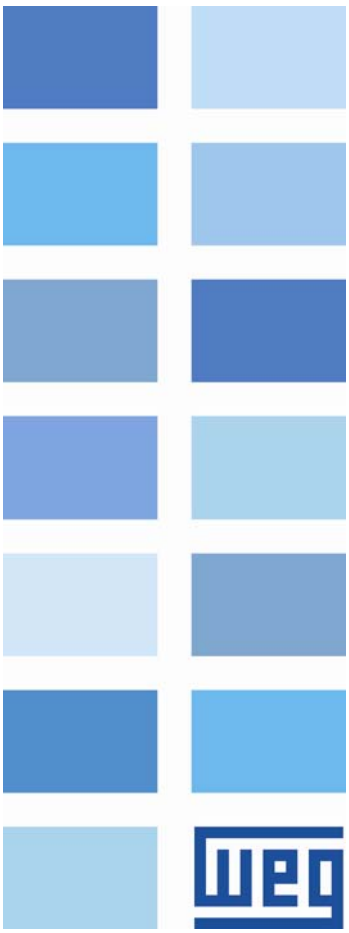
WEGTP

SCA06

User's Manual



WEGTP User's Manual

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CONTENTS

ABOUT THIS MANUAL

This manual supplies the necessary information for the operation of the SCA06 servodrive using the RS232 and RS485 serial interfaces. This manual must be used together with the SCA06 user manual.

ABBREVIATIONS AND DEFINITIONS

ASCII	American Standard Code for Information Interchange
CRC	Cycling Redundancy Check
EIA	Electronic Industries Alliance
TIA	Telecommunications Industry Association
RTU	Remote Terminal Unit

NUMERICAL REPRESENTATION

Decimal numbers are represented by means of digits without suffix. Hexadecimal numbers are represented with the letter ‘h’ after the number.

1 INTRODUCTION TO SERIAL COMMUNICATION

In a serial interface the data bits are sent sequentially through a communication channel or bus. Several technologies use the serial communication for data transfer, including the RS232 and RS485 interfaces.

The directions that specify the RS232 and RS485 standards, however, do neither specify the character format, nor its sequence for the data transmission and reception. Therefore, besides the interface, it is also necessary to identify the protocol used for the communication. Among the several existent protocols, one used a lot in the industry is the WEGTP protocol.

In the sequence the characteristics of the RS232 and RS485 serial interfaces available for the product will be presented, as well as the protocols for the use of those interfaces.

2 DESCRIPTION OF THE INTERFACES

To enable the serial communication on the servodrive SCA06, you must use the communication and expansion module ECO1 described below. Information about the installation of this module can be found in the guide that comes with the accessory.

2.1 RS232 AND RS485 ECO1 COMMUNICATION AND EXPANSION MODULE

- WEG Item: 11330271.
- Composed by the communication module ECO1 (figure beside) and a mounting guide.
- Interface galvanically insulated and with differential signal, providing greater robustness against electromagnetic interference.
- RS232 and RS485 signals are independent channels and can be used simultaneously.

2.2 RS232

2.2.1 Indications

O led LA121 indicates (lights) when transmitting data through the communication RS232.

2.2.2 Connection to Network RS232

- RX and TX signals of the servo drive must be connected respectively to the TX and RX of the master, besides the connection of the reference signal (GND).
- The interface RS232 is very susceptible to interference. For this reason, the wire used for communication must be as short as possible – always shorter than 10 meters – and must be routed separately from the power wiring that feeds the servo drive and the motor.

2.2.3 Connecting cables in RS232

If desired, items of the following cables for RS232 connection between the servo drive and network master, such as a PC, are available.

Table 2.1: *RS232 Cable*

Cable	Item
RS232 shielded cable with DB9 connectors Length: 3 meters	10050328
RS232 shielded cable with DB9 female connectors Length: 10 meters	10191117

Other cables, however, can be found on the market – usually called null-modem – or can be assembled according to the installation requirements.

2.2.4 Connector Pin Assignment

The connection for the RS232 interface is available through the XA121 and XA122 connectors using the following pin assignment:

Table 2.2: *Connector pin assignment for RS232 XA121*

Pin	Function
1	Ground
2	RX_232
3	TX_232
4	Reserved[1]
5	GND
6	Reserved[1]
7	232 RTS
8	A
9	B

Table 2.3: *Connector pin assignment for RS232 XA122*

Pin	Function
1	NC
2	RX_232
3	TX_232
4	Reserved[1]
5	GND
6	NC
7	232 RTS
8	NC
9	NC
Frame	Ground

2.3 RS485

2.3.1 Indications

O led LA122 indicates (lights) when transmitting data through the communication RS485.

2.3.2 Characteristics of the RS485 interface

- The Interface follows the standard EIA/TIA-485.
- It can operate as a slave of the WEGTP network.
- It allows communication using rates from 9600 to 57600 kbit/s.
- Interface galvanically insulated and with differential signal, providing greater robustness against electromagnetic interference.
- It allows the connection of up to 32 devices to the same segment. A larger number of devices can be connected through repeaters.[2]
- Maximum length of the bus of 1000 meters.

2.3.3 Connector Pin Assignment

The connection for the RS485 interface is available through connector XC1 using the following pin assignment:

Table 2.4: *Connector pin assignment for RS485 XA121*

Pin	Function
1	Ground
2	RX_232
3	TX_232
4	Reserved[1]
5	GND
6	Reserved[1]
7	232 RTS
8	A
9	B

[1] Do not connect reserved pins.
[2] The maximum number of devices that can be connected to the network also depends on the used protocol.

Table 2.5: *Connector pin assignment for RS485 XA123*

Pin	Function
1	NC
2	NC
3	NC
4	NC
5	GND
6	Reserved
7	NC
8	A (data -)
9	B (data +)
Frame	Ground

2.3.4 Termination resistor

For each segment of the RS485 network, it is necessary to enable a termination resistor at the end of the main bus. The accessory ECO1 features two dip-switches that can be activated (placing both switches SA121 in the ON position) to enable the termination resistor.

Figure 2.1: *Termination resistor*

2.3.5 Connection to RS485 network

For the connection of the SCA06 servo drive using the RS485 interface, the following points must be observed:

- It is recommended to use a cable with shielded braided pair.
- It is also recommended that the cable have an additional wire for connecting the reference signal (GND). If the cable does not have the additional wire, you should leave the GND signal disconnected.
- The routing of the cable must be done separately (and if possible, distant) from the power supply cables.
- All the network devices must be properly grounded, preferably to the same connection of the ground wire. The cable shield must also be grounded.
- Enable the termination resistors only in two points, at the endpoints of the main bus, even if there are derivations from the bar.

3 PROGRAMMING

Next, the SCA06 servodrive parameters related to the WEGTP communication will be presented.

3.1 SYMBOLS FOR THE PROPERTIES DESCRIPTION

RW	Reading and writing parameter
AC	Parameter visible on the HMI only when the corresponding accessory is connected

P00650 – SERVO DRIVE ADDRESS IN THE SERIAL COMMUNICATION 1 – RS232

P00656 – SERVO DRIVE ADDRESS IN THE SERIAL COMMUNICATION 2 – RS485

Range:	1 to 247	**Default:** 1
Properties:	RW, AC	

Description:
It allows programming the used address for serial communication of the equipment. It is necessary that each device on the network have a different address from one another. The valid addresses for this parameter depend on the protocol programmed on the servo drive.

- P00654/P00660 = 1 (WEGTP) → Valid addresses: 1 to 30.
- P00654/P00660 = 2 (Modbus RTU) → Valid addresses: 1 to 247.

P00652 – BIT RATE SERIAL 1 – RS232

P00658 – BIT RATE SERIAL 2 – RS485

Range:	0 = 4800 bits/s 1 = 9600 bits/s 2 = 14400 bits/s 3 = 19200 bits/s 4 = 24000 bits/s 5 = 28800 bits/s 6 = 33600 bits/s 7 = 38400 bits/s 8 = 43200 bits/s 9 = 48000 bits/s 10 = 52800 bits/s 11 = 57600 bits/s	**Default:** 1
Properties:	RW, AC	

Description:
It allows programming the desired value for the baud rate of the serial interface in bits per second. This rate must be the same for all the devices connected to the network.

P00653 – SERIAL CONFIGURATION 1 – RS232

P00659 – SERIAL CONFIGURATION 2 – RS485

Range:	0 = 8 data bits, no parity, 1 stop bit 1 = 8 data bits, parity even, 1 stop bit 2 = 8 data bits, parity odd, 1 stop bit 3 = 8 data bits, no parity, 2 stop bits 4 = 8 data bits, parity even, 2 stop bits 5 = 8 data bits, parity odd, 2 stop bits 6 = 7 data bits, no parity, 1 stop bit 7 = 7 data bits, parity even, 1 stop bit 8 = 7 data bits, parity odd, 1 stop bit 9 = 7 data bits, no parity, 2 stop bits 10 = 7 data bits, parity even, 2 stop bits 11 = 7 data bits, parity odd, 2 stop bits	**Default:** 3
Properties:	RW, AC	

Description:
It allows the configuration of the number of data bits, parity and stop bits in the bytes of the serial interface. This configuration must be the same for all the devices connected to the network.

P00654 – SELECT SERIAL PROTOCOL 1 – RS232

P00660 – SELECT SERIAL PROTOCOL 2 – RS485

Range:	1 = WEGTP 2 = Modbus RTU	**Default:** 1
Properties:	RW	

Description:
It allows selecting the desired protocol for the serial interface. The detailed description of the protocol is presented in item 4 of this manual.

P0662 – ACTION FOR COMMUNICATION ERROR

Range:	0 = Cause Alarm 1 = Cause Fault 2 = Cause alarm and execute STOP 3 = Cause alarm and disable drive	**Default:** 0
Properties:	CFG	

Description:
This parameter allows selecting which action must be executed by the equipment in case it is controlled via network and a communication error is detected.

Table 3.1: *Options for parameter P0662*

Option	Description
0 = Cause Alarm	It just indicates alarm.
1 = Cause Fault	Instead of alarm, a communication error causes a fault on the equipment, and it is necessary to reset the faults so as to return to normal operation.
2 = Execute STOP	The alarm will be indicated together with the execution of the STOP command. It is necessary to reset the faults or disable the drive for the servo to exit this condition.
3 = Disable drive	The alarm will be indicated together with the execution of the disable command.

The followings events are considered communication errors:

Serial Communication (RS232/RS485):
- Alarm A00128/Fault F00028: timeout of the serial interface.

P00663 – WATCHDOG SERIAL

Range:	0.0 to 999.0s	**Default:** 0.0
Properties:	RW	

Description:
It allows programming a time for the detection of the communication error via serial interface. 1 - In case the servo drive does not receive valid telegrams for a period longer than that adjusted in this parameter, it will be assumed a communication error occurred, the alarm A128 will be displayed on the HMI (or fault F228, depending on the settings on P0313) and the action programmed on P0313 will be executed.

After energized, the servo drive will begin counting this time from the first valid telegram received. The value 0,0 disables this function.

P00664 – SAVE PARAMETERS IN NON-VOLATILE MEMORY

Range:	0 = Parameter is not saved in non-volatile memory 1 = Parameter is saved in non-volatile memory	**Default:** 1
Properties:	RW	

Description:
It allows selecting if the writing of parameters via serial must save the content of the parameters in the non-volatile memory (EEPROM) or not. When using the Modbus protocol, it is only this parameter that determines if the parameters written via serial will be saved or not in the non-volatile memory. However, when using the WEGTP protocol, it must be observed that the information about saving or not the parameter in the EEPROM is contained in the telegram code byte. In order to save them in non-volatile memory via WEGTP, it is necessary that these two pieces of information, the telegram code byte and the parameter P00664, be true.

NOTE!
This type of memory features a limited number of records (100,000 times). Depending on the application, this limit can be exceeded if some parameters are written cyclically via serial (speed, torque reference, etc). In these cases, it may be desired that, during the operation of the servo drive, the writing via serial does not save the content of the parameters in non-volatile memory so as not to exceed the number of writings on the servo drive.

NOTE!
This parameter does not apply when writing is performed using the USB interface.

P00667 – SAVE ON MARKERS

Range :	0 = Reads and writes normally the content on the corresponding parameter 1 = Reads and writes content in volatile WORD markers from the MW13000	**Default:** 0
Properties:	RW	

Description:
Property verified when parameter is written and read via serial. It selects whether the content to be written/read must be saved on parameter or in volatile WORD marker.

NOTE!
If this parameter P00667 = 1, when writing in parameter P00105 = 30 via serial, the content of the parameter will be stored in the Word marker 13105 (Initial MW + Even_number => 13000 + 105). Therefore, MW13105 = 30.

Note: Once P00667 = 1, it cannot be changed via serial. Because when trying to write in parameter P00667, you will be writing in Word marker P13667.

4 WEGTP PROTOCOL

WEGTP was developed in order to enable communication with PLCs of the TP line. But due to its flexibility and ease of use, it has been used in other applications, being often implemented on PLCs and other systems for control and monitoring of WEG equipment.

In these documents are defined the message formats used by the elements that are part of WEGTP network, services (or functions) which can be accessed via network, and also how these elements exchange data in the network.

4.1 ADDRESSING IN WEGTP PROTOCOL

For WEGTP protocol, during the telegram transmission, the address selected in the address parameter of the servo drive in the serial communication is represented by an ASCII character, according to the following table:

Table 4.1: *WEGTP Address for the WEGTP protocol*

Address	ASCII	hexadecimal	Address	ASCII	hexadecimal
0	@	0x40	16	P	0x50
1	A	0x41	17	Q	0x51
2	B	0x42	18	R	0x52
3	C	0x43	19	S	0x53
4	D	0x44	20	T	0x54
5	E	0x45	21	U	0x55
6	F	0x46	22	V	0x56
7	G	0x47	23	W	0x57
8	H	0x48	24	X	0x58
9	I	0x49	25	Y	0x59
10	J	0x4A	26	Z	0x5A
11	K	0x4B	27	[	0x5B
12	L	0x4C	28	\	0x5C
13	M	0x4D	29	]	0x5D
14	N	0x4E	30	^	0x5E
15	O	0x4F	31	_	0x5F

Addresses to perform special tasks:

- Address 0: any servo drive is queried, regardless of its address. There must be only one servo drive connected to the network (point-to-point) to prevent any short circuits in the interface lines.
- Address 31: a command can be transmitted simultaneously to all the network servo drives, without recognition of acceptance.

4.2 PROTOCOL FIELDS

- STX: Byte of “Start of Transmission”: Value: 0x02 (hexadecimal); 2 (decimal).
- ETX: Byte of “End of Transmission”: Value: 0x03 (hexadecimal); 3 (decimal).
- ADR: Byte of the servo drive address in the network
  Range of Values: 0x41 (hexadecimal); 65 (decimal); ‘A’ (ASCII) ... 0x5E (hexadecimal); 94 (decimal); ‘^’ (ASCII) ➔ Represent the values from 1 ... 30 programmed in the parameter of the servo drive address.
  Special 1: 0x40 (hexadecimal); 64 (decimal); ‘@’ (ASCII) ➔ Allows the writing or reading of all the devices connected to the network.
  Special 2: 0x5F (hexadecimal); 95 (decimal); ‘_’ (ASCII) ➔ Allows the writing on all the devices connected to the network without answer of acceptance or refusal.

- COD: Byte of the Telegram Code
  Reading : 0x3C (hexadecimal); 60 (decimal); ‘<’ (ASCII) ...
  Writing: 0x3D (hexadecimal); 61 (decimal); ‘=’ (ASCII) without saving the parameter in the EEPROM
  Writing: 0x3E (hexadecimal); 62 (decimal); ‘>’ (ASCII) saving the parameter in the EEPROM

- BCC: Longitudinal Checksum Byte of the telegram, i.e., OR EXCLUSIVE among all bytes of the telegram. Size of 1 byte (0x00 ... 0xFF hexadecimal)

- DMW: "Data Master Write". Four writing bytes that the master sends to the slave, and the first two represent the parameter and/or the basic variable and the last two the value to be written in this parameter.
  PH: Byte representing the high part of the parameter
  PLo: Byte representing the low part of the parameter
  VHi: Byte representing the high part of the value to be written
  VLo: Byte representing the low part of the value to be written
  Example: Write 2000 rpm on the speed reference (P0121) ➔ PHI = 0x00 (hexadecimal), PLo = 0x79 (hexadecimal), VHI = 0x07 (hexadecimal), VLo = 0xD0 (hexadecimal).

- DMR: "Data Master Read". Two reading bytes that the master sends to the slave which represent the parameter to be read.
  PHi: Byte representing the high part of the parameter
  PLo: Byte representing the low part of the parameter
  Example: Read the value contained in the parameter of the status of the DIs (P0008) ➔ PHi = 0x00 (hexadecimal), PLo = 0x08 (hexadecimal).

- NUM: Byte that represents the number of DMW or DMR to be transmitted, according to the telegram COD. Range of Values: 1 ... 6 (decimal)

- DSV: "Data Slave Value". Two bytes that the slave sends to the master after a request of a reading telegram from the master, representing the value contained in the requested parameter.
  VHi: Byte representing the high part of the value to be written
  VLo: Byte representing the low part of the value to be written
  Example: Response to the request of reading the enabling parameter (P0099) ➔ VHi = 0x00 (hexadecimal), VLo = 0x01 (hexadecimal), informing that the servo drive is enabled.

- ACK: Acceptance byte of the slave after a writing of the master
  Value: 0x06 (hexadecimal); 6 (decimal);

- NAK: Refusal byte of the slave after a reading or writing of the master. It can occur when the master requests the writing or reading of a non-existing parameter or the value to be written in the parameter is outside the allowed adjustable range,
  Value: 0x15 (hexadecimal); 21 (decimal);

4.3 TELEGRAM FORMAT

The formats of the reading and writing telegrams in parameters are presented below. It is important to note that each telegram in the WEGTP protocol allows the reading or writing of up to 6 parameters at a time. Telegrams that feature error in the format or incorrect BCC will be ignored by the servo drive, which will not send answer to the master.

NOTE!
The writing time in the EEPROM is 10ms per parameter, so it is necessary to take care for not overloading the servo drive with many telegrams in a row, because this can cause the servo drive to ignore the last telegrams so as to have the time to write all parameters in the EEPROM (when that occurs the servo drive indicates alarm 107).

NOTE!
The number of writings on the EEPROM limits its useful life; therefore, it is recommended not to save on the EEPROM parameters which are written many times a day. The user must save on EEPROM only those parameters in which this action is really necessary.

4.3.1 Reading telegram

Master:

STX	ADR	COD	NUM	DMR	...	DMR	ETX	BCC

- COD: code for reading → 0x3C (hexadecimal); 60 (decimal); '<' (ASCII)
- NUM: number of parameters read. Range from 1… 6.
- DMR: Number of the requested parameter. The number of DMRs must be equal the value set in the NUM byte.

Slave:

ADR	DSV	...	DSV	BCC

or

ADR	NAK

- DSV: value of the requested parameter. The number of DSVs is equal to the value set in the NUM byte

Remembering that:

DMR	
PHi	PLo

DSV	
VHi	VLo

4.3.2 Writing telegram

Master:

STX	ADR	COD	NUM	DMW	...	DMW	ETX	BCC

- COD: code for writing
  0x3E (hexadecimal); 62 (decimal); '>' (ASCII)→ saving on the EEPROM
  0x3D (hexadecimal); 61 (decimal); '=' (ASCII)→ without saving on the EEPROM
- NUM: number of parameters written. Range from 1… 6.
- DMW: number and content for the parameter. The number of DMWs must be equal to the value set in the NUM byte.

Slave:

ADR	ACK

or

ADR	NAK

Remembering that:

DMW			
PHi	PLo	VHi	VLo

4.4 EXAMPLE OF TELEGRAMS USING THE WEGTP PROTOCOL

All the following examples consider that the servo drive is programmed with the address 1, then the field ADR is set for 41.

Example 1: reading of two parameters of the servo drive:
- Servomotor speed: P0002 (assuming P0002 at 1200rpm = 0x04B0).
- Status of the servo drive - P0006 (assuming P0006 at 1 = 0x0001).

Master:

0x02	0x41	0x3C	0x02	0x00	0x02	0x00	0x06	0x03	0x7A
STX	ADR	COD	NUM	DMR:P0002		DMR:P0006		ETX	BCC
				Parâmetro		Parâmetro			

Slave:

0x41	0x04	0xB0	0x00	0x01	0xF4
ADR	DSV:1200		DSV:1		BCC
	Valor		Valor		

Example 2: change the servo drive to ladder mode:

- For this, it is necessary to put the parameter P0202 in 4.
- Writing telegram saving on the EEPROM.
- P0202 = 4 (202 in decimal = 0x00CA, 4 in decimal = 0x0004)

Master:

0x02	0x41	0x3E	0x01	0x00	0xCA	0x00	0x04	0x03	0xB1
STX	ADR	COD	NUM	DMW: P0202 = 4				ETX	BCC
				Parâmetro		Valor			

Slave:

0x41	0x06
ADR	ACK

5 FAULTS AND ALARMS RELATED TO WEGTP COMMUNICATION

A00128/F00028 – TIMEOUT AT THE TELEGRAM RECEPTION

Description:

Alarm that indicates serial communication fault. It indicates the equipment stopped receiving valid serial telegrams for a period longer than that set on P00663.

Actuation:

The parameter P00663 allows setting a time within which the servo drive must receive at least one valid telegram via serial RS485 interface – with correct address and error checking field – otherwise it will be considered that there was a problem in serial communication. The time starts to be counted after receiving the first valid telegram. This function can be used for any serial protocol supported by the servo drive.

After identifying the timeout in the serial communication, it will be signaled, through the HMI, the alarm message A00128 - or fault F00028, depending on the setting on P00662. For alarms, in case the communication is restored, the alarm indication will be removed from the HMI.

Possible Causes/Correction:

- Check network installation, broken cable or fault/poor contact on the connections with the network/grounding.
- Ensure the master always sends telegrams to the equipment in a time shorter than that set on P00663.
- Disable this function on P00663.

I. APPENDICES

APPENDIX A. ASCII TABLE

Table I.1: *ASCII Characters*

Dec	Hex	Chr		Dec	Hex	Chr	Dec	Hex	Chr	Dec	Hex	Chr
0	00	NUL	(Null char.)	32	20	Sp	64	40	@	96	60	`
1	01	SOH	(Start of Header)	33	21	!	65	41	A	97	61	a
2	02	STX	(Start of Text)	34	22	"	66	42	B	98	62	b
3	03	ETX	(End of Text)	35	23	#	67	43	C	99	63	c
4	04	EOT	(End of Transmission)	36	24	$	68	44	D	100	64	d
5	05	ENQ	(Enquiry)	37	25	%	69	45	E	101	65	e
6	06	ACK	(Acknowledgment)	38	26	&	70	46	F	102	66	f
7	07	BEL	(Bell)	39	27	'	71	47	G	103	67	g
8	08	BS	(Backspace)	40	28	(	72	48	H	104	68	h
9	09	HT	(Horizontal Tab)	41	29	)	73	49	I	105	69	i
10	0A	LF	(Line Feed)	42	2A	*	74	4A	J	106	6A	j
11	0B	VT	(Vertical Tab)	43	2B	+	75	4B	K	107	6B	k
12	0C	FF	(Form Feed)	44	2C	,	76	4C	L	108	6C	l
13	0D	CR	(Carriage Return)	45	2D	-	77	4D	M	109	6D	m
14	0E	SO	(Shift Out)	46	2E	.	78	4E	N	110	6E	n
15	0F	SI	(Shift In)	47	2F	/	79	4F	O	111	6F	o
16	10	DLE	(Data Link Escape)	48	30	0	80	50	P	112	70	p
17	11	DC1	(Device Control 1)	49	31	1	81	51	Q	113	71	q
18	12	DC2	(Device Control 2)	50	32	2	82	52	R	114	72	r
19	13	DC3	(Device Control 3)	51	33	3	83	53	S	115	73	s
20	14	DC4	(Device Control 4)	52	34	4	84	54	T	116	74	t
21	15	NAK	(Negative Acknowledgement)	53	35	5	85	55	U	117	75	u
22	16	SYN	(Synchronous Idle)	54	36	6	86	56	V	118	76	v
23	17	ETB	(End of Trans. Block)	55	37	7	87	57	W	119	77	w
24	18	CAN	(Cancel)	56	38	8	88	58	X	120	78	x
25	19	EM	(End of Medium)	57	39	9	89	59	Y	121	79	y
26	1A	SUB	(Substitute)	58	3A	:	90	5A	Z	122	7A	z
27	1B	ESC	(Escape)	59	3B	;	91	5B	[	123	7B	{
28	1C	FS	(File Separator)	60	3C	<	92	5C	\	124	7C	|
29	1D	GS	(Group Separator)	61	3D	=	93	5D	]	125	7D	}
30	1E	RS	(Record Separator)	62	3E	>	94	5E	^	126	7E	~
31	1F	US	(Unit Separator)	63	3F	?	95	5F	_	127	7F	DEL

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