Spectroradiometer CS-2000

Communication Specifications

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Konica Minolta Sensing, Inc.
3-91, Daisennishimachi, Sakai-ku, Sakai-shi, Osaka, JAPAN
http://www.konicaminolta.com/selector/instruments.html

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Table of Contents

1 Communication Settings

Communication with the CS-2000 is performed via a USB1.1 CDC (communications device class). Therefore, communication with a PC can be performed with the instrument configured as using a COM port. The standard settings are as follows:

Baud rate	9,600
Data length	8 bits
Parity	None
Stop bits	1
Flow control	None
Delimiter	CR (0x0D), LF (0x0A), or CR+LF (0x0D 0x0A)

Installation of the USB driver for connecting the CS-2000 is performed using the file kmsecs2000.inf. This file is installed on the computer when the CS-S10w software included with the CS-2000 as a standard accessory is installed.
When the CS-2000 is connected to the computer and the Found New Hardware Wizard appears, specify the folder in which CS-S10w was installed as the driver location.

2 Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER02	Measurement error
ER05	No user calibration values
ER10	Over measurement range
ER17	Parameter error
ER20	No data
ER30	Flash memory error
ER51	CCD Peltier abnormality
ER52	Temperature count abnormality
ER71	Outside synchronization signal range
ER81	Shutter operation abnormality
ER82	Internal ND filter operation malfunction
ER83	Measurement angle abnormality
ER99	Program abnormality

3 Command details

MEAS (Measure)

Function

Performs only measurement (measurement data are not output)

Input/Output Format

PC		CS-2000
(Normal measurement)		
"MEAS,1" + *Delimiter code*	⇨	(Instrument performs pre-measurement.)
	⇦	"*Error-check code*,*1*" + *Delimiter code* (Instrument starts actual measurement.)
	⇦	"*Error-check code*" + *Delimiter code* (Measurement completed.)
(Canceled measurement)		
"MEAS,1" + *Delimiter code*	⇨	(Instrument performs pre-measurement.)
	⇦	"*Error-check code*,*1*" + *Delimiter code* (Instrument starts actual measurement.)
"MEAS,0" + *Delimiter code*	⇨	(Measurement is canceled.)
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
	Command parameter	0: Cancel measurement 1: Start measurement

Response Parameters

	Meaning	Details/range
1	Measurement time	002 to 242: 3-character string indicating measurement time in seconds determined by pre-measurement

Explanation

Performs measurement.
Measurement starts when MEAS,1 is input. A pre-measurement is taken to determine the required measurement time (and notification of this time is sent from the CS-2000 to the PC) and then the actual measurement begins automatically. When measurement has been completed, the instrument returns an error-check code (OK00 if measurement was completed successfully).
To cancel a measurement in progress, MEAS,0 can be input after the pre-measurement has been completed.
No commands will be accepted during pre-measurement.
During actual measurement, commands other than MEAS,0 will result in a response of ER00.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER10	Over measurement range
ER17	Parameter error (including receipt of MEAS,0 when measurement is not in progress)
ER83	Measurement area abnormality

MEDR (Measurement Data Read)

Function

Reads measurement data from instrument.

Input/Output Format

PC	CS-2000

(For normal measurement)

"MEDR,1,2,3" + *Delimiter code* ⇨

⇦ "*Error-check code*,1" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Data mode	0: Measurement conditions 1: Spectral data 2: Colorimetric data
2	Data format	0: Alphanumeric 1: Hexadecimal (IEEE floating point format: 4-byte big-endian hexadecimal string)
3	Data block number	Stored data block number to be read. For spectral data: 01: 100 pieces of data from 380 to 479nm 02: 100 pieces of data from 480 to 579nm 03: 100 pieces of data from 580 to 679nm 04: 101 pieces of data from 680 to 780nm For colorimetric data: 00: All colorimetric data 01: X,Y,Z 02: x, y, Lv 03: u',v',Lv 04: T, Δuv, Lv 05: λd, Pe,Lv 11: X10,Y10,Z10 12: x10, y10, Lv10 13: u'10,v'10,Lv10 14: T10, Δuv10, Lv10 15: λd10, Pe10,Lv10 100: Le 101: Lv

Response Parameters

	Meaning	Details/range
1	Output data	When Data mode=0 (Measurement conditions): Speed mode: 0: Normal 1: Fast 2: Multi 3: Manual Sync mode: 0: No sync 1: Internal sync 2: External sync Integration time:

		9-character text value in units of µsec Internal ND filter: 0: Off 1: On Close-up lens: 0: None 1: Attached External ND filter: 0: None 1: Attached Measurement angle: 0: 1° 1: 0.2° 2: 0.1° User calibration channel: 00 (No user calibration) to 10
		When Data mode=1 (Spectral data): Data are output in blocks of 100 pieces (except for block 4, which is a block of 101 pieces) Each piece of data is 8-byte ASCII data (4-byte floating data converted to ASCII code), separated by commas.
		When Data mode=2 (Colorimetric data): For each data block number, data are output as follows: 00: All colorimetric data are output in the following order: Le, Lv, X, Y, Z, x, y, u', v', T, Δuv, λd, Pe, X10, Y10, Z10, x10, y10, u'10, v'10, T10, Δuv10, λd10, Pe10 01: X,Y,Z 02: x, y, Lv 03: u',v',Lv 04: T, Δuv, Lv 05: λd, Pe,Lv 11: X10,Y10,Z10 12: x10, y10, Lv10 13: u'10,v'10,Lv10 14: T10, Δuv10, Lv10 15: λd10, Pe10,Lv10 100: Le 101: Lv Data are 8-byte ASCII data (4-byte floating data converted to ASCII code); comma-delimited. For parameters other than 00, data are output in the order of the variables stated above.

Explanation

Data are read from the instrument.
Data are output as comma-delimited.
When measurement button is enabled:

- Reading all 4 blocks of spectral data or reading any set of colorimetric data clears the measurement data from the instrument's buffer.
- If an error occurs during measurement, the corresponding error-check code is output but no measurement data are output. When the error-check code is read, measurement data are cleared from the instrument's buffer.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER02	Measurement error (only when measurement button is enabled)
ER10	Over measurement range (only when measurement button is enabled)
ER17	Parameter error
ER20	No data

ER51	CCD Peltier abnormality (only when measurement button is enabled)
ER52	Temperature count abnormality (only when measurement button is enabled)
ER71	Outside synchronization signal range (only when measurement button is enabled)
ER83	Measurement area abnormality (only when measurement button is enabled)

SPMS (Speed Mode Set)

Function

Sets speed mode of the instrument.

Input/Output Format

PC		CS-2000
(For Speed mode of Normal or Fast)		
"SPMS,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*
(For Speed mode of Multi)		
"SPMS,*1*,*2*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*
(For Speed mode of Manual)		
"SPMS,*1*,*3*,*4*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Speed mode	0: Normal 1: Fast 2: Multi 3: Manual
2	Integration time for Speed mode: 2 (Multi)	01 to 16: Integration time in seconds to ensure stable measurements using Multi mode
3	Integration time for Speed mode: 3 (Manual)	000005000 to 120000000: 9-character alphanumeric value for integration time in µsec. Use leading 0 if necessary to achieve length of 9 characters.
4	Internal ND filter On/Off for Speed mode: 3 (Manual)	0: Off 1: On

Response Parameters

	Meaning	Details/range

Explanation

Sets Speed mode of instrument. Settings are stored in flash memory, and are therefore maintained even if instrument is switched off.
When Speed mode is set to 3 (Manual), the On/Off setting for the internal ND filter is not reflected immediately upon receipt of this command. The setting is reflected at the time of measurement. After measurement, the internal ND filter is left in the last used position (to minimize unnecessary movement of the ND filter).

Error-check codes

Code	Meaning

OK00	Command was processed normally
ER00	Invalid command string or number of parameters received. For Speed mode = 0 or 1, integration time was also input. For Speed mode = 2, integration time was not input. For Speed mode = 3, integration time and/or internal ND filter On/Off was not input
ER17	Parameter error Speed mode set to a value outside of the range 0 to 3 (inclusive) Integration time was set to a value outside the setting range.
ER30	Flash memory error

SPMR (Speed Mode Read)

Function

Reads speed mode of the instrument.

Input/Output Format

PC	CS-2000
(For Speed mode of Normal or Fast) "SPMR" + *Delimiter code* ⇨	⇦ "*Error-check code*,*1*" + *Delimiter code*
(For Speed mode of Multi) "SPMR" + *Delimiter code* ⇨	⇦ "*Error-check code*,*1*,*2*" + *Delimiter code*
(For Speed mode of Manual) "SPMR" + *Delimiter code* ⇨	⇦ "*Error-check code*,*1*,*3*,*4*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	Speed mode	0: Normal 1: Fast 2: Multi 3: Manual
2	Integration time for Speed mode: 2 (Multi)	01 to 16: Integration time in seconds to ensure stable measurements using Multi mode
3	Integration time for Speed mode: 3 (Manual)	000005000 to 120000000: 9-character alphanumeric value for measurement time in µsec. Use leading 0 if necessary to achieve length of 9 characters.
4	Internal ND filter On/Off for Speed mode: 3 (Manual)	0: Off 1: On

Explanation

Reads Speed mode of instrument.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER30	Flash memory error

SCMS (Sync Mode Set)

Function

Sets sync (synchronization) mode of the instrument.

Input/Output Format

PC	CS-2000
(For Sync mode of No sync or External sync) "SCMS,*1*" + *Delimiter code*	⇨
	⇦ "*Error-check code*" + *Delimiter code*
(For Sync mode of Internal) "SCMS,*1*,*2*" + *Delimiter code*	⇨
	⇦ "*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Sync mode	0: No sync 1: Internal sync 2: External sync
2	Synchronization frequency for Sync mode: 1 (Internal sync)	2000 to 20000: Synchronization frequency for internal sync. 5-digit value of 100× actual value (Actual range: 20.00 to 200.00Hz) If value is not 5 digits, value should be preceded by a space (20h) to make it 5 digits.

Response Parameters

	Meaning	Details/range

Explanation

To obtain stable measurements of periodic light sources, it is necessary to set the integration time according to the periodic frequency of the light source.
When Sync mode is set to 1 (Internal sync), the integration time is set according to the synchronization frequency that is input as the second parameter.
When Sync mode is set to 2 (External sync), the integration time is set according to the synchronization signal input via the external sync terminal.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Sync mode set to a value outside of the range 0 to 2 (inclusive) Synchronization frequency was set to a value outside the setting range.

SCMR (Sync Mode Read)

Function

Reads sync (synchronization) mode of the instrument.

Input/Output Format

PC		CS-2000
(For Sync mode of No sync or External sync)		
"SCMR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*" + *Delimiter code*
(For Sync mode of Internal)		
"SCMR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*,*2*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	Sync mode	0: No sync 1: Internal sync 2: External sync
2	Synchronization frequency for Sync mode: 1 (Internal sync)	2000 to 20000: Synchronization frequency for internal sync. 5-digit value of 100× actual value (Actual range: 20.00 to 200.00Hz) If value is not 5 digits, value will be preceded by a space (20h) to make it 5 digits.

Explanation

When Sync mode is set to 1 (Internal sync), the synchronization frequency will also be output as the second parameter.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER30	Flash memory error

BALS (Backlight Control Set)

Function

Sets control of external display backlight during measurement.

Input/Output Format

PC		CS-2000
"BALS,*1*,*2*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	External display backlight normally on/off	0: Off 1: On
2	External display backlight on/off during measurement	0: Off 1: On

Response Parameters

	Meaning	Details/range

Explanation

Controls whether the backlight for the external display (LCD) on the rear of the instrument is on or off normally and during measurement.
Parameter [1] controls whether the backlight is normally on or off. When set to off, the backlight will be lit only when the menu is being used; when measurement values are shown or during measurement, the backlight will be off. When using multiple instruments, this allows the backlight to be switched off so that it does not affect the measurements being taken by other instruments.
Parameter [2] controls whether the backlight is on or off during measurement. This allows the backlight to be switched off only while a measurement is being taken. But since if the backlight is switched off it is difficult to determine when measurement has been completed, the backlight can be set to on.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error (Parameter set to a value outside the setting range of 0 or 1.)

BALR (Backlight Control Read)

Function

Reads the setting for control of external display backlight during measurement.

Input/Output Format

PC		CS-2000
"BALR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*,*2*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	External display backlight normally on/off	0: Off 1: On
2	External display backlight on/off during measurement	0: Off 1: On

Explanation

Reads the setting for control of whether the backlight for the external display (LCD) on the rear of the instrument is on or off normally and during measurement.
For further information, please see the BALS command.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

CSMS (Color Space Mode Set)

Function

Sets the color space to be displayed on the instrument's LCD.

Input/Output Format

PC		CS-2000
"CSMS,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Color space mode	0: Lv, x, y 1: Lv, u', v' 2: Lv, T, Δuv 3: X, Y, Z 4: λd, Pe 5: Spectral graph

Response Parameters

	Meaning	Details/range

Explanation

Sets the color space to be displayed on the LCD at the rear of the instrument.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Color space mode set to a value outside of the range 0 to 5 (inclusive)

CSMR (Color Space Mode Read)

Function

Reads the color space to be displayed on the instrument's LCD.

Input/Output Format

PC	CS-2000
"CSMR" + *Delimiter code*	⇨
	⇦ "*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	Color space mode	0: Lv, x, y 1: Lv, u', v' 2: Lv, T, Δuv 3: X, Y, Z 4: λd, Pe 5: Spectral graph

Explanation

Reads the color space to be displayed on the LCD at the rear of the instrument.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

DIMS (Display Mode Set)

Function

Sets the display mode (absolute or difference) for the instrument's LCD.

Input/Output Format

PC		CS-2000
"DIMS,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Display mode	0: Absolute data display 1: Difference data display

Response Parameters

	Meaning	Details/range

Explanation

Sets the display mode (absolute or difference) for the LCD at the rear of the instrument.
Setting is stored in flash ROM, so it is maintained even if power is switched off.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Display mode set to a value other than 0 or 1.

DIMR (Display Mode Read)

Function

Reads the display mode (absolute or difference) for the instrument's LCD.

Input/Output Format

PC		CS-2000
"DIMR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	Display mode	0: Absolute data display 1: Difference data display

Explanation

Reads the display mode (absolute or difference) for the LCD at the rear of the instrument.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

OBSS (Observer Set)

Function

Sets the observer mode.

Input/Output Format

PC		CS-2000
"OBSS,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Observer	0: 2° 1: 10°

Response Parameters

	Meaning	Details/range

Explanation

Sets the CIE observer mode for colorimetric calculations.
Setting is stored in flash ROM, so it is maintained even if power is switched off.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Observer mode set to a value other than 0 or 1.

OBSR (Observer Read)

Function

Reads the observer mode.

Input/Output Format

PC		CS-2000
"OBSR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	Observer	0: 2° 1: 10°

Explanation

Reads the CIE observer mode for colorimetric calculations.
Setting is stored in flash ROM.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

STDS (Store Data Set)

Function

Stores current measurement data to memory number.

Input/Output Format

PC		CS-2000
"STDS,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Memory number to store data in	00 to 99

Response Parameters

	Meaning	Details/range

Explanation

Copies the just-measured data to the specified memory number.
If data already exists in that memory number, it will be overwritten.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Memory number set to a value outside the range of 00 to 99.
ER20	No data No measurement data available for copying to memory number.

STDR (Stored Measurement Data Read)

Function

Reads stored measurement data from instrument.

Input/Output Format

PC	CS-2000

(For normal measurement)

"MEDR,1,2,3,4" + *Delimiter code* ⇨

⇦ "*Error-check code*,1" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Memory number to read data from	00 to 99
2	Data mode	0: Measurement conditions 1: Spectral data 2: Colorimetric data
3	Data format	0: Alphanumeric 1: Hexadecimal (IEEE floating point format: 4-byte big-endian hexadecimal string)
4	Data block number	Stored data block number to be read. For spectral data: 01: 100 pieces of data from 380 to 479nm 02: 100 pieces of data from 480 to 579nm 03: 100 pieces of data from 580 to 679nm 04: 101 pieces of data from 680 to 780nm For colorimetric data: 00: All colorimetric data 01: X,Y,Z 02: x, y, Lv 03: u',v',Lv 04: T, Δuv, Lv 05: λd, Pe,Lv 11: X10,Y10,Z10 12: x10, y10, Lv10 13: u'10,v'10,Lv10 14: T10, Δuv10, Lv10 15: λd10, Pe10,Lv10 100: Le 101: Lv

Response Parameters

	Meaning	Details/range
1	Output data	When Data mode=0 (Measurement conditions): Speed mode: 0: Normal 1: Fast 2: Multi 3: Manual Sync mode: 0: No sync 1: Internal sync 2: External sync

		Integration time: 9-character text value in units of µsec Internal ND filter: 0: Off 1: On Close-up lens: 0: None 1: Attached External ND filter: 0: None 1: Attached Measurement angle: 0: 1° 1: 0.2° 2: 0.1° User calibration channel: 00 (No user calibration) to 10
		When Data mode=1 (Spectral data): Data are output in blocks of 100 pieces (except for block 4, which is a block of 101 pieces) Each piece of data is 8-byte ASCII data (4-byte floating data converted to ASCII code), separated by commas.
		When Data mode=2 (Colorimetric data): For each data block number, data are output as follows: 00: All colorimetric data are output in the following order: Le, Lv, X, Y, Z, x, y, u', v', T, Δuv, λd, Pe, X10, Y10, Z10, x10, y10, u'10, v'10, T10, Δuv10, λd10, Pe10 01: X,Y,Z 02: x, y, Lv 03: u',v',Lv 04: T, Δuv, Lv 05: λd, Pe,Lv 11: X10,Y10,Z10 12: x10, y10, Lv10 13: u'10,v'10,Lv10 14: T10, Δuv10, Lv10 15: λd10, Pe10,Lv10 100: Le 101: Lv Data are 8-byte ASCII data (4-byte floating data converted to ASCII code); comma-delimited. For parameters other than 00, data are output in the order of the variables stated above.

Explanation

Reads data stored in memory from the instrument.
Data are output as comma-delimited.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Input parameter is outside setting range.
ER20	No data No data are stored in the specified memory channel.

STDD (Store Data Delete)

Function

Deletes data stored in the specified memory number.

Input/Output Format

PC		CS-2000
"STDD,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Memory number to delete data from	00 to 99

Response Parameters

	Meaning	Details/range

Explanation

Deletes data from the specified memory number.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Memory number set to a value outside the range of 00 to 99.
ER20	No data No measurement data in the selected memory number.

STAD (Store All Data Delete)

Function

Deletes data stored in all memory numbers.

Input/Output Format

PC		CS-2000
"STAD" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range

Explanation

Deletes data from all memory numbers.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

TGSL (Target Number Select)

Function

Selects the target number.

Input/Output Format

PC		CS-2000
"TGSL,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Target number	01 to 20

Response Parameters

	Meaning	Details/range

Explanation

Selects the target number to use for displaying color difference when taking measurements with the instrument alone (not connected to computer).

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Target number set to a value outside the range of 01 to 20.

TGSR (Target Number Selection Read)

Function

Reads the currently selected target number.

Input/Output Format

PC		CS-2000
"TGSR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	Target number	00 to 20 00 indicates no target number is selected.

Explanation

Reads the currently selected target number to use for displaying color difference when taking measurements with the instrument alone (not connected to computer).
If 00 is returned, no target number is currently selected.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

TGDS (Target Data Set)

Function

Sets target data in instrument.

Input/Output Format

PC	CS-2000
(For writing target data) "TGDS,1,2,3,4,5" + *Delimiter code*	⇨
	⇦ "*Error-check code*" + *Delimiter code*
(For writing target ID name: Data format=0, Data mode =3) "TGDS,1,2,3,5" + *Delimiter code*	⇨
	⇦ "*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Data format	0: Alphanumeric 1: Hexadecimal (IEEE floating point format: 4-byte big-endian hexadecimal string)
2	Data mode	0: Spectral data 1: Colorimetric data 3: Target ID name
3	Target number	01 to 20
4	Data block number	Data block number to set. For spectral data: 000 to 400: 380nm to 780nm For colorimetric data: 00: All colorimetric data 01: X,Y,Z 02: x, y, Lv 03: u',v',Lv 04: T, Δuv, Lv 05: λd, Pe,Lv 11: X10,Y10,Z10 12: x10, y10, Lv10 13: u'10,v'10,Lv10 14: T10, Δuv10, Lv10 15: λd10, Pe10,Lv10 100: Le 101: Lv
5	Target data	When Data mode=0 (Spectral data): 8-byte ASCII data (4-byte floating data converted to ASCII code).

		When Data mode=1 (Colorimetric data): For each data block number, data should be input as follows: 00: All colorimetric data should be input in the following order: Le, Lv, X, Y, Z, x, y, u', v', T, Δuv, λd, Pe, X10, Y10, Z10, x10, y10, u'10, v'10, T10, Δuv10, λd10, Pe10 01: X,Y,Z 02: x, y, Lv 03: u',v',Lv 04: T, Δuv, Lv 05: λd, Pe,Lv 11: X10,Y10,Z10 12: x10, y10, Lv10 13: u'10,v'10,Lv10 14: T10, Δuv10, Lv10 15: λd10, Pe10,Lv10 100: Le 101: Lv Data are 8-byte ASCII data (4-byte floating data converted to ASCII code); comma-delimited. For parameters other than 00, data are output in the order of the variables stated above.
		When Data mode=3 (Target ID name): Alphanumeric string; Maximum length: 10 characters

Response Parameters

	Meaning	Details/range

Explanation

Sets target data from PC to instrument.
Either spectral or colorimetric data can be set.
When spectral data is set, the colorimetric data are calculated and stored.
If there are no spectral data, only the colorimetric data can be stored.
If only part of spectral data are input, the data are not stored in the flash ROM.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error

TGDR (Target Data Read)

Function

Reads target data in instrument.

Input/Output Format

PC	CS-2000
(For reading target data) "TGDS,*1*,*2*,*3*,*4*" + *Delimiter code*	⇨
	⇦ "*Error-check code*,*1*" + *Delimiter code*
(For reading target ID name: Data format=0, Data mode =3) "TGDS,*1*,*2*" + *Delimiter code*	⇨
	⇦ "*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Target number	01 to 20
2	Data mode	0: Measurement conditions 1: Spectral data 2: Colorimetric data 3: Target ID name
3	Data format	0: Alphanumeric 1: Hexadecimal (IEEE floating point format: 4-byte big-endian hexadecimal string)
4	Data block number	Stored data block number to be read. For spectral data: 01: 100 pieces of data from 380 to 479nm 02: 100 pieces of data from 480 to 579nm 03: 100 pieces of data from 580 to 679nm 04: 101 pieces of data from 680 to 780nm For colorimetric data: 00: All colorimetric data 01: X,Y,Z 02: x, y, Lv 03: u',v',Lv 04: T, Δuv, Lv 05: λd, Pe,Lv 11: X10,Y10,Z10 12: x10, y10, Lv10 13: u'10,v'10,Lv10 14: T10, Δuv10, Lv10 15: λd10, Pe10,Lv10 100: Le 101: Lv

Response Parameters

	Meaning	Details/range
		When Data mode=0 (Measurement conditions): Speed mode: 0: Normal 1: Fast 2: Multi 3: Manual Sync mode: 0: No sync 1: Internal sync 2: External sync Integration time: 9-character text value in units of µsec Internal ND filter: 0: Off 1: On Close-up lens: 0: None 1: Attached External ND filter: 0: None 1: Attached
		When Data mode=1 (Spectral data): Data are output in blocks of 100 pieces (except for block 4, which is a block of 101 pieces) Each piece of data is 8-byte ASCII data (4-byte floating data converted to ASCII code), separated by commas.
		When Data mode=1 (Colorimetric data): For each data block number, data are output as follows: 00: All colorimetric data are output in the following order: Le, Lv, X, Y, Z, x, y, u', v', T, Δuv, λd, Pe, X10, Y10, Z10, x10, y10, u'10, v'10, T10, Δuv10, λd10, Pe10 01: X,Y,Z 02: x, y, Lv 03: u',v',Lv 04: T, Δuv, Lv 05: λd, Pe,Lv 11: X10,Y10,Z10 12: x10, y10, Lv10 13: u'10,v'10,Lv10 14: T10, Δuv10, Lv10 15: λd10, Pe10,Lv10 100: Le 101: Lv Data are 8-byte ASCII data (4-byte floating data converted to ASCII code); comma-delimited. For parameters other than 00, data are output in the order of the variables stated above.
		When Data mode=3 (Target ID name): Alphanumeric string; Maximum length: 10 characters

Explanation

Reads target data from PC to instrument.
Either spectral or colorimetric data can be set.
When spectral data is set, the colorimetric data are calculated and stored.
If there are no spectral data, only the colorimetric data can be stored.
If only part of spectral data are input, the data are not stored in the flash ROM.

Error-check codes

Code	Meaning
OK00	Command was processed normally

ER00	Invalid command string or number of parameters received.
ER17	Parameter error A parameter was set outside the setting range.
ER20	No data No data in the selected target number.

TGDD (Target Data Delete)

Function

Deletes data for the specified target number.

Input/Output Format

PC		CS-2000
"TGDD,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Target number to delete	01 to 20

Response Parameters

	Meaning	Details/range

Explanation

Deletes data for the specified target number.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Memory number set to a value outside the range of 01 to 20.
ER20	No data No data in the selected target number.

TGAD (Target All Data Delete)

Function

Deletes data stored in all target numbers.

Input/Output Format

PC		CS-2000
"TGAD" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range

Explanation

Deletes data from all target numbers.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

IDDR (Identification Data Read)

Function

Reads the product identification information from the instrument's flash ROM.

Input/Output Format

PC		CS-2000
"IDDR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*,*2*,*3*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	Product name	9-byte value Fixed at "CS-2000" for mass-production units. May be different for custom units. If value is less than 9 bytes, space (20h) will be added.
2	Variation code	0 to 9: Used to differentiate models If other than 0 to 9, "*" will be output.
3	Serial number	7-digit integer If serial number is not an integer or exceeds "9999999", "*******" will be output.

Explanation

Reads the product identification information (product name, variation, serial number) from the instrument's flash ROM.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

STSR (Aperture Stop Status Read)

Function

Reads the status of the instrument's aperture stop.

Input/Output Format

PC	CS-2000
"STSR" + *Delimiter code*	⇨
	⇦ "*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	Measurement angle (aperture stop position)	0: 1.0° 1: 0.2° 2: 0.1°

Explanation

Reads the status of the instrument's aperture stop, which determines the measurement angle.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER83	Measurement angle abnormality

RMTS (Remote Mode Select)

Function

Selects the remote mode setting.

Input/Output Format

PC		CS-2000
"RMTS,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Remote mode setting	0: Off (Key mode: commands other than RMTS are not accepted.) 1: On (Communication commands will be accepted.)

Response Parameters

	Meaning	Details/range

Explanation

Sets the remote mode setting.
When remote mode is off (0), the unit is in key mode and will not accept any commands other than RMTS.
When remote mode is on (1), the unit will accept communication commands, and key operations are disabled (with the exception of the measuring button, which can be enabled using the command MSWE).

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

MSWE (Measuring Switch Enable)

Function

Enables/disables the measuring button.

Input/Output Format

PC		CS-2000
"MSWE,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Measuring button status	0: Disabled 1: Enabled

Response Parameters

	Meaning	Details/range

Explanation

Enables/disables the measuring button.
When the measuring button is enabled, measurements can be started by pressing the measuring button, and the measurement results can be read using the command MEDR). When data has been read using MEDR, the data is cleared from the instrument's buffer.
Normal program flow when the measuring button is enabled would be to repeatedly attempt to read data using MEDR: While data is not present, "ER20" (No data) would be output by the instrument; When a measurement is taken by pressing the measuring button and data preparations have been completed, the measurement data will be output by the instrument and then cleared from the instrument's buffer.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

DTCR (Date/Time of Calibration Read)

Function

Reads the date and time of factory calibration.

Input/Output Format

PC		CS-2000
"DTCR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*,*2*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	Date of factory calibration	8 characters indicating year (4 characters), month (2 characters), and day (2 characters) For example, "20070201" means February 1, 2007.
2	Time of factory calibration	6 characters indicating hour (2 characters; 24-hour clock), minute (2 characters), and second (2 characters). For example, "235607" indicates 23:56:07 (11:56:07 PM)

Explanation

Reads the date and time of factory calibration.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.

UCCS (User Calibration Channel Select)

Function

Selects the user calibration channel to use.

Input/Output Format

PC		CS-2000
"UCCS,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	User calibration channel	00 to 10 00: No user calibration 01 to 10: User calibration channel to use

Response Parameters

	Meaning	Details/range

Explanation

Sets the user calibration channel to use when determining measurement data. When set to 00, measurement data are determined based on factory calibration.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER05	No user calibration values
ER17	Parameter error Input user calibration channel is outside the setting range of 00 to 10.
ER99	Program abnormality Error writing to flash ROM

UCCR (User Calibration Channel Read)

Function

Reads the number of the currently selected user calibration channel.

Input/Output Format

PC		CS-2000
"UCCR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	User calibration channel	00 to 10 00: No user calibration 01 to 10: Currently selected user calibration channel

Explanation

Reads the currently selected user calibration channel. 00 indicates no user calibration channel is selected

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER05	No user calibration values

UCPS (User Calibration Parameter Set)

Function

Sets user calibration parameters.

Input/Output Format

PC	CS-2000

Setting user calibration parameters is a three-step process:

Step 1: Send user calibration coefficients (Repeat for each wavelength.)

"UCPS,*1*,*2*,*3*,*4*" + *Delimiter code* ⇨

Step 2: Send user calibration ID name

"UCPS,2,*2*,*5*" + *Delimiter code* ⇨

Step 3: Finalize data and write to flash ROM

"UCPS,3" + *Delimiter code* ⇨

⇦ "*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	User calibration type	0: Wavelength correction 1: Level compensation
2	User calibration channel	01 to 10
3	Wavelength number	000 to 400 (380nm to 780nm) Wavelength for which calibration data will be written.
4	Calibration data	Calibration data for the specified wavelength. For wavelength correction, the corrected wavelength should be input. Range: Nominal wavelength ±2nm; i. e., the correction wavelength should be such that |*(Corrected wavelength) - (Wavelength number + 380)) ≤2| For level compensation, the compensation factor should be input as absolute value, not percentage. (For example, 10% should be written as 0.1f) Range: 0.001 to 1000 Data should be written in hexadecimal (IEEE floating point format: 4-byte big-endian hexadecimal string) format.
5	Calibration channel ID name	Alphanumeric string Length: 10 characters (if name is less than 10 characters, add spaces to achieve 10 characters)

Response Parameters

	Meaning	Details/range

Explanation

Sets user calibration data.
For wavelength correction, Lagrange interpolation is used to convert the data from 380nm to 780nm

based on the specified wavelength shift.
For level compensation, the measured data are multiplied by the compensation factor to obtain the final measurement results.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Parameter set to value outside setting range
ER30	Flash memory error

UCPR (User Calibration Parameter Read)

Function

Reads user calibration parameters for the specified user calibration channel.

Input/Output Format

PC	CS-2000
(To read user calibration coefficients)	
"UCPR,*1*,*2*,*3*" + *Delimiter code* ⇨	
	⇦ "*Error-check code*,*1*" + *Delimiter code*
(To read user calibration ID name)	
"UCPS,2,*2*" + *Delimiter code* ⇨	
	⇦ "*Error-check code*,*2*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	User calibration type	0: Wavelength correction 1: Level compensation
2	User calibration channel	01 to 10
3	Wavelength number	000 to 400 (380nm to 780nm) Wavelength for which calibration data will be written.

Response Parameters

	Meaning	Details/range
1	Calibration data	Calibration data for the specified wavelength. For wavelength correction, the corrected wavelength is output. For level compensation, the compensation factor is output as absolute value, not percentage. (For example, 10% is output as 0.1f) Range: 0.001 to 1000 Data are output in hexadecimal (IEEE floating point format: 4-byte big-endian hexadecimal string) format.
2	Calibration channel ID name	Alphanumeric string Length: 10 characters (if name is less than 10 characters, additional spaces will be used to achieve 10 characters)

Explanation

Reads user calibration data and ID name.
For wavelength correction, Lagrange interpolation is used to convert the data from 380nm to 780nm based on the specified wavelength shift.
For level compensation, the measured data are multiplied by the compensation factor to obtain the final measurement results.
Data should be written for each wavelength.
Once all data have been written and the ID name has been input, the data can be finalized and written to flash ROM according to step 3.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Parameter set to value outside setting range
ER20	No data
ER30	Flash memory error

UCCD (User Calibration Channel Delete)

Function

Deletes data stored in the specified user calibration channel.

Input/Output Format

PC		CS-2000
"UCCD,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	User calibration channel	01 to 10

Response Parameters

	Meaning	Details/range

Explanation

Deletes data from the specified user calibration channel.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Memory number set to a value outside the range of 00 to 99.
ER30	Flash memory error

LNSS (Close-up Lens Status Select)

Function

Selects the status of the close-up lens.

Input/Output Format

PC		CS-2000
"LNSS,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Close-up lens status	0: None 1: Attached

Response Parameters

	Meaning	Details/range

Explanation

Sets whether or not the close-up lens is attached to the instrument.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Memory number set to value other than 0 or 1.
ER30	Flash memory error

LNSR (Close-up Lens Status Read)

Function

Reads the status of the close-up lens.

Input/Output Format

PC		CS-2000
"LNSR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	Close-up lens status	0: None 1: Attached

Explanation

Sets whether or not the close-up lens is attached to the instrument.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER30	Flash memory error

ALFS (Attachment Lens Compensation Factor Set)

Function

Sets compensation factors for attachment lens (closeup lens).

Input/Output Format

PC	CS-2000
Setting compensation factors is a two-step process:	
Step 1: Send compensation factors (Repeat for each wavelength)	
"ALFS,*1*,*2*,*3*" + *Delimiter code*	⇨
Step 2: Finalize data and write to flash ROM	
"ALFS,3" + *Delimiter code*	⇨
	⇦ "*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Measurement angle	0: 1° 1: 0.2° 2: 0.1°
2	Wavelength number	000 to 400 (380nm to 780nm) Wavelength for which compensation factor will be written.
3	Compensation factor	The compensation factor (transmittance data) should be input as absolute value, not percentage. (For example, 10% should be written as 0.1f) Data should be written in hexadecimal (IEEE floating point format: 4-byte big-endian hexadecimal string) format.

Response Parameters

	Meaning	Details/range

Explanation

Sets compensation factor (transmittance data) when using close-up attachment lens.
Data are not written to the flash ROM until "ALFS,3" is sent.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Parameter set to value outside setting range
ER30	Flash memory error

ALFR (Attachment Lens Compensation Factor Read)

Function

Reads compensation factors for attachment lens (closeup lens).

Input/Output Format

PC		CS-2000
"ALFR,*1*,*2*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Measurement angle	0: 1° 1: 0.2° 2: 0.1°
2	Wavelength number	000 to 400 (380nm to 780nm) Wavelength for which compensation factor will be read.

Response Parameters

	Meaning	Details/range
1	Compensation factor	The compensation factor (transmittance data) will be in hexadecimal (IEEE floating point format: 4-byte big-endian hexadecimal string) format.

Explanation

Reads compensation factor (transmittance data) stored in instrument for when close-up attachment lens is used.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Parameter set to value outside setting range
ER20	No data

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NDFS (External ND Filter Select)

Function

Selects which external ND filter (if any) is attached.

Input/Output Format

PC		CS-2000
"NDFS,*1*" + *Delimiter code*	⇨	
	⇦	"*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	External ND filter	0: None 1: ND1 attached 2: ND2 attached

Response Parameters

	Meaning	Details/range

Explanation

Sets which (if any) external ND filter is attached to the instrument.
Setting is stored in flash ROM, and is maintained even if instrument power is switched off.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Memory number set to value other than 0, 1, or 2.
ER30	Flash memory error

NDFR (External ND Filter Read)

Function

Reads which external ND filter (if any) is attached.

Input/Output Format

PC		CS-2000
"NDFR" + *Delimiter code*	⇨	
	⇦	"*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range

Response Parameters

	Meaning	Details/range
1	External ND filter	0: None 1: ND1 attached 2: ND2 attached

Explanation

Reads which (if any) external ND filter is attached to the instrument.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER30	Flash memory error

NFCS (ND Filter Compensation Factor Set)

Function

Sets compensation factors for external ND filter attached to instrument.

Input/Output Format

PC	CS-2000
Setting compensation factors is a two-step process:	
Step 1: Send compensation factors (Repeat for each wavelength)	
"NFCS,1,2,3,4" + *Delimiter code*	⇨
Step 2: Finalize data and write to flash ROM	
"NFCS,3" + *Delimiter code*	⇨
	⇦ "*Error-check code*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Measurement angle	0: 1° 1: 0.2° 2: 0.1°
2	External ND filter number	1: ND1 2: ND2
3	Wavelength number	000 to 400 (380nm to 780nm) Wavelength for which compensation factor will be written.
4	Compensation factor	The compensation factor (transmittance data) should be input as absolute value, not percentage. (For example, 10% should be written as 0.1f) Data should be written in hexadecimal (IEEE floating point format: 4-byte big-endian hexadecimal string) format.

Response Parameters

	Meaning	Details/range

Explanation

Sets compensation factor (transmittance data) when using external ND filter.
Data are stored in both SRAM and flash ROM.
Data are not written to the flash ROM until "NFCS,3" is sent. The same flash ROM sector is used for both ND1 and ND2 compensation data, so a single "NFSC,3" command is sufficient.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Parameter set to value outside setting range
ER30	Flash memory error

NFCR (ND Filter Compensation Factor Read)

Function

Reads compensation factors for external ND filter attached to instrument.

Input/Output Format

PC	CS-2000
"NFCR,*1*,*2*,*3*" + *Delimiter code*	⇨
	⇦ "*Error-check code*,*1*" + *Delimiter code*

Command Parameters

	Meaning	Details/range
1	Measurement angle	0: 1° 1: 0.2° 2: 0.1°
2	External ND filter number	1: ND1 2: ND2
3	Wavelength number	000 to 400 (380nm to 780nm) Wavelength for which compensation factor will be written.

Response Parameters

	Meaning	Details/range
3	Compensation factor	The compensation factor (transmittance data) will be in hexadecimal (IEEE floating point format: 4-byte big-endian hexadecimal string) format.

Explanation

Reads compensation factor (transmittance data) stored in instrument for when external ND filter is attached.

Error-check codes

Code	Meaning
OK00	Command was processed normally
ER00	Invalid command string or number of parameters received.
ER17	Parameter error Parameter set to value outside setting range
ER20	No data
ER30	Flash memory error