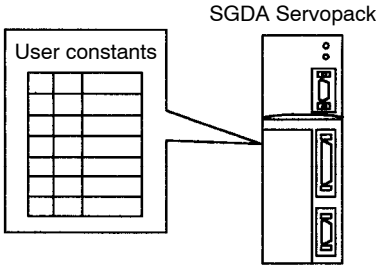
Appendix D

List of User Constants

• Σ-Series Servopacks provide many functions, and have parameters called "user constants" to allow the user to select each function and perform fine adjustment. This appendix lists these user constants.

• User constants are divided into the following two types:

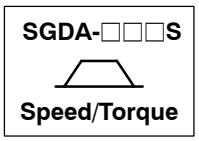
1)Memory switch Cn-01, Cn-02	Each bit of this switch is turned ON or OFF to select a function.
5) User constant setting Cn-03 and later	A numerical value such as a torque limit value or speed loop gain is set in this constant.



NOTE 1) Some user constants for speed/torque control and position control are different. Always refer to the correct list of user constants for the Servopack type.

2) Refer to *Chapter 3* for details of how to use user constants.

3) For details of how to set user constants, refer to *Section 4.1.5 Operation in User Constant Setting Mode*



For Speed/Torque Control (SGDA-□□□S)

List of User Constants (User Constant Setting)

Category	User Constant No.	Code	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Remarks
	Cn-00	Not a user constant. (Cn-00 is used to select special mode for digital operator.)						
	Cn-01	Memory switch (see on page 404.)						See note 1
	Cn-02	Memory switch (see on page 405.)						See note 1
Gain Related Constants	Cn-03	VREFGN	Speed reference gain	(r/min)/V	0	2162	500	
	Cn-04	LOOPHZ	Speed loop gain	Hz	1	2000	80	See note 2
	Cn-05	PITIME	Speed loop integration time constant	ms	2	10000	20	See note 2
	Cn-1A	POSGN	Position loop gain	1/s	1	500	40	See note 2 and 3
Torque Related Constants	Cn-13	TCRFGN	Torque reference gain	(0.1 V/rated torque)	10	100	30	
	Cn-06	EMGTRQ	Emergency stop torque	%	0	Maximum torque	Maximum torque	
	Cn-08	TLMTF	Forward rotation torque limit	%	0	Maximum torque	Maximum torque	
	Cn-09	TLMTR	Reverse rotation torque limit	%	0	Maximum torque	Maximum torque	
	Cn-14	TCRLMT	Speed limit for torque control I	r/min	0	Maximum speed	Maximum speed	
	Cn-17	TRQFIL	Torque reference filter time constant	100 μs	0	250	4	
	Cn-18	CLMIF	Forward external torque limit	%	0	Maximum torque	100	
	Cn-19	CLMIR	Reverse external torque limit	%	0	Maximum torque	100	
Sequence Related Constants	Cn-07	SFSACC	Soft start time (acceleration)	ms	0	10000	0	See note 4
	Cn-23	SFSDEC	Soft start time (deceleration)	ms	0	10000	0	See note 4
	Cn-0B	TGONLV	Zero-speed level	r/min	1	Maximum speed	20	
	Cn-0F	ZCLVL	Zero-clamp level	r/min	0	16383	10	
	Cn-12	BRKTIM	Time delay from brake reference until servo OFF	10 ms	0	50	0	
	Cn-15	BRKSPD	Speed level for brake reference output during motor operation	r/min	0	Maximum speed	100	
	Cn-16	BRKWAI	Output timing of brake reference during motor operation	10 ms	10	100	50	

Category	User Constant No.	Code	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Remarks
	Cn-22	VCMPLV	Speed coincidence signal output range	r/min	0	100	10	
Pulse Related Constants	Cn-0A	PGRAT	Dividing ratio setting	P/R	16	32768	2048	See note 1
	Cn-11	PULSNO	Number of encoder pulses	P/R	513	32768	2048	See note 1
Other Constants	Cn-0C	TRQMSW	Mode switch (torque reference)	%	0	Maximum torque	200	
	Cn-0D	REFMSW	Mode switch (speed reference)	r/min	0	Maximum speed	0	
	Cn-0E	ACCMSW	Mode switch (acceleration reference)	10 (r/min)/s	0	3000	0	
	Cn-10	JOGSPD	Jog speed	r/min	0	Maximum speed	500	
	Cn-1F	SPEED1	1st speed (contact input speed control)	r/min	0	Maximum speed	100	
	Cn-20	SPEED2	2nd speed (contact input speed control)	r/min	0	Maximum speed	200	
	Cn-21	SPEED3	3rd speed (contact input speed control)	r/min	0	Maximum speed	300	
	Cn-28	NFBCC	Speed loop compensation constant	---	0	100	0	
	Cn-29	AXISNO	Axis address	---	0	14	0	

: User constants that must be always set

Note 1) After changing the setting, always turn the power OFF, then ON. This makes the new set ting valid.

2) Automatically set by autotuning function

3) Valid only when zero-clamp function is used

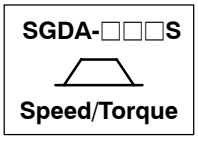
4) To use soft start function, always set both Cn-07 and Cn-23.

List of User Constants (Memory Switch Setting) (1)

	User Constant No.	Bit No.	Setting				Factory Setting
Input signal enable/disable	Cn-01	0	0		1		0
			Uses servo ON input ($\overline{\text{S-ON}}$).		Does not use servo ON input ($\overline{\text{S-ON}}$). Servo is always ON.		
		1	0		1		0
			Uses SEN signal input (SEN) when absolute encoder is used.		Does not use SEN signal input (SEN) when absolute encoder is used. Servopack automatically treats signal voltage as high level.		
		2	0		1		0
			Uses forward rotation prohibited input (P-OT).		Does not use forward rotation prohibited input (P-OT). Forward rotation is always possible.		
		3	0		1		0
			Uses reverse rotation prohibited input ($\overline{\text{N-OT}}$).		Does not use reverse rotation prohibited input ($\overline{\text{N-OT}}$). Reverse rotation is always possible.		
TGON signal switching		4	0		1		0
			Uses TGON signal (TGON) as running output.		Uses TGON signal (TGON) as torque limit output.		
Operation performed at recovery from power loss		5	0		1		0
			Remains in servo alarm status at recovery from power loss.		Automatically resets servo alarm status at recovery from power loss.		
Sequence selection at alarm condition		6	0		1		0
			Stops the motor by applying dynamic brake when an alarm arises.		Causes the motor to coast to a stop when an alarm arises.		
		7	0		1		1
			When an alarm arises, stops the motor by applying dynamic brake and then releases dynamic brake.		When an alarm arises, stops the motor by applying dynamic brake but does not release dynamic brake.		
		8	0		1		0
			Stops the motor according to bit 6 setting when overtravel is detected (P-OT, N-OT).		Decelerates the motor to a stop by applying the torque specified in Cn-06 when overtravel is detected (P-OT, N-OT).		
		9	0		1		0
			When overtravel is detected (P-OT, N-OT), decelerates the motor to a stop by applying the torque specified in Cn-06 and then turns the servo OFF.		When overtravel is detected (P-OT, N-OT), decelerates the motor to a stop by applying the torque specified in Cn-06 and then performs zero-clamp.		
Control mode selection		B•A	0•0	0•1	1•0	1•1	0•0
			Speed control	Speed control with zero-clamp function	Torque control I	Torque control II	
Mode switch selection		D•C	0•0	0•1	1•0	1•1	0•0
			Uses internal torque reference as a condition. (Level setting: Cn-0C)	Uses speed reference as a condition. (Level setting: Cn-0D)	Uses acceleration as a condition. (Level setting: Cn-0E)	Does not use mode switch function.	

	User Constant No.	Bit No.	Setting		Factory Setting
Encoder selection	Cn-01	E	0	1	0
			Uses incremental encoder.	Uses absolute encoder.	
Torque feed-forward function		F	0	1	0
			Does not use torque feed-forward function.	Uses torque feed-forward function.	
Rotation direction selection	Cn-02	0	0	1	0
			Defines counterclockwise (CCW) rotation as forward rotation.	Defines clockwise (CW) rotation as forward rotation (reverse rotation mode).	
Home position error processing selection		1	0	1	0
			Detects home position error (when absolute encoder is used).	Does not detect home position error.	
Contact input speed control		2	0	1	0
			Does not use contact input speed control.	Uses contact input speed control.	

Note For the Cn-01 and Cn-02 memory switches, always turn the power OFF and then ON after changing the setting. This makes the new setting valid.



For Speed/Torque Control (SGDA-□□□S)

List of User Constants (Memory Switch Setting) (2)

	User Constant No.	Bit No.	Setting		Factory Setting
Reserved	Cn-02	5•4•3•7•6	Reserved (not to be set)		0
Motor selection		8	0	1	*
			SGM motor	SGMP motor	
Reserved		A•9	Reserved (not to be set)		0
Integration time constant setting unit		B	0	1	0
			1 ms	0.01 ms	
Torque reference filter type		C	0	1	0
			Primary	Secondary	
Reserved		E•D	Reserved (not to be set)		0
Torque reference input selection		F	0	1	0
			Uses torque reference or torque feed-forward reference.	Uses analog voltage reference as torque limit input.	

The factory setting depends on the Servopack type as shown below.

Servopack Type	Factory Setting
SGDA-□□□S	0
SGDA-□□□SP	1

Note For the Cn-01 and Cn-02 memory switches, always turn the power OFF and then ON after changing the setting. This makes the new setting valid.

SGDA-□□□ P

Positions

For Position Control (SGDA-□□□P)

List of User Constants (User Constant Setting)

Category	User Constant No.	Code	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Remarks
	Cn-00	Not a user constant. (Cn-00 is used to select special mode for digital operator.)						
	Cn-01	Memory switch (see on page 408.)						See note 1
	Cn-02	Memory switch (see on page 410.)						See note 1
Gain Related Constants	Cn-04	LOOPHZ	Speed loop gain	Hz	1	2000	80	See note 2
	Cn-05	PITIME	Speed loop integration time constant	ms	2	10000	20	See note 2
	Cn-1A	POSGN	Position loop gain	1/s	1	500	40	See note 2
	Cn-1C	BIASLV	Bias	r/min	0	450	0	
	Cn-1D	FFGN	Feed-forward	%	0	100	0	
	Cn-26	ACCTME	Position reference acceleration/deceleration time constant	100 μs	0	640	0	
	Cn-27	FFFILT	Feed-forward reference filter	100 μs	0	640	0	
Torque Related Constants	Cn-06	EMGTRQ	Emergency stop torque	%	0	Maximum torque	Maximum torque	
	Cn-08	TLMTF	Forward rotation torque limit	%	0	Maximum torque	Maximum torque	
	Cn-09	TLMTR	Reverse rotation torque limit	%	0	Maximum torque	Maximum torque	
	Cn-17	TRQFIL	Torque reference filter time constant	100 μs	0	250	4	
	Cn-18	CLMIF	Forward external torque limit	%	0	Maximum torque	100	
	Cn-19	CLMIR	Reverse external torque limit	%	0	Maximum torque	100	
Sequence Related Constants	Cn-07	SFSACC	Soft start time (acceleration)	ms	0	10000	0	See note 4
	Cn-23	SFSDEC	Soft start time (deceleration)	ms	0	10000	0	See note 4
	Cn-0B	TGONLV	Zero-speed level	r/min	1	Maximum speed	20	
	Cn-12	BRKTIM	Time delay from brake reference until servo OFF	10 ms	0	50	0	
	Cn-15	BRKSPD	Speed level for brake reference output during motor operation	r/min	0	Maximum speed	100	

Category	User Constant No.	Code	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Remarks
Sequence Related Constants	Cn-16	BRKWAI	Output timing of brake reference during motor operation	10 ms	10	100	50	
	Cn-1B	COINLV	Positioning complete range	Reference unit	0	250	7	
Pulse Related Constants	Cn-0A	PGRAT	Dividing ratio setting	P/R	16	32768	2048	See note 1
	Cn-11	PULSNO	Number of encoder pulses	P/R	513	32768	2048	See note 1
	Cn-24	RATB	Electronic gear ratio (numerator)		1	65535	4	See note 3
	Cn-25	RATA	Electronic gear ratio (denominator)		1	65535	1	See note 3
Other Constants	Cn-0C	TRQMSW	Mode switch (torque reference)	%	0	Maximum torque	200	
	Cn-0D	REFMSW	Mode switch (speed reference)	r/min	0	Maximum speed	0	
	Cn-0E	ACCMSW	Mode switch (acceleration reference)	10 (r/min)/s	0	3000	0	
	Cn-0F	ERPMSW	Mode switch (error pulse)	Reference unit	0	10000	10000	
	Cn-10	JOGSPD	Jog speed	r/min	0	Maximum speed	500	
	Cn-1E	OVERLV	Overflow	256 reference unit	1	32767	1024	
	Cn-1F	SPEED1	1st speed (contact input speed control)	r/min	0	Maximum speed	100	
	Cn-20	SPEED2	2nd speed (contact input speed control)	r/min	0	Maximum speed	200	
	Cn-21	SPEED3	3rd speed (contact input speed control)	r/min	0	Maximum speed	300	
	Cn-28	NFBCC	Speed loop compensation constant	---	0	100	0	
	Cn-29	AXISNO	Axis address	---	0	14	0	

: User constants that must be always set

Note 1) After changing the setting, always turn the power OFF, then ON. This makes the new set ting valid.

2) Automatically set by autotuning function

3) The following restriction applies to electronic gear ratio (Cn-24 and Cn-25):

$$0.01 \leqq \frac{B(Cn\text{-}24)}{A(Cn\text{-}25)} \leqq 100$$

4) The soft-start function is valid during the jog operation or when the contact input speed control mode is selected. The function is invalid during pulse command operations.

D

SGDA-□□□ P

Positions

For Position Control (SGDA-□□□P)

List of User Constants (Memory Switch Setting)

	User Constant No.	Bit No.	Setting		Factory Setting
Input signal enable/ disable	Cn-01	0	0	1	0
			Uses servo ON input ($\overline{\text{S-ON}}$).	Does not use servo ON input ($\overline{\text{S-ON}}$). Servo is always ON.	
		1	Reserved (not to be set)		0
		2	0	1	0
			Uses forward rotation prohibited input (P-OT).	Does not use forward rotation prohibited input (P-OT). Forward rotation is always possible.	
		3	0	1	0
			Uses reverse rotation prohibited input ($\overline{\text{N-OT}}$).	Does not use reverse rotation prohibited input ($\overline{\text{N-OT}}$). Reverse rotation is always possible.	
TGON signal switching		4	0	1	0
			Uses TGON signal (TGON) as running output.	Uses TGON signal (TGON) as torque limit output.	
Operation performed at recovery from power loss		5	0	1	0
			Remains in servo alarm status at recovery from power loss.	Automatically resets servo alarm status at recovery from power loss.	
Sequence selection at alarm condition		6	0	1	0
			Stops the motor by applying dynamic brake when an alarm arises.	Causes the motor to coast to a stop when an alarm arises.	
		7	0	1	1
			When an alarm arises, stops the motor by applying dynamic brake and then releases dynamic brake.	When an alarm arises, stops the motor by applying dynamic brake but does not release dynamic brake.	
		8	0	1	0
			Stops the motor according to bit 6 setting when overtravel is detected (P-OT, N-OT).	Decelerates the motor to a stop by applying the torque specified in Cn-06 when overtravel is detected (P-OT, N-OT).	
		9	0	1	0
			When overtravel is detected (P-OT, N-OT), decelerates the motor to a stop by applying the torque specified in Cn-06 and then turns the servo OFF.	When overtravel is detected (P-OT, N-OT), decelerates the motor to a stop by applying the torque specified in Cn-06 and then performs zero-clamp.	

	User Constant No.	Bit No.	Setting				Factory Setting
Operation performed at servo OFF	Cn-01	A	0		1		0
			Clears error pulse when servo is turned OFF.		Does not clear error pulse when servo is turned OFF.		
Mode switch selection		B	0		1		0
			Uses mode switch function as set in bits D and C of Cn-01.		Does not use mode switch function.		
		D•C	0•0	0•1	1•0	1•1	0•0
			Uses internal torque reference as a condition. (Level setting: Cn-0C)	Uses speed reference as a condition. (Level setting: Cn-0D)	Uses acceleration as a condition. (Level setting: Cn-0E)	Uses error pulse as a condition. (Level setting: Cn-0F)	
Encoder selection		E	0		1		0
			Uses incremental encoder.		Uses absolute encoder.		
Internal speed selection*1		F	0		1		0
			Stops the motor when both contact signals $\overline{\text{P-CL}}$ and $\overline{\text{N-CL}}$ are OFF.		Receives pulse reference when both contact signals $\overline{\text{P-CL}}$ and $\overline{\text{N-CL}}$ are OFF.		
INHIBIT function			0		1		
			Always receives pulse reference.		Enables INHIBIT function.		
Rotation direction selection	Cn-02	0	0		1		0
			Defines counterclockwise (CCW) rotation as forward rotation.		Defines clockwise (CW) rotation as forward rotation (reverse rotation mode).		
Home position error processing selection		1	0		1		0
			Detects home position error (when absolute encoder is used).		Does not detect home position error.		
Contact input speed control		2	0		1		0
			Does not use contact input speed control.		Uses contact input speed control.		
Reference pulse form selection		5•4•3	0•0•0	0•0•1	0•1•0	0•1•1	1•0•0	0•0•0
			Sign + Pulse	CW + CCW	Phase A + Phase B (x 1 multiplication)	Phase A + Phase B (x 2 multiplication)	Phase A + Phase B (x 4 multiplication)	
Reserved		7•6	Reserved (not to be used)					0
Motor selection		8	0		1			See note 2
			SGM motor		SGMP motor			

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	User Constant No.	Bit No.	Setting		Factory Setting
Error counter clear signal	Cn-02	A	0	1	0
			Clears the error counter when an error counter clear signal is at high level.	Clears the error counter when the leading edge of an error counter clear signal rises.	
Integration time constant setting unit		B	0	1	0
			1 ms	0.01 ms	
Torque reference filter		C	0	1	0
			Primary	Secondary	
Reference pulse logic		D	0	1	0
			Does not invert reference pulse logic.	Inverts reference pulse logic.	
Others		E	0	1	0
			Displays position error Un-08 in x 1 reference units while in monitor mode.	Displays position error Un-08 in x 100 reference units while in monitor mode.	
		F	0	1	0
			Line driver (Maximum reference pulse frequency: 450 kpps)	Open collector (Maximum reference pulse frequency: 200 kpps)	

D

: User constants that must be always set

NOTE For the Cn-01 and Cn-02 memory switches, always turn the power OFF and then ON after changing the setting. This makes the new setting valid.

Note 1) Internal speed selection is valid only when bit 2 of Cn-02 is set to "1."

2) The factory setting depends on the Servopack type as shown below.

Servopack Type	Factory Setting
SGDA-□□□P	0
SGDA-□□□PP	1