1. Purpose: To change user constants with personal computer.

Using a 3CN connector (for digital operator), by connecting Σ series AC servopack SGDA model to a personal computer's serial communication port, the personal computer can be used to display and set user constants and to monitor the status of the servopack.

2. Communication Specifications

(1) Transmission Speed — 9600 B/S

(2) Bit Composition — Start 1 bit
Data 7 bit (JIS 7 bit code)
Stop 1 bit
Even Number Parity1 bit

(3) Synchronizing Method — Asynchronous Method

	Start	B0	B1	B2	B3	B4	B5	B6	P	Stop

(4) XON/XOFF Control — None

(5) Shift Control — None

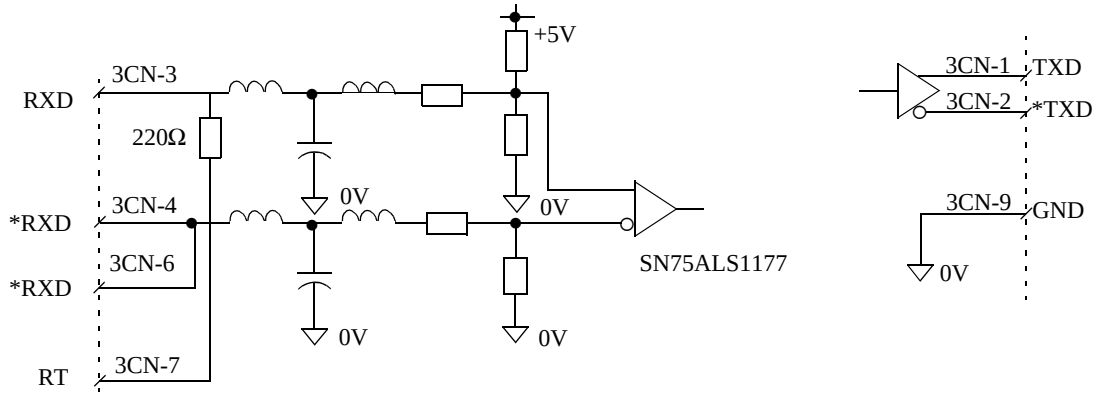
(6) Communication — Half-Duplex Transmission

3. Hardware Specifications

(1) Transmission Distance — Maximum of 30m (total extension of communication line)

(2) Transmission Method — RS422A (non-insulated type)

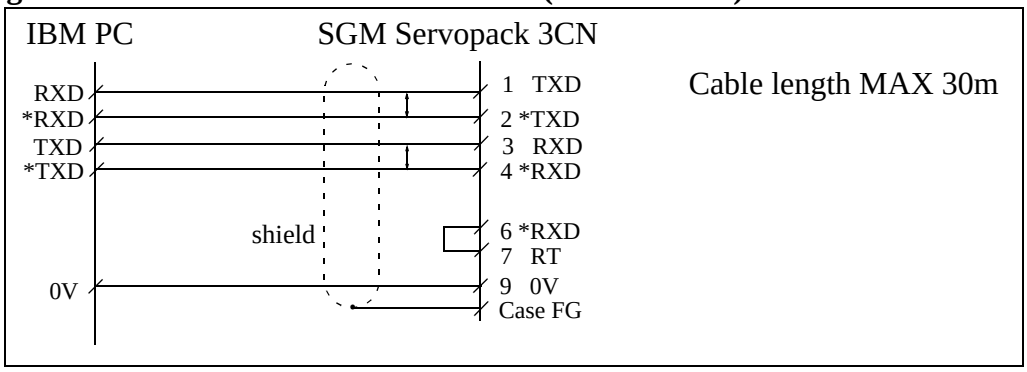
(3) Circuit



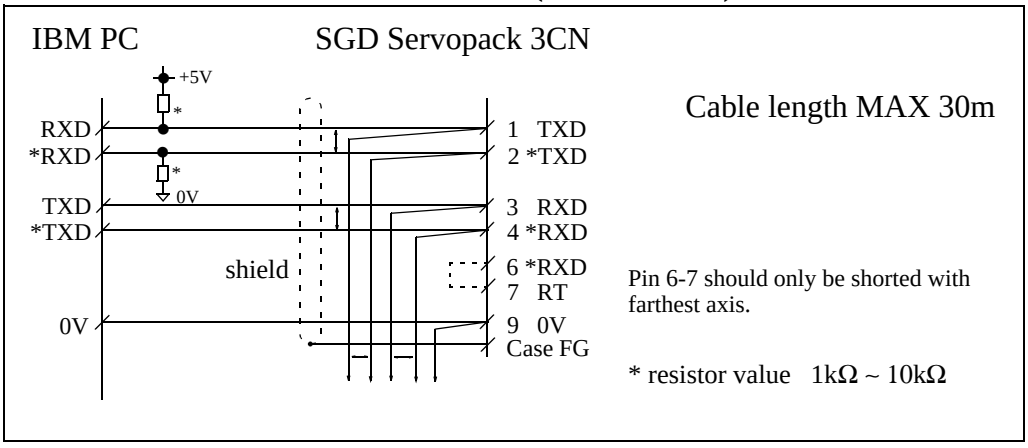
Servopack

4. Connection

- **Single axis** communication mode <IBM PC **(RS422A Port)**>

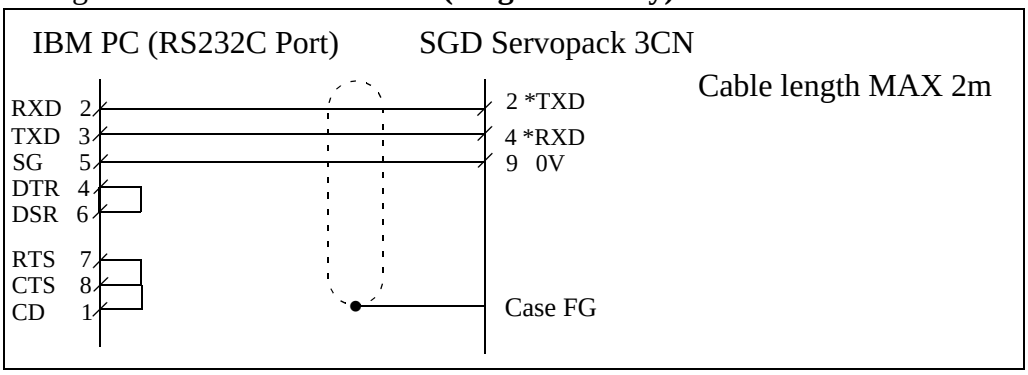


- **Multi axes** communication mode <IBM PC **(RS422A Port)**>



  - The shield should be connected to the frame ground on the Servopack side through the connector case.
  - The arrows indicate twisted pair wires.

- If the cable length is shorter than 2m, it is possible to directly connect it to **RS232C port** according to the connection below. **(Single axis only)**



5. Communication Connector Specification

(1) Servopack 3CN Functions of individual pins.

Pin #	Signal Name	Signal Circuit Name	Signal Direction
1	TXD	Transmitting data (non-inverting side)	P ← S
2	* TXD	Transmitting data (inverting side)	P ← S
3	RXD	Receiving data (non-inverting side)	P → S
4	* RXD	Receiving data (inverting side)	P → S
5	OPH	---	#
6	* RXD	If 6 pin and 7 pin is shorted, 220Ω terminator is connected between RXD and *RXD.	
7	RT		
8	5VPP	---	#
9	GND	Signal ground	---

P = Personal Computer S = Servopack # = Do not wire

(2) Connector
D-SUB 9 pins

Servopack side (male)	17LE-13090-27 (D2BC) Mfg. by DDK or equivalent
Cable side (female)	17JE-23090-02 (D8B) Mfg. by DDK or equivalent

6. Communication Method

Use 14 letter JIS code with the letter "W" at the beginning, followed by 12 numbers and [CR]. ([CR] is a carriage return code for Japanese Industrial Standard (JIS).)

(1) Command (PC → Servopack)

Data read command	Wn0aaaa0000ss [CR]
Data setting command	Wn1aaaaddddss [CR]
Multiple read command	Wn2aaaabbbbss [CR]

(2) Answer (Servopack → PC)

Wneaaaaddddss [CR]

Wn2aaaabbbbssdddd · · · · dddd [CR]

(3) Address (aaaa / 4 digit hexadecimal in JIS-code)

Refer to section 8. for Address, User Constants Application Table.

(4) Data (dddd / 4 digit hexadecimal in JIS-code)

The contents of user constants and display conditions are shown in hexadecimal.

(5) No. of Bytes (bbbb / 4 digit hexadecimal in JIS-code)

The number of bytes to read in hexadecimal.

(6) Check Sum (ss / 2 digit hexadecimal in JIS-code)

When commands or answers is:

$$Wn_1c_1a_1a_2a_3a_4d_1d_2d_3d_4s_1s_2 \text{ [CR]}$$

it adds in hexadecimal and the lower 2 bytes of:

$n_1c_1+a_1a_2+a_3a_4+d_1d_2+d_3d_4+S_1S_2$ becomes 00H.

(7) Condition of Answer (e / 1 digit hexadecimal in JIS-code)

command	e / 1 digit hexadecimal	condition
Read command	0	normal
	8	address abnormal
	4	data abnormal
Setting command	1	normal
	9	address abnormal
	5	data abnormal
Multiple command	2	normal
	A	address abnormal
	6	data abnormal

(8) Axis Address (n / 1 digit hexadecimal in JIS-code)

When Cn-29 (axis address) equals 0:

It is in single-axis communication mode and transmission is always enabled. Sends command setting n=0.

When Cn-29 (axis address) is not equal to 0:

It is in multiple-axes communication mode. Transmission is only enabled when transmitting an answer. Executes command and sends back answer only when Cn-29 setting corresponds to command's axis address.

7. Example

① Reading Cn-04. Cn-04 = 80 (0050H)
Command W0001080000F7 [CR]
Answer W0001080050A7 [CR]

② Setting Cn-11=1024 (0400H)
Command W0101220400D8 [CR]
Answer W0101220400D8 [CR]

③ When reading erroneous address 1122H
Command W0011220000CD [CR]
Answer W0811220000C5 [CR]

④ When set to erroneous address 1122H
Command W0111220400C8 [CR]
Answer W0911220400C0 [CR]

⑤ When date was erroneously set with reading command
Command W0001080001F6 [CR]
Answer W0401080001F2 [CR]

⑥ When Cn-04 was erroneously set to 10000 (2710H) when setting command (data is over maximum setting value of 2000H.)
Command W0101082710BF [CR]
Answer W0501082710BB [CR]

8. (1) Address, User Constants Application Table

	Address	User Constant	Abbreviation	Name
	0102	Cn-01	---	memory switch 1
	0104	Cn-02	---	memory switch 2
(S)	0106	Cn-03	VREFGN	speed command adjustment gain
	0108	Cn-04	LOOPHZ	speed loop gain
	010A	Cn-05	PITIME	speed loop integration time
	010C	Cn-06	EMGTRQ	emergency stop torque
	010E	Cn-07	SFSACC	soft start accelerating time
	0110	Cn-08	TLMTF	forward running torque limit
	0112	Cn-09	TLMTR	reverse running torque limit
	0114	Cn-0A	PGRAT	PG dividing ratio
	0116	Cn-0B	TGONLV	zero speed level
	0118	Cn-0C	TRQMSW	mode switch torque command
	011A	Cn-0D	REFMSW	mode switch speed command
	011C	Cn-0E	ACCMSW	mode switch acceleration speed
(S)	011E	Cn-0F	ZCLVL	zero clamp level
(P)			ERPMSW	mode switch positioning deviation
	0120	Cn-10	JOGSPD	JOG speed
	0122	Cn-11	PULSNO	quantity of pulses
	0124	Cn-12	BRKTIM	braking time
(S)	0126	Cn-13	TCRFGN	torque command gain
(S)	0128	Cn-14	TCRLMT	speed limit (torque control I)
	012A	Cn-15	BRKSPD	braking rpm
	012C	Cn-16	BRKWAI	braking time
	012E	Cn-17	TRQFIL	torque command filter
	0130	Cn-18	CLMIF	outside current limit on forward running side
	0132	Cn-19	CLMIR	outside current limit on reverse running side
	0134	Cn-1A	POSGN	positioning loop gain
(P)	0136	Cn-1B	COINLV	positioning completion range
(P)	0138	Cn-1C	BIASLV	bias
(P)	013A	Cn-1D	FFGN	feed forward
(P)	013C	Cn-1E	OVERLV	overflow
	013E	Cn-1F	SPEED1	speed #1
	0140	Cn-20	SPEED2	speed #2
	0142	Cn-21	SPEED3	speed #3
(S)	0144	Cn-22	VCMPLV	speed consistency signal output range
	0146	Cn-23	SFSDEC	soft start deceleration time
(P)	0148	Cn-24	RATB	electronic gear ratio (numerator)
(P)	014A	Cn-25	RATA	electronic gear ratio (denominator)
(P)	014C	Cn-26	ACCTME	command filter
(P)	014E	Cn-27	FFFILT	feed forward filter
	0150	Cn-28	DTIME	speed loop derivative time constant
	0152	Cn-29	AXISNO	axis address

- Refer to the Technical Manual for further details on user constants.
- The data for Cn-01, 02 should convert from bit data to 4 digit hexadecimal.
  ie:) When bit # 2, 3, and 8 are only set to 1 and all others are set to 0, it becomes 010C.
- (S) speed control (P) positioning control

(2) Address, Monitor No. Application Table (Read only)

	Address	Monitor No.	Type of Monitor
	0802	Status	bit data run / forward, reverse OT, etc.
	0804	Alarm	content of current alarm
	0820	Un-00	speed for feedback (rpm)
(S)	0822	Un-01	speed command (rpm)
	0824	Un-02	torque command (%)
	0826	Un-03	# of pulses from U phase edge (x 4 pulses)
	0828	Un-04	electrical angle (deg)
	082A	Un-05	internal status 1
	082C	Un-06	internal status 2
(P)	082E	Un-07	speed of command pulse (rpm)
(P)	0830	Un-08	position error (x100) (command unit)
	0832	Un-09	command pulse counter value (command unit)
(S)	0806	00-03A	speed command zero offset
	0808	00-04F	motor parameter
	080A	00-04Y	Y specification number
	080C	00-06	software version
	0840	0 - A.	alarm traceback data alarm occurrence no. = 0
	0842	1 - A.	alarm occurrence no. = 1
	0844	2 - A.	alarm occurrence no. = 2
	0846	3 - A.	alarm occurrence no. = 3
	0848	4 - A.	alarm occurrence no. = 4
	084A	5 - A.	alarm occurrence no. = 5
	084C	6 - A.	alarm occurrence no. = 6
	084E	7 - A.	alarm occurrence no. = 7
	0850	8 - A.	alarm occurrence no. = 8
	0852	9 - A.	alarm occurrence no. = 9

- Data on address in above table cannot be set.
- (S) speed control (P) position control
- Un-00, 01, 02, 03, 04, 07, 08, 09,00 - 03A, 04F, 04Y data is sent by 4 digit hexadecimal.
  ie:) When Un-00 is 3000 rpm, data becomes 0 B B 8
- 00-04 (motor parameter) data, is as follows:

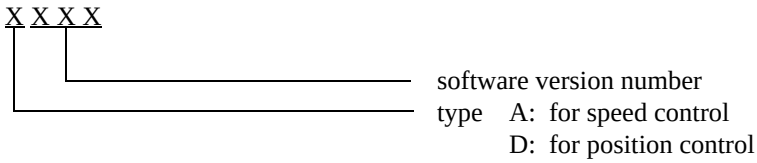
X X X X

motor capacity
- 9E: 30W
- B2: 50W
- 01: 100W
- 02: 200W
- 03: 300W
- 04: 400W
- 08: 800W

motor type
- 00: SGM 200V
- 02: SGMP 200V
- 41: SGM 100V
- 43: SGMP 100V

(exp.) when the corresponding motor is SGM 200V, 200W, data becomes 0002.

- *00-06 (software version) data, will become as follows:



ie:) with the servopack for speed control, and the software version is #5, the data becomes A005.

- Status, Un-05, and 06 data is converted to 4 digit hexadecimal and sent.

bit #	Status	Un-05	Un-06
0	base block	SVALM	PCON
1	Run	DBON	P-OT
2	forward OT	DIR	N-OT
3	reverse OT	TGON/CLT	SEN (S)
4	alarm	V-CMP (S)/ COIN (P)	PUL (P)
5	not used	MSON	SIGN (P)
6	not used	P-CL	CLR (P)
7	not used	N-CL	BK
8	power on	B-ON	ALMRST
9	V-CMP (S)/COIN (P)	PA	AL01
A	TGON/CLT	PB	AL02
B	inputting speed/positioning com-mand	PC	AL03
C	inputting torque command (S)	PU	not used
D	not used	PV	not used
E	not used	PW	not used
F	not used	SVON	not used

- (S) speed control (P) position control

Each signal is active when set to 1.

PA - PW is at high level when set to 1.

ie:) When status is [run], [power on], [V-CMP], [TGON], or [inputting speed command], data becomes 0F02.

Alarm Table

The following table is a summary of data responses to alarm traceback data.

	Data	Alarm Contents
(A)	0000	absolute error
	0002	parameter breakdown
	0004	abnormal parameter setting
	0010	overcurrent detected
(P)	0031	excessive following error
	0040	overvoltage detected
	0051	overspeed detected
	0052	excessive command input
	0071	overload detected (instantaneous overload)
	0072	overload detected (continuous overload)
(A)	0080	alarm fault
(A)	0081	encoder backup error
(A)	0082	encoder check sum error
(A)	0083	encoder battery error
(A)	0084	encoder absolute position error
(A)	0085	encoder overspeed
(S)	00B1	error reading command input
	00C1	overrun detection
	00C2	erroneous phase detected
	00C3	disconnected PA, PB phase
	00C4	disconnected PC phase
	00F3	instantaneous power off
	0099	alarm reset, power on/off, no alarm

- (S) for speed control (P) for position control, and (A) when absolute encoder is used.

9. Address, Operation Table

Address	Operation
0880	Set/confirm mode
0882	Operation command (only setting, cannot monitor)
0884	Machine rigidity - set/confirm (auto tuning)

- Data for set/confirm mode is a follows:

  000X

  Mode
  - 0: standard mode
  - 1: JOG mode
  - 2: command offset auto adjustment mode (S)
  - 3: mode for clearing alarm traceback data
  - 4: speed command input offset manual adjustment mode (S)
  - 5: auto tuning mode
  - 6: alarm reset
  - 7: 12 bit absolute encoder setup (a)
  - D: data trace mode

- Data for setting/confirming machine rigidity is as follows:

  000X

  Machine rigidity selection: 1 (low response) ~ 7 (high response)

- Data for operating command is as follows:

  000X

  - 0: stop
  - 1: start
  - 2: UP (forward running)
  - 3: DOWN (reverse running)
  - 4: JOGSVON, etc.

- User constants can be written only in standard mode.
- In the offset automatic adjustment, clear trace/alarm reset, and absolute encoder setup modes, by setting to 1 (execute), the mode executed and setting will automatically return to 0. After the execute command is sent, communication is shut down for 2 seconds. Further, in the absolute encoder setup mode, by setting it to 4 the SEN signal can be switched between “mask” and “no mask”.
- In the offset manual adjustment mode, by setting to 2 (up) or 3 (down) it adjusts offset value and records offset value into memory when stop command is executed.
- In Jog and auto tuning mode, by setting to 4 (JOGSVON), it switches between “servo on” and “servo off”, and by setting to 2 (forward running) or 3 (reverse running) it starts turning for one second. By setting it to 0 (stop) the motor stops. It continues running if command 2 or 3 is repeatedly sent within one second. Further, in the auto tuning mode, upon completion of tuning mode, it will return to 0. The mode also returns to 0 when there is an alarm or when an alarm is reset.

10. Data Trace Function

The user can monitor the servo's responses, etc. The servopack can store data in its memory with certain sampling time set.

(1) Addresses Relative to Data Trace Function

Address	Abbreviation	Contents	
6302 (R/W)	SMPTMS	sampling interval; even if setting is "0", sampling interval is defined as "1".	<0001-0FFF)
6304 (R/W)	PTRGNO	number of pre-trigger data	<0000-03E7)
6308 (R/W)	TRGC1	trigger condition	
630A (R/W)	TRGC2	trigger level	
6326 (R)	TRGADR	trigger address	<0000-07FE)
6320 (R)	MAXTRQC	torque when data is 15000	(%)
6322 (R)	OSVELCC	speed when data is 15000	(r / min)
6324 (R)	CYCLEC	unit of trace sampling time	(μs)
0880 (R/W)	(mode setting)	Sets 000D. Cancels at 0000 setting.	
0882 (W)	(execution)	Sets 0001.	
2000 (R) ~ 27FE	torque/reference pulse speed data	torque reference pulse speed (P)	(*MAXTRQC / 15000%) (/32 reference unit/CYCLEC)
2800 (R) ~ 2FFE	speed/position error data	speed position error	(*OSVELCC/15000 r/min) (reference unit)

6800 (R) ~ 6FFE	bit data I/O PUT signal	bit7 SEN	bit6 /N-CL	bit5 /PCL	bit4 /N-OT	bit3 /P-OT	bit2 /ALRST	bit1 /P-CON	bit0 /S-ON
		bitF /ALM	bitE AL03	bitD AL02	bitC AL01	bitB /TGON	bitA (*)	bit9 /BK	bit8 ALM

- (*) /V-CMP for speed control, /COIN for position control.
- In the address column about (R)=read, (W)=write, (R/W)=read/write.

(2) Execution

① Selecting Trace Data (for position control only)

Tracing data is selected by setting the following user constants.

Cn-02 bit6=0: torque data
1: reference pulse speed data
Cn-02 bit7=0: speed data
1: position error data

② Setting Sampling Time

Set ST/CYCLEC to SMPTMS when the sampling time is selected to ST(μs). Data will be saved at each SMPTMS x CYCLEC (μs).

③ Setting of Pre-Trigger Data

1000 data are saved in the memory. The number of data which is stored before the trigger is set in PTRGNO. (not applicable when trigger is not selected)

④ Setting Trigger Condition

TRGC1 data are defined as follows.

bit1,0	0:	no trigger
(trigger selection)	1:	torque or reference pulse speed data is trigger
	2:	speed or position error data is trigger
	3:	bit data is trigger
bit2	0:	ineffective
(rising edge trigger)	1:	effective
bit3	0:	ineffective
(falling edge trigger)	1:	effective

There is no trigger when bit 2 and 3 are both 0.

When trigger is other than bit data, in TRGC2 set trigger level with sign. The unit is converted using MAXTRQC, OSVELCC.

When trigger is bit data, in TRGC2 only the bit data used for the trigger should be set to 1, and all other data should be set to 0. (There is only one signal which can be applied to a trigger.)

(Example)

To use trigger (OSVELCC = 1356H), change speed from < -1000r/min to ≥ -1000r/min

TRIGC1 ← 0006 (falling edge trigger is effective, trigger selection = speed)
TRIGC2 ← F42A (= -1000 *1356H/15000)

To use trigger to change /COIN signal

TRIGC1 ← 000F (falling or rising trigger is effective, trigger selection = bit)
TRIGC2 ← 0400 (/COIN signal (bitA) = 1)

⑤ Starting Trace

Trace is started by setting [0880] ← 000D and [0882] ← 0001.

It can tell when trace is completed by reading [0880] since [0880] is 000D when executing, and [0880] becomes 0000 when finished.
The trace can be cancelled by setting [0880] ← 0000.

Note: The analog monitor is not effective while trace is executing (voltage will be uncertain).

⑥ Monitoring Traced Data

By reading TRGADR it knows the address where trigger occurred. In this, the pre-trigger data refers to (TRGADR - 2*PTRGNO) & 07FEH ~ (TRGADR - 2) & 07FE, and the post-trigger data refers to TRGADR ~ (TRGADR + 07CEH - 2*PTRGNO) & 07FEH.

(The actual address for: torque/reference pulse speed is +2000H, speed/position error is +2800H, and bit data is +6800H)

The unit is converted by MAXTRQC (torque), OSVELCC (speed).

Note: Since the trigger detection is scanned to every 5ms (approx.), if the sampling time is shorter, there may be instances in which value of TRGADR becomes 10 to 20 address after the actual trigger. The trigger in short time, may be missed.

⑦ Multiple Data Read Command

It is convenient to use the multiple data read command since there are many words used in the data trace.

Note: If mode [0880] is other than 0, abnormal address error occurs. Only the address of the trace data can be used. You must consider your PC's capability and your buffer size and decide on the number of byte per command since there is no XON/XOFF control. If the transmission takes more than 0.2 second, a communication error may occur.

(Example)

When [2800]=0987H, [2802]=1234H, [2804]=5736:

command W0228000006D6 [CR]

answer W0228000006D6098712345736 [CR]

11. Communication Procedure

- Servopack answers within 0.2 seconds.
- Servopack will not respond in the following conditions:
  1. When a parity error or framing error occurs.
  2. When the number of characters in a command is other than 14.
  3. When the command does not start with "W00", "W01", or "W02".
  4. When there is no [CR] at the end of a command
  5. When correct data format is not used
  6. When check sum error is detected

- After a command is sent from the PC it should wait for an answer before sending the next command. After answer is returned, send the next commands (half-duplex type).
  If an answer does not come back within 0.2 seconds after sending a command, resend the command.