration/deceleration and control parameters) inside of amplifier/controller. This is the **stored mode** (or **indirect drive mode**) up to **16** points data. Another **non-stored mode** is the **direct drive mode** from PC through SIO for **infinite** number of stop locations.
2) The entry of these stored positioning data up to **16** points could be managed by PC, PLC or Ternary TET 001 teaching pendant. In case of TET-001 the available number of point data are limited up to **4**.
3) In stored mode, once the point data are stored in ROM, the motion sequence could also be managed by switches at teaching pendant or PLC through PIO

The electric installation is very easy, basically only two cable connector, power and command, are required to connect.

The command cable contains two kind of command interface to control TERNARY INTELLIGENT SERVO SYSTEM, namely parallel interface (PIO) and serial communication interface (SIO), and selectable according to the type of host controller and usage.

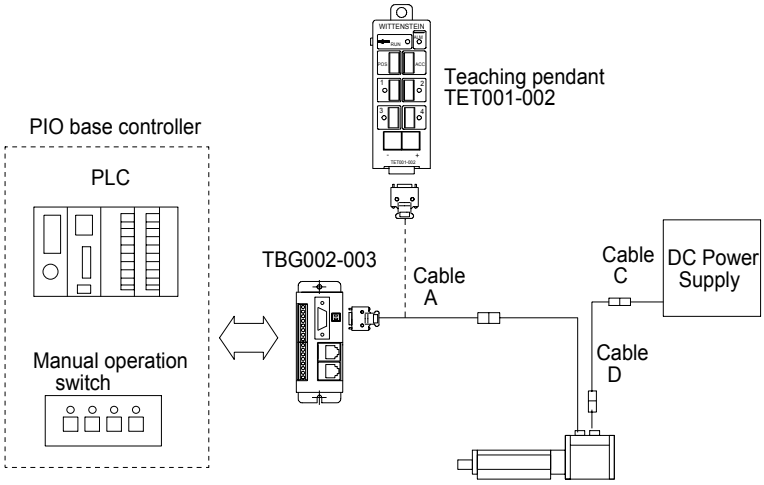
PIO command interface is suitable to connect with conventional programmable logic controller (PLC). User can easily control Ternary intelligent rotary / linear servo system in conventional ladder programming environment like doing on pneumatic cylinder. Teaching pendant TET001-002 is available to set target position and travel speed profile up to 4 point sets via. this PIO interface.

SIO communication interface can be connect to RS232C serial port of personal computer using with RS232C <-> RS485 converter TBG001-001. Thanks for it's communication capacity due to high speed communication rate, detailed servo parameter setting and internal state monitoring are available by using PC utility software TET002-001.

For power supply, control and main power are required to connect to DC 24V line with separately. With respect to main power supply line, ON / OFF control device like relay is recommended to install for safety operation.

6.2 System Connection

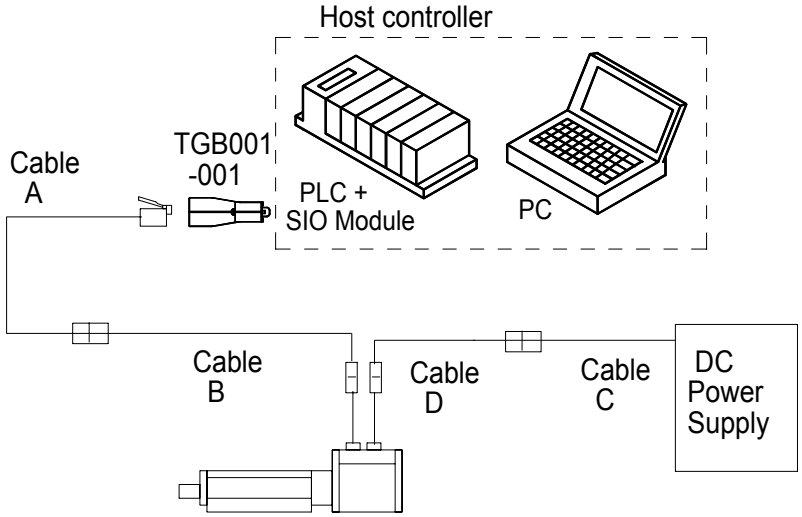
1) Single axis control under PIO interface



Cable No.	Cable type	Standard cable	high protection cable
Cable A	Command cable	TCC002-006-***	TCC002-008-***
Cable C	Power cable	TCC001-003-***	TCC001-001-***
Cable D	Power cable	TCC001-004-***	TCC001-002-***

Fig 6.1 Single axis control via PIO

2) Single axis control under SIO interface



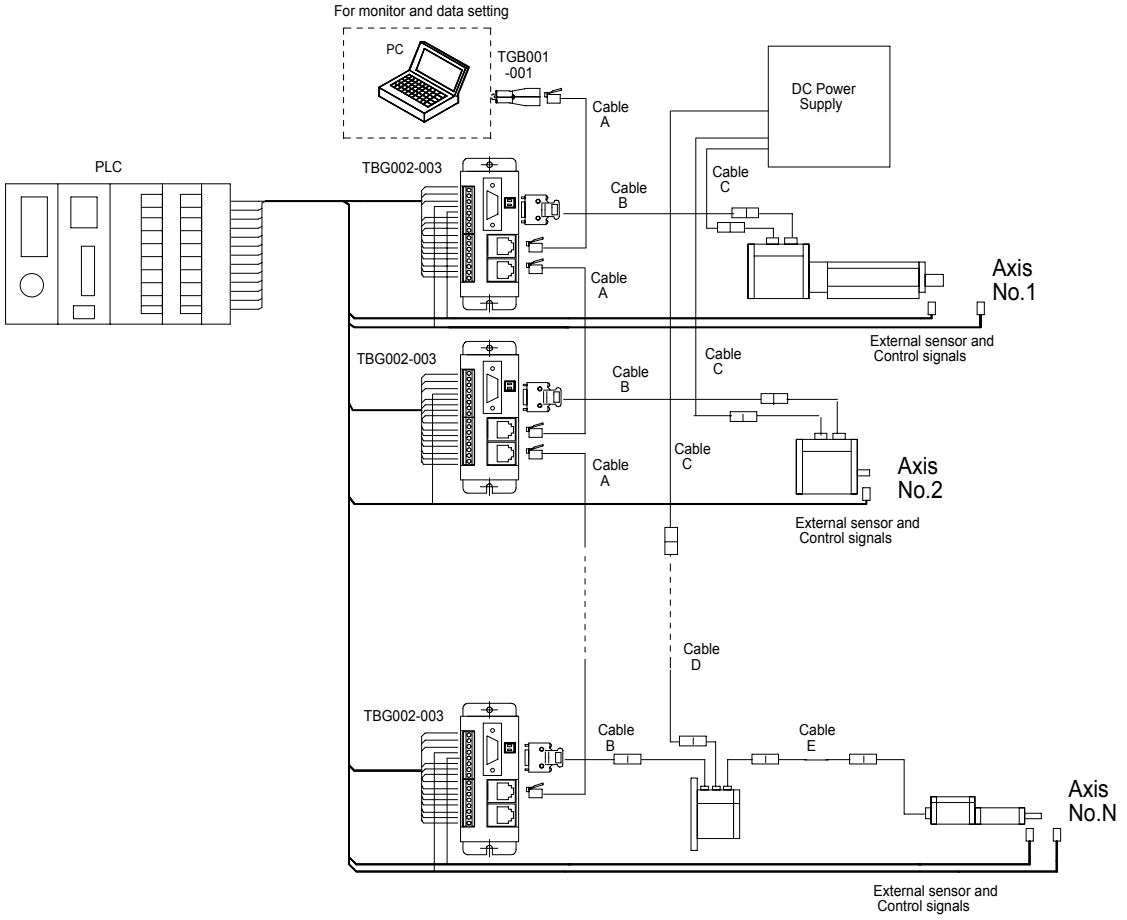
Cable No.	Cable type	Standard cable	high protection cable
Cable A	Command cable	TCC002-007-***	TCC002-005-***
Cable B	Command cable	TCC002-006-***	TCC002-004-***
Cable C	Power cable	TCC001-003-***	TCC001-001-***
Cable D	Power cable	TCC001-004-***	TCC001-002-***

Fig 6.2 Single axis control via SIO

3) Multi axes control under PIO interface

Using SIO / PIO terminal TBG002-003, PIO signals between PLC and Ternary actuator are easily connected. Multiple connection of actuator is also easy.

SIO line (cable A) and PC are for data configuration and monitoring only.

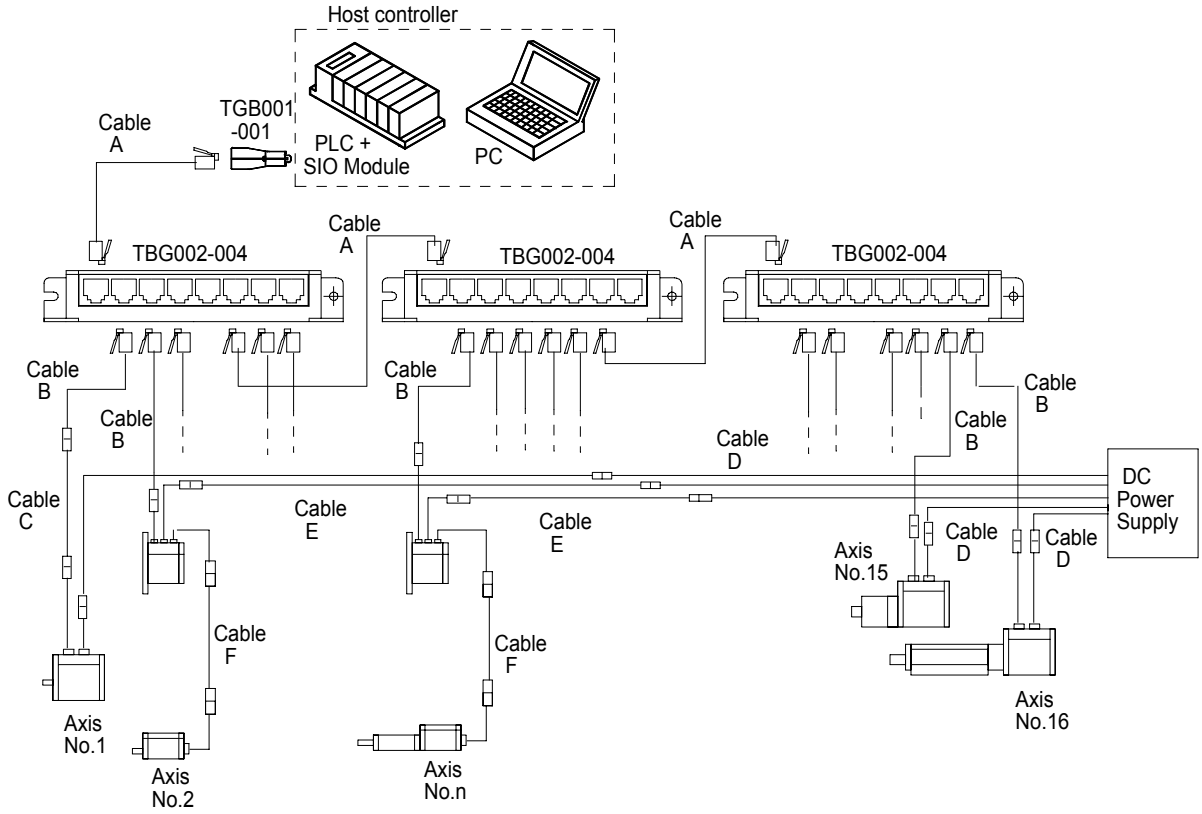


Cable No.	Cable type	Standard cable	high protection cable
Cable A	Command cable	TCC002-001-***	-
Cable B	Command cable	TCC002-006-***	TCC002-008-***
Cable C	Power cable	TCC001-003-***	TCC001-001-***
Cable D	Power cable	TCC001-004-***	TCC001-002-***
Cable E	Motor & encoder cable	TCC003-002-***	TCC003-001-***

Fig 6.3 Multi-axes control via PIO

4) Multi-axes control under PIO interface

Using SIO terminal TBG002-004, up to 16 axes of Ternary actuators are available to control under one SIO line. TBG002-004 terminal can be used cascade connection as shown in Fig 6.4 Logic power for TBG001-001 is supplied from Ternary actuator which connected to OUT1 of first TBG002-004.



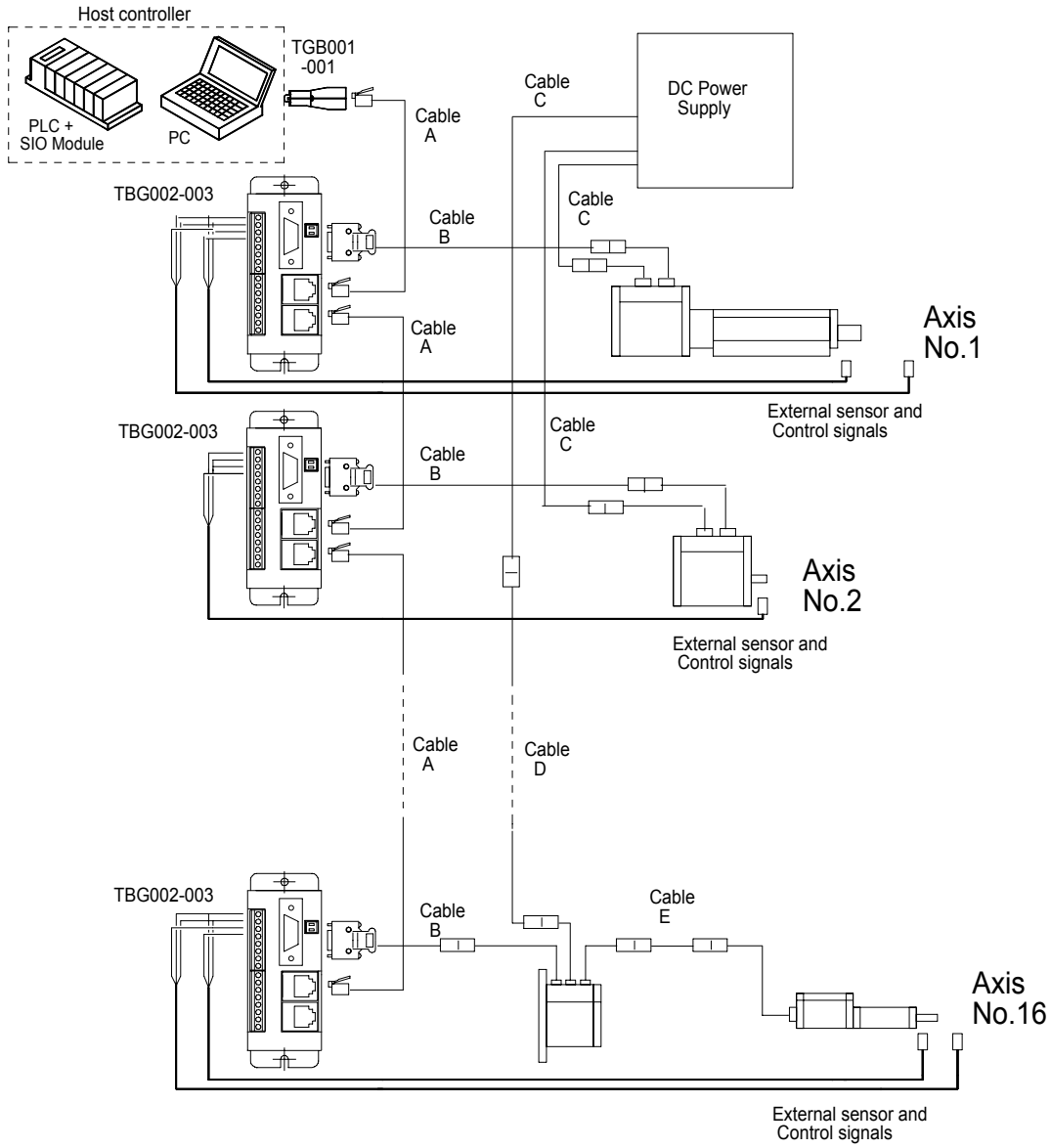
Cable No.	Cable type	Standard cable	high protection cable
Cable A	Command cable	TCC002-001-***	-
Cable B	Command cable	TCC002-007-***	TCC002-005-***
Cable C	Command cable	TCC002-006-***	TCC002-004-***
Cable D	Power cable	TCC001-003-***	TCC001-001-***
Cable E	Power cable	TCC001-004-***	TCC001-002-***
Cable F	Motor & encoder cable	TCC003-002-***	TCC003-001-***

Fig 6.4 Multi-axes control via SIO

5) Multi-axes control under combined interface (PIO+SIO)

Mixed interface is also available for Ternary actuator control.

Fig 6.5 shows example of such mixed interface. In this example, SIO line is main control line, additionally external sensor signal or control signal on PIO line (stroke limit signal, origin point signal, interlock or emergency stop signal, and etc) are applicable into Ternary control.



Cable No.	Cable type	Standard cable	high protection cable
Cable A	Command cable	TCC002-001-***	-
Cable B	Command cable	TCC002-006-***	TCC002-008-***
Cable C	Power cable	TCC001-003-***	TCC001-001-***
Cable D	Power cable	TCC001-004-***	TCC001-002-***
Cable E	Motor & encoder cable	TCC003-002-***	TCC003-001-***

Fig 6.5 Multi-axes control via SIO & PIO

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