SERIAL INTERFACE MANUAL

Sound Level Meter

NL-21/NL-31

RION CO., LTD.

Organization of the NL-21/NL-31 Documentation

The documentation for the Sound Level Meter NL-21/NL-31 consists of three separate manuals.

- Instruction Manual

    Describes operating procedures for the Sound Level Meter NL-21/NL-31, connection and use of peripheral equipment such as a level recorder and printer, and use of the memory card.

- Serial Interface Manual (this document)

    Describes how to use the serial interface built into the Sound Level Meter NL-21/NL-31. The manual covers the communication protocol, use of control commands for the sound level meter, format of data output by the sound level meter, and other topics.

- Technical Notes

    This document provides in-depth information about the circuit configuration and performance of the sound level meter, microphone construction and characteristics, influence of extension cables and windscreen on the measurement, and other topics.

* Company names and product names mentioned in this manual are usually trademarks or registered trademarks of their respective owners.

Contents

Outline

The Sound Level Meter NL-21 and NL-31 incorporate a serial interface. This interface allows the use of a computer to make measurement parameter settings and to control the measurement. It is also possible to send measurement results (current results as well as data stored in the memory of the sound level meter) to the computer for further processing.

This manual describes the use of the RS-232-C interface for interaction with a computer. The manual is divided into the following sections:

- Connection to a Computer
  The separately available interface cable CC-92 is required for connection to a computer.

- Transfer Protocol and Transfer Procedure
  This section explains the RS-232-C interface transfer protocol and the procedure to send and receive data.

- Commands and output data
  In this section, all commands which can be used to control the NL-21/ NL-31 are listed, and command format and functions are explained.
  This section explains how measurement data and stored data are output via the RS-232-C interface.

Connection to a Computer

The illustration below shows how to connect the NL-21/NL-31 to a computer.
Use the separately available interface cable for this connection.

AC / DC
OUT

I/O

POWER

I/O connector

Interface cable CC-92

To RS-232-C interface
of computer
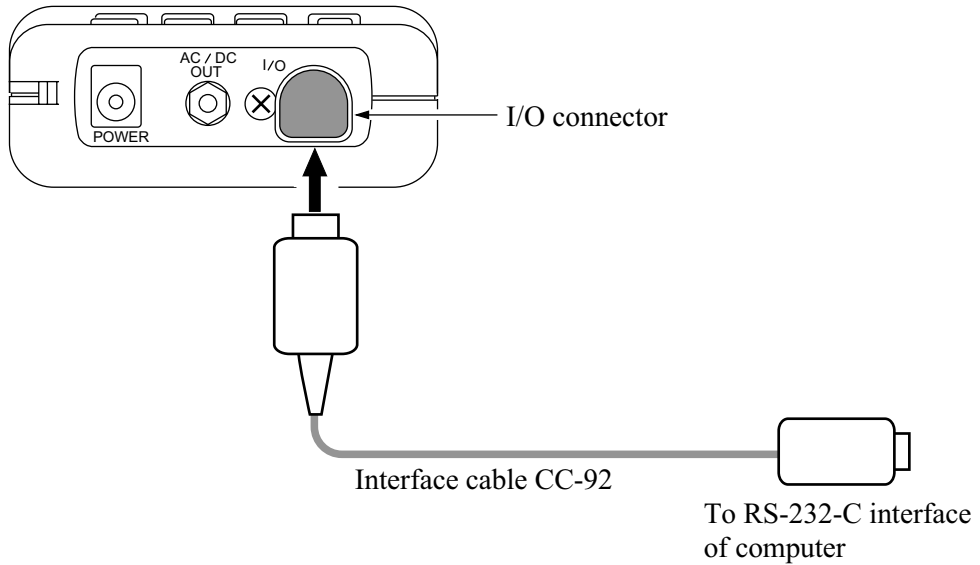
The CC-92 interface cable uses a 9-pin connector (female). The computer-side connector is a HDE-CTF1/HDEB-9S (Hirose Electric).

The cable is available as an option.

Interface cable CC-92
NL-21
NL-31

Computer

Shield

Signal	Pin		Pin
RXD	1		3
CTS	2		7
TXD	3		2
RTS	4		8
$\overline{EN}$	6		5
GND	10		1
			4
			6

Connector
TCP8946-010100
 (Hoshiden Electronics)

Connector
HDEB-9S/HDE-CTF1
 (Hirose Electric)
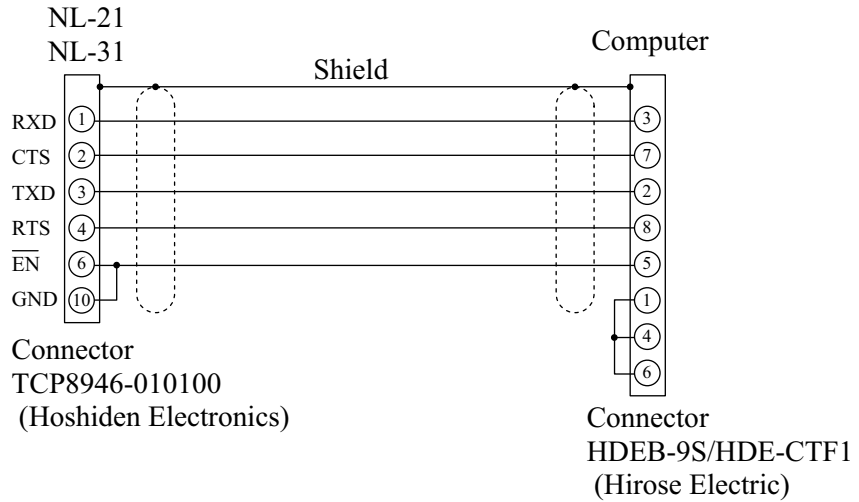
Transfer Protocol and Transfer Procedure

Transfer Protocol

Transfer principle:	full duplex
Sync principle:	asynchronous
Transfer rate:	4800/9600/19200 bps
Data word length:	8 bit
Stop bits:	1 bit
Parity check:	none
X parameter control:	X parameter or RTS/CTS (selectable)
Maximum block size:	256 bytes
Command flow control:	yes/no (selectable)

Remote Mode/Local Mode

Operation mode	Key operation	Communication
Remote	Disabled	Enabled
Local	Enabled	Enabled

Local mode

In this mode, the NL-21/NL-31 is operated with the controls on the unit. This is the default mode after power-on.

Remote mode

In this condition, the controls on the unit are inactive, and the unit only carries out communication with the computer. The indication "Remote" appears on the display.

Indicates remote mode

Display

4
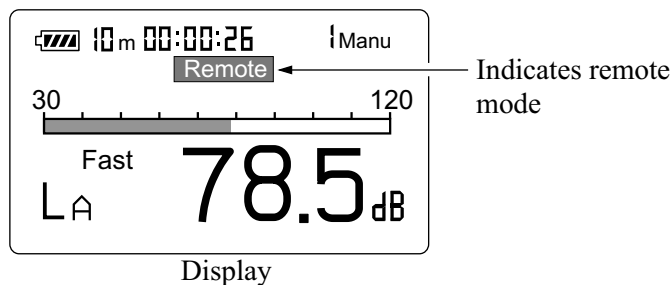
Remote mode/local mode switching

Switching between local mode and remote mode is carried out by a command.

Key operation in remote mode

Only the power key is active. All other keys are disabled.

Transfer Codes

The following codes are used for communication with the unit.

Control codes

Code	Hex notation	Meaning
<ENQ>	05H	Enquire
<ACK>	06H	Acknowledge
<NAK>	15H	Not acknowledge
<STX>	02H	Start block
<ETX>	03H	End block
<CR>	0DH	Terminator (1st character)
<LF>	0AH	Terminator (2nd character)
<SUB>	1AH	Stop
<DC3>	13H	Pause
<DC1>	11H	Restart

Special codes

ATTR	Control code or special code	Block attribute
ID	01H to FFH	Other/own station ID
BCC	00H to FFH	Block check code

Commands, parameters, data
ASCII codes 20H to 7EH

Transfer Format

Command block: Command from computer

<STX>	ID	ATTR	Command	Parameter	<ETX>	BCC	<CR>	<LF>
1	1	1	M	N	1	1	1	1	byte

* ATTR = 'C'

If there are two or more parameters, they are separated by single spaces.

Data response block: Data from sound level meter (response data in ASCII)

<STX>	ID	ATTR	Response data	<ETX>	BCC	<CR>	<LF>
1	1	1	N	1	1	1	1	byte

* ATTR = 'A' or 'Q'

If there are two or more data, they are separated by commas.

Acknowledgment block: Computer or sound level meter

<STX>	ID	ATTR	<ETX>	BCC	<CR>	<LF>
1	1	1	1	1	1	1	byte

* ATTR = <ACK>

Negative Acknowledgment block: Computer or sound level meter

<STX>	ID	ATTR	Error code	<ETX>	BCC	<CR>	<LF>
1	1	1	4	1	1	1	1	byte

* ATTR = <NAK>

Verify other station block: Computer

<STX>	ID	ATTR	<ETX>	BCC	<CR>	<LF>
1	1	1	1	1	1	1	byte

* ATTR = <ENQ>

Stop request block: Computer

<STX>	ID	ATTR	<ETX>	BCC	<CR>	<LF>
1	1	1	1	1	1	1	byte

* ATTR = <SUB>

Stop request code: Computer

```
┌────────┐
│<SUB>   │
└────────┘
    1
```

Pause request with X parameter control: Computer

```
┌────────┐
│<DC3>   │
└────────┘
    1
```

Restart request with X parameter control: Computer

```
┌────────┐
│<DC1>   │
└────────┘
    1
```

ID Number

Outline

When multiple units are connected, ID numbers are used to distinguish between individual units. The ID number range is 1 to 255 (01H to FFH). Numbers are expressed in binary notation. In strings sent out by the computer, the ID selects the unit to be controlled. In strings sent out by the sound level meter, the ID identifies the data source.

Broadcasting

In commands sent from the computer, the ID 00 has a special meaning. It selects all units (broadcast command).

Sound level meter response

The sound level meter responds only to a communication block that contains its own ID. Other blocks are disregarded.

When the ID is 00 (zero), setting commands are processed but no response is returned. Request commands are not processed and no response is returned.

ATTR   Block Attribute

The block attribute information is added by the sender, to facilitate processing of the block at the receiving end.

Code	Meaning
<ACK> 06H	Acknowledge block
<NAK> 15H	Not acknowledge block
<ENQ> 05H	Enquiry block
<SUB> 1AH	Stop request block
<EOT> 03H	End-of-transmission block
'C' 43H	Command block
'A' 41H	Data response block (last block)
'Q' 51H	Data response block (intermediate block)

BCC   Block Check Code

The BCC is calculated by the sender. The receiver applies checksum processing to the same range to verify the block.

Calculation range: From STX to ETX
Calculation method: Exclusive OR sum of range

If the computer sends a block where BCC is set to 00H (NULL), the sound level meter omits block check processing.
This is to allow simple sending from the computer.

Block Reception Processing

For reception processing, the unit is initially in the <STX> wait (standby) mode, except during a sequence while waiting for response from the computer.

Command Types

There are two types of commands: setting commands and request commands.

Setting command

This type of command serves for changing the sound level meter status or measurement parameters. Only some commands of this type will produce a response from the sound level meter. The response consists of status information returned after the setting command has been processed.

Request command

This type of command serves for getting information about unit settings and for obtaining measurement data including display data and stored data. The sound level meter returns the requested data.

Error Processing

Transmission errors

Transmission errors can be detected in the following categories.

Error item	Contents	Measure
Framing error	Character level framing error	Disregard character and wait for next character
Block reset	<STX> received after incomplete block (excluding ID number)	Start block again from that point

Command processing errors

Block format is correct, but command interpretation or processing has resulted in an error.

Error item	Contents	Measure
Undefined command	Command problem	Return error code 0001
Parameter error	Parameter number or value not correct	Return error code 0002
Processing error	Processing cannot be carried out in current state	Return error code 0003
Processing timeout	Timeout interval has elapsed	Return error code 0004

Flow Control

The sound level meter implements X parameter and RTS/CTS flow control. When XON = 1, the X parameter is used to perform control. When XON = 0, RTS/CTS is used to perform control.

X parameter control mode

In the send sequence for multiple blocks, the next block is sent after the computer returns an acknowledge code.
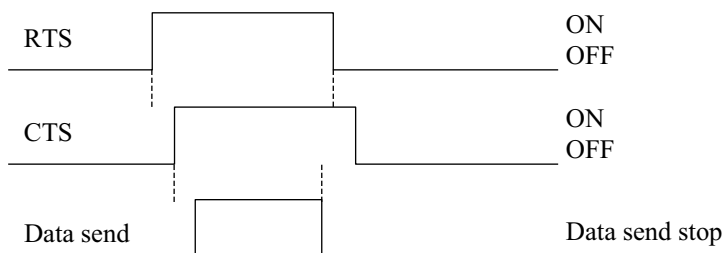
While a block is being sent, the computer cannot interrupt the transmission. RTS and CTS control is not possible.

RTS/CTS control mode
Send

To send data, the sound level meter sets RTS to ON, waits until CTS becomes ON, and then sends the data.

Immediately after sending the data, the sound level meter sets RTS to OFF.

```
RTS                 ┌──────────┐              ON
 ───────────────────┘          └──────────── OFF

CTS                    ┌───────────┐          ON
 ──────────────────────┘           └──────── OFF

Data send              ┌────────┐             Data send stop
 ──────────────────────┘        └──────────
```

When the computer sets RTS to OFF (CTS at sound level meter becomes OFF), sending is interrupted immediately.

Because RTS/CTS control is hardware control, sending can be interrupted also midway in a block.

Sending is not resumed until the computer sets RTS to ON (sound level meter CTS becomes ON).

RTS		ON OFF
CTS		ON OFF
Data send	Pause Restart	Data send stop
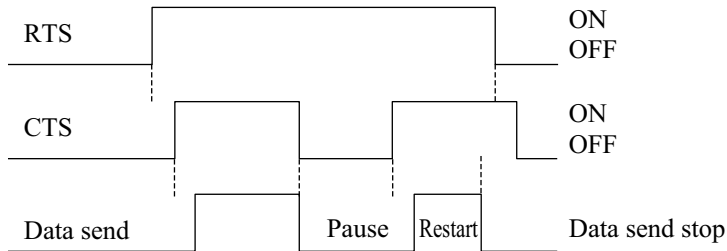
Receive

The sound level meter constantly monitors CTS. CTS = ON while sending is not in progress means that there is a send request from the computer. The sound level meter then sets RTS to ON.

Because no provision is made for receive overflow at the sound level meter, a send request from the computer (sound level meter CTS = ON) always triggers RTS = ON. The sound level meter is always ready for receiving.

When this mode is used, X parameter control is not available.

Transfer Sequence

The transfer sequences are as follows.

[Check other station] sequence

[Setting command without response] sequence

[Setting command with response] sequence

[Request] sequence

[Continuous request] sequence

[Error] sequence

The setting sequence can be selected to have a response or not.

The sample sequences shown below generally assume that the block from the computer comprises the ID of the sound level meter.

[Check other station] sequence

An acknowledge block is returned in response to the [check other station] block. This is an independent sequence. It does not need to come before a command sequence.

```
  Computer                          Sound level meter

         [Check other station] block
         ─────────────────────────────>  Block normal

               [Acknowledge] block
         <─────────────────────────────
```
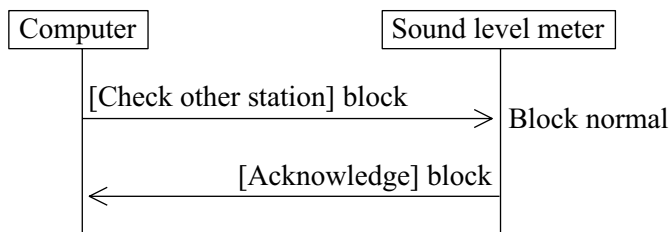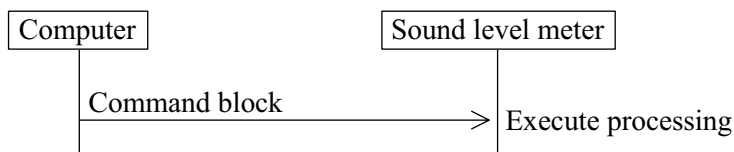
[Setting command without response] sequence

This type of command is executed without producing a response. Because it corresponds to an error code request, the processing result (including error) of the last command is retained.
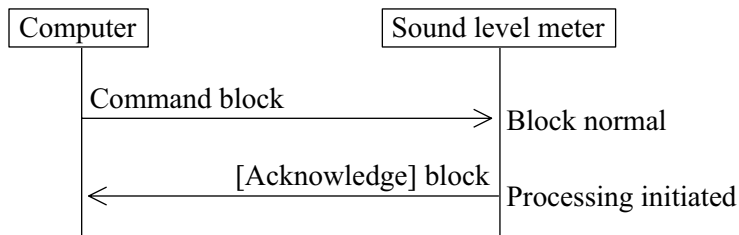
The "RET0" command activates this sequence.

Execute processing

```
  Computer                          Sound level meter

           Command block
         ─────────────────────────────>  Execute processing
```
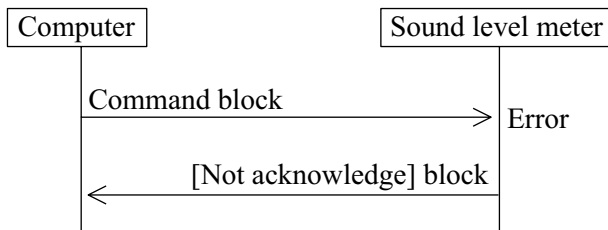
[Setting command with response] sequence

Normal processing

An [acknowledge] response is returned after command processing was initiated. "Initiated" means that for example execution of the "Store" command was started. It does not mean that the store process was completed.
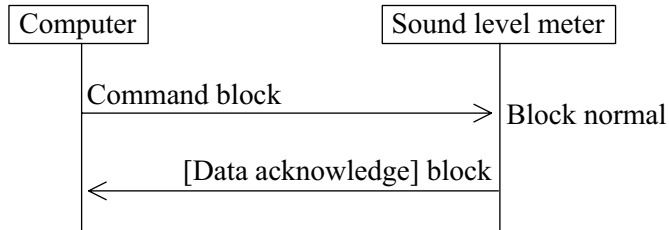
```
┌──────────┐                    ┌────────────────────┐
│ Computer │                    │  Sound level meter │
└──────────┘                    └────────────────────┘
     │          Command block              │
     │────────────────────────────────────▶│ Block normal
     │                                      │
     │         [Acknowledge] block          │
     │�◀─────────────────────────────────── │ Processing initiated
     │                                      │
```

Error processing

When an error has occurred during block or command processing, a [not acknowledge] response is returned.

```
┌──────────┐                    ┌────────────────────┐
│ Computer │                    │  Sound level meter │
└──────────┘                    └────────────────────┘
     │          Command block              │
     │────────────────────────────────────▶│ Error
     │                                      │
     │        [Not acknowledge] block       │
     │◀─────────────────────────────────── │
     │                                      │
```
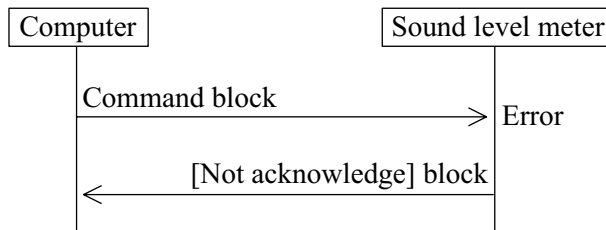
The "RET1" command activates this sequence.

[Request] sequence (1 block)

Normal processing

A response is returned immediately to the request command.

```
┌──────────┐                    ┌──────────────────┐
│ Computer │                    │ Sound level meter │
└──────────┘                    └──────────────────┘
     │         Command block          │
     │───────────────────────────────>│ Block normal
     │      [Data acknowledge] block   │
     │<───────────────────────────────│
     │                                 │
```

Error processing

When an error has occurred during block or command processing, a [not acknowledge] response is returned.

```
┌──────────┐                    ┌──────────────────┐
│ Computer │                    │ Sound level meter │
└──────────┘                    └──────────────────┘
     │         Command block          │
     │───────────────────────────────>│ Error
     │      [Not acknowledge] block    │
     │<───────────────────────────────│
     │                                 │
```

[Request] sequence (multiple blocks)
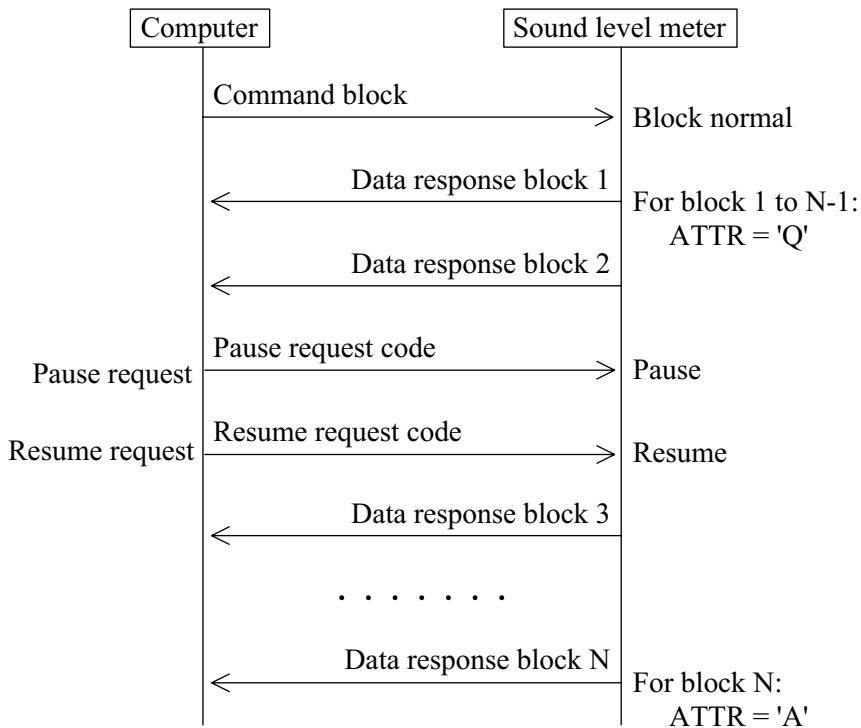### X parameter flow control

Normal processing

In general, there is no need for returning response codes from the computer. The sound level meter sends blocks continuously.

The computer can send a pause request code to pause the transmission, a resume code to resume the transmission, or a stop code to stop the transmission. The sound level meter disregards any other codes that are received. (Processing is not carried out also after stop.)

When sending a pause or stop code to the sound level meter, wait until the current block has been fully sent. (Do not send a pause or stop code in the middle of a block.)

After the last block has been sent or after stop mode was entered, the sound level meter goes into the idling state.

```
        ┌──────────┐                  ┌──────────────────┐
        │ Computer │                  │ Sound level meter │
        └────┬─────┘                  └────────┬─────────┘
             │       Command block             │
             │────────────────────────────────▷│ Block normal
             │                                 │
             │       Data response block 1     │
             │◁────────────────────────────────│ For block 1 to N-1:
             │                                 │     ATTR = 'Q'
             │       Data response block 2     │
             │◁────────────────────────────────│
             │                                 │
Pause request│       Pause request code        │
             │────────────────────────────────▷│ Pause
             │                                 │
Resume request│      Resume request code       │
             │────────────────────────────────▷│ Resume
             │                                 │
             │       Data response block 3     │
             │◁────────────────────────────────│
             │        . . . . . . .            │
             │       Data response block N     │
             │◁────────────────────────────────│ For block N:
             │                                 │     ATTR = 'A'
```

RTS/CTS flow control

When the computer sets RTS to OFF (CTS at sound level meter becomes OFF), sending is interrupted immediately.

Because RTS/CTS control is hardware control, sending can be interrupted also midway in a block.

Sending is not resumed until the computer sets RTS to ON (sound level meter CTS becomes ON).

Continuous request sequence

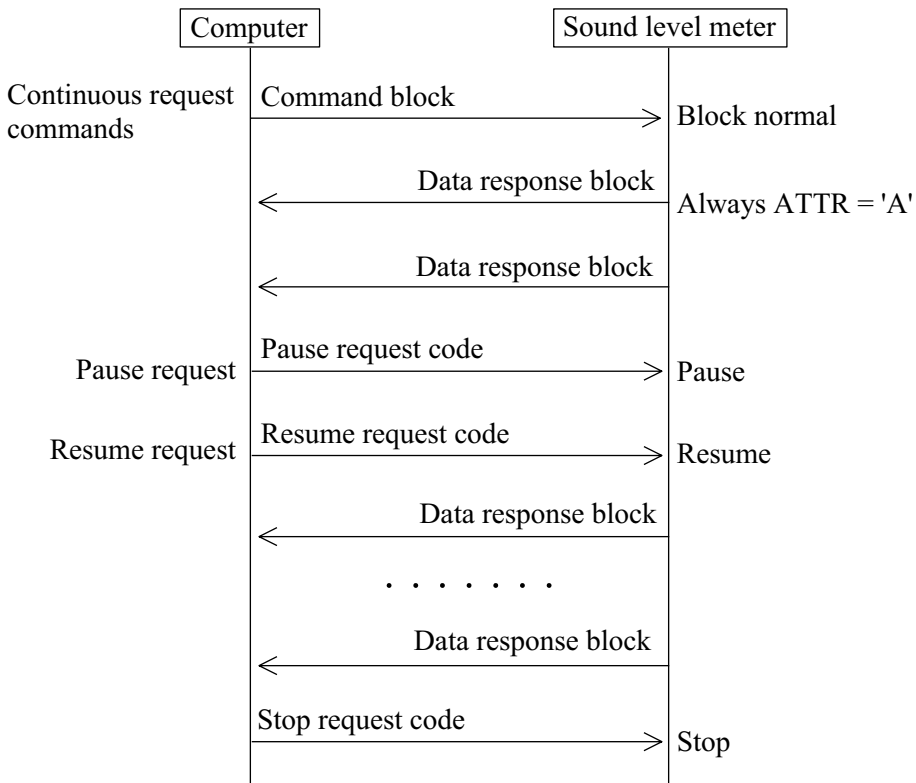This sequence uses only commands to periodically request measurement data.

X parameter flow control

In general, there is no need for returning response codes from the computer. The sound level meter sends blocks periodically.

The computer can send a pause request code to pause the transmission, a resume code to resume the transmission, or a stop code to stop the transmission. The sound level meter disregards any other codes that are received. (Processing is not carried out also after stop.)

When sending a pause or stop code to the sound level meter, wait until the current block has been fully sent. (Do not send a pause or stop code in the middle of a block.)

After he stop mode was entered, the sound level meter goes into the idling state.

Computer		Sound level meter
Continuous request commands	Command block ⟶	Block normal
	⟵ Data response block	Always ATTR = 'A'
	⟵ Data response block	
Pause request	Pause request code ⟶	Pause
Resume request	Resume request code ⟶	Resume
	⟵ Data response block	
	· · · · · · ·	
	⟵ Data response block	
	Stop request code ⟶	Stop

RTS/CTS flow control

When the computer sets RTS to OFF (CTS at sound level meter becomes OFF), sending is interrupted immediately.

Because RTS/CTS control is hardware control, sending can be interrupted also midway in a block.

Sending is not resumed until the computer sets RTS to ON (sound level meter CTS becomes ON).

While interrupted, periodic data do not accumulate, but are overwritten.

Error response

When an error has occurred at the block level, the following error sequence occurs.

After an error response, the unit returns to the idling state and does not continue to send multiple blocks etc.
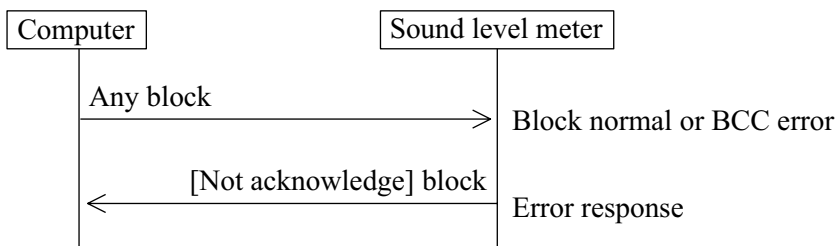
Communication Cutoff

Power Save Mode

When power save mode is enabled, the unit enters the sleep state after the current block has been sent. In the sleep state, the sound level meter does not send or accept commands.

Power Off

During power off processing, communication is terminated after the current block was sent.

Auto Shutdown

Same as power off.

Ratings

Guaranteed Values

Case	Rating	Remarks
Sound level meter response time	Max. 3 s	Processing timeout error response if due to processing reasons
Send character interval	Max. 100 ms	—

Rated Values

Case	Rating	Remarks
Multiple block request sequence ACK wait	10 s	Pause sequence and go into idling state
Send timeout with flow control (except RTS/CTS control)	3 s	Pause sequence and go into idling state
Block generation wait time after receiving <STX>	No limit	—
Receive character interval	No limit	—

Multiple Unit Operation

These specifications also include cases where communication includes several sound level meters of the same type or compatible type. The X parameter and stop request code are received without ID by all units, but during a request sequence, only one unit is supposed to be active and all others are in the idling state, so that processing is carried out normally only by one unit.

When multiple units are connected, observe the following points.

- Do not broadcast request commands. These will be disregarded.
- Do not send a request command sequence simultaneously to multiple units. Wait until processing of a request command sequence at one unit has finished before sending other request commands.

Command List

Commands

Command Format

In this manual, 1 character is represented as "□", a space as "_", parameters as "p1,p2,...", and response data as "d1,d2,...". Parameters and response data may be more than 1 character long.

Commands consists of three letters which are not case-sensitive (upper-case or lower-case can be used).

    □□□

When a command has one parameter, the parameter follows the command. It can be appended to the command either directly or with a separating space.

□□□p1	Acceptable
□□□_p1	Acceptable

When a command has several parameters, the parameters must be separated by a space.

□□□p1_p2	Acceptable
□□□p1p2	Not acceptable

Note
One command block can only contain one command. Do not include several commands in a block.

A request command consists of the command, any required parameter, and a "?". The command and "?" or parameter and "?" may be separated by a space.

□□□?	Acceptable
□□□_?	Acceptable
□□□p1?	Acceptable
□□□1_?	Acceptable

Unless specified otherwise, parameters and response data are of variable length. Depending on the value range, the length of the parameter will differ. There is no need for padding with spaces or other measures.

☐☐☐_1	Acceptable
☐☐☐_10	Acceptable
☐☐☐_01	Not acceptable

Command Send Example

To set frequency weighting to "C"

<STX>	1	C	WGT	1	<ETX>	00	<CR><LF>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

(1) Start of transfer data and command

(2) ID number (hexadecimal). The ID number range is 0 to 255. In a command string, this is expressed as 01 (= ID number 1) to FF (= ID number 255).

Note
ID number should be expressed by binary code "01", not by ASCII code "1".

(3) Attribute ("C" for command)

(4) Command

(5) Parameter (corresponds to p1, p2, etc. in command description section of the manual)

(6) Command end

(7) BCC (Entering 00 disables BCC checking for (1) to (6).)

(8) Transfer data end

Command Description

For details on the transfer format, please refer to page 7.

Basic setting and display commands

BER

Set data exclusion (back-erase) function

BER_p1

    p1 = 0:   Back-erase off

    p1 = 1:   Back-erase on

Transfer format: Command block

Get data exclusion (back-erase) function setting

BER?

    NL-21/NL-31 response data to BER?

        Response data d1

        d1:   Corresponds to p1

Transfer format: Response block

DPI

Set display of various processing values

DPIp1_p2

p1 = 1:	L_{eq}	p1 = 2:	L_E
p1 = 3:	L_{max}	p1 = 4:	L_{min}
p1 = 5:	L_{N1}	p1 = 6:	L_{N2}
p1 = 7:	L_{N3}	p1 = 8:	L_{N4}
p1 = 9:	L_{N5}	p1 = 10:	L_y
			(auxiliary processing)
p1 = 11:	List	p1 = 12:	Time-Level
p2 = 0:	Off	p2 = 1:	On

Operation: Sets p1 display to p2. Toggles the On/Off setting on the display menu.

Transfer format: Command block

Get display setting for various processing values

DPI?

NL-21/NL-31 response data to DPI?

Response data d1,d2,d3,...,dn,...,d12

dn corresponds to pn for the display on/off setting of processing values.

dn = 0:   Off (not displayed)

dn = 1:   On (displayed)

Transfer format: Response block

DSP

Set type of display data

DSPp1

p1 = 1:	L_{eq}	p1 = 2:	L_E
p1 = 3:	L_{max}	p1 = 4:	L_{min}
p1 = 5:	L_{N1}	p1 = 6:	L_{N2}
p1 = 7:	L_{N3}	p1 = 8:	L_{N4}
p1 = 9:	L_{N5}	p1 = 10:	L_y
			(auxiliary processing)
p1 = 11:	List	p1 = 12:	Time-Level

Transfer format: Command block

Get currently displayed processing types

DSP?

NL-21/NL-31 response data to DSP?

Response data d1

dn = 1 to 12: Displayed processing types

Transfer format: Response block

LXI

Set percentile level

LXIp1_p2

    p1 = 1 to 5:   Specify number out of 5

    p2 = 1 to 99:   Specify percentage

Transfer format: Command block

Get percentile level settings

LXI?

NL-21/NL-31 response data to LXI?

    Response data d1,d2,d3,d4,d5: Percentage for five settings

    d1 to d5:   Corresponds to p2

Transfer format: Response block

LYY

Set auxiliary processing type

LYYp1

p1 = 0:	L_{Ceq}	p1 = 1:	L_{Cpeak}
p1 = 2:	L_{peak}	p1 = 3:	L_{AI}
p1 = 4	L_{AIeq}		
p1 = 5:	L_{Atm5}		

Transfer format: Command block

Get auxiliary processing type

LYY?

NL-21/NL-31 response data to LYY?

    Response data d1

    d1 = 0 to 5:   Auxiliary processing type

Transfer format: Response block

MTI

Set measurement time

MTIp1

p1 = 0:	Arbitrary	p1 = 1 to 3:	Not accepted
p1 = 4:	10 s	p1 = 5:	1 m
p1 = 6:	5 m	p1 = 7:	10 m
p1 = 8:	15 m	p1 = 9:	30 m
p1 = 10:	1 h	p1 = 11:	8 h
p1 = 12:	24 h		

Transfer format: Command block

Get measurement time setting

MTI?

NL-21/NL-31 response data to MTI?

Response data d1

d1:   Corresponds to p1

Transfer format: Response block

RNG

Set level range

RNGp1

p1 = 7:	*(10 to 70 dB)	p1 = 8:	20 to 80 dB
p1 = 9:	20 to 110 dB	p1 = 10:	20 to 100 dB
p1 = 11:	20 to 110 dB	p1 = 12:	30 to 120 dB
p1 = 13:	40 to 130 dB		

* is valid only if filter (1/1 oct, 1/3 oct, Univ.) is set to On.

Transfer format: Command block

Get level range setting

RNG?

NL-21/NL-31 response to RNG?

Response data d1

d1:   Corresponds to p1

Transfer format: Response block

TMC

Set time weighting for main processing

TMCp1

p1 = 0:   Fast

p1 = 1:   Slow

Transfer format: Command block

Get time weighting setting

TMC?

NL-21/NL-31 response data to TMC?

Response data d1

d1:   Corresponds to p1

Transfer format: Response block

WGT

Set frequency weighting

WGTp1

p1 = 0:   A weighting

p1 = 1:   C weighting

p1 = 2:   FLAT response

Transfer format: Command block

Get frequency weighting setting

WGT?

NL-21/NL-31 response data to WGT?

Response data d1

d1:   Corresponds to p1

Transfer format: Response block

Operation commands

PSE

Pause/restart measurement and memory store

PSEp1

p1 = 0:   Restart measurement or memory store

p1 = 1:   Pause measurement or memory store

Transfer format: Command block

Get measurement and memory store pause status

PSE?

NL-21/NL-31 response data to PSE?

Response data d1

d1:   1 if paused, otherwise 0

Transfer format: Response block

SRT

Start/stop measurement

SRTp1

p1 = 0:   Stop measurement

p1 = 1:   Start measurement

Transfer format: Command block

Get measurement running status

SRT?

NL-21/NL-31 response data to SRT?

Response data d1

d1:   1 if measurement in progress, otherwise 0

Transfer format: Response block

STO

Start/stop memory store

STOp1

When manual store is selected

p1 = 1:   Execute store (data number incremented by 1)

When Auto1 or Auto2 store is selected

p1 = 1:   Start store

(Use SRT0 to end.)

Transfer format: Command block

Get memory store running status

STO?

NL-21/NL-31 response data to STO?

Response data d1

d1 = 0:   Memory store not in progress

d1 = 1:   Memory store in progress

Transfer format: Response block

Memory and store commands

ADR

Set address

Valid only in manual store mode. During recall, the command sets the address corresponding to the store mode.

Address setting

ADRp1

p1 = Any address

Transfer format: Command block

Get address setting

ADR?

NL-21/NL-31 response data to ADR?

Response data d1

d1:   Currently selected address number
             (displayed address)

Transfer format: Response block

CDR?

Get remaining card capacity

NL-21/NL-31 response data to CDR?

Response data d1

d1:   Card capacity in KB

Transfer format: Response block

CDV?

Verify whether card is inserted

NL-21/NL-31 response data to CDV?

Response data d1

d1 = 0:   Card not inserted

d1 = 1:   Card inserted

Transfer format: Response block

FMT

Delete all files from memory card

No parameter

Transfer format: Command block

MDC

Delete manual data from internal memory

No parameter

Transfer format: Command block

PLP

Set Auto 1 store cycle

PLPp1

p1 = 1:   Not accepted

p1 = 2:   100 ms   p1 = 3:   200 ms

p1 = 4:   1 sec   p1 = 5: $L_{\text{eq, 1sec}}$

Transfer format: Command block

Get store cycle setting

PLP?

NL-21/NL-31 response data to PLP?

Response data d1

d1:   Corresponds to p1

Transfer format: Response block

RCL

Activate recall state

This command immediately calls up the recall screen. The displayed address is the address that was selected when the recall screen was last terminated.

RCLp1_p2

p1 = 0:	Cancel recall mode
p1 = 1:	Activate recall mode
p2:	File name
	(Example: AU1_0001; where "AU" is in capitals)

When p1 = 0 or internal manual recall is activated, p2 is disregarded.

- To cancel the recall mode, use RCL0_X (where X is arbitrary).
- Also for internal manual recall, enter an arbitrary value for p2.

For internal manual data recall, MANUAL is returned. For other card recall, the store name is returned.

Transfer format: Command block

Get recall state

RCL?

NL-21/NL-31 response data to RCL?

Response data d1

d1=1:	recall state
d1=2:	not recall state

Transfer format: Response block

SMD

Set memory store format (Manu, Auto1, Auto2)

SMDp1

p1 = 0:	Manual	p1 = 1:	Auto 1
p1 = 2:	Auto 2	p1 = 3:	Timer Auto 1
p1 = 4:	Timer Auto 2		

Transfer format: Command block

Get memory store setting

SMD?

NL-21/NL-31 response data to SMD?

Response data d1

d1:   Corresponds to p1

Transfer format: Response block

SNR?

Get store name shown on recall menu

- No parameter

  Example: AU1_0001

- Return data format

  When there are two or more store data, the names are returned as separate blocks.

When card recall is used and there are no store data, the string "NO FILE NAME" is returned.

Transfer format: Response block

SNS

Set store name

The store mode setting is made with the SMD command.

SNSp1

p1 = 0000 to 9999

Takes a 4-digit integer. If a string other than a 4-digit integer is specified, an error (0002) is returned.

If the same store name already exists on the card, an error (0004) is returned (the setting is effective).

Transfer format: Command block

Get store name

SNS?

d1 = p1

Example: 0010 ("0010" part of "AU1_0010")

Transfer format: Response block

TMT

Set timer mode time

TMTpn

p1:	Start month	p2:	Start day
p3:	Start hours	p4:	Start minutes
p5:	End month	p6:	End day
p7:	End hours	p8:	End minutes
p9:	Interval time		

p9 = 0: Off   1: 5 min   2: 10 min

3: 15 min   4: 30 min   5: 1 hour

Transfer format: Command block

Get timer mode time setting

TMT?

NL-21/NL-31 response data to TMT?

response data d1

Transfer format: Response block

Calibration commands

CAL

Activate calibration mode

CALp1

p1 = 0:	Cancel calibration mode
p1 = 1:	Internal calibration mode
p1 = 2:	External calibration mode

Transfer format: Command block

Get calibration status

CAL?

NL-21/NL-31 response data to CAL?

Response data d1

d1:	Corresponds to p1
d1 = 1:	Internal calibration mode
d1 = 2:	External calibration mode
d1 = 0:	Other mode

Transfer format: Response block

CBM

Perform adjustment with Cal control

CBMp1

p1 = 0:	Reduce level setting
p1 = 1:	Increase level setting

Transfer format: Command block

Get Cal control level setting

CBMp1?

NL-21/NL-31 response data to CBM?

Response data d1

p1 = 118 to 670 (irregular steps)

Transfer format: Response block

Various setting and information commands

BAT?

Get battery status

BAT?

NL-21/NL-31 response data to BAT?

Response data d1

d1 = 0:   Battery indicator flashing

d1 = 1:   [battery icon]   d1 = 2:   [battery icon]

d1 = 3:   [battery icon]   d1 = 4:   [battery icon]

Transfer format: Response block

BLA

Set backlight auto turn-off function

BLAp1

p1 = 0:   Enable

p1 = 1:   Disable

Transfer format: Command block

Get backlight auto turn-off setting

BLA?

NL-21/NL-31 response data to BLA?

Response data d1

d1:   Corresponds to p1

Transfer format: Response block

CLK

Set current year, month, day, hours, minutes

CLKp1,p2,p3,p4,p5,p6

p1:	4-digit year	p2:	Month
p3:	Day	p4:	Hours
p5:	Minutes	p6:	Seconds

1 can also be specified as 01.

Transfer format: Command block

Get year, month, day, hours, minutes setting

CLK?

NL-21/NL-31 response data to CLK?

Response data d1,d2,d3,d4,d5,d6

d1 to d6:   Correspond to p1 to p6

1 is returned as 01.

Transfer format: Response block

CMP

Set comparator level

CMPp1

p1:   0 or 30 to 130 in 1-dB steps

0 means that comparator is disabled.

Transfer format: Command block

Get comparator level

CMP?

NL-21/NL-31 response data to CMP?

Response data d1

d1:   Corresponds to p1 (comparator level setting)

Transfer format: Response block

DCL

Initialize unit (reset to factory defaults)

- Clock is not reset.
- Contents of manual store memory are not cleared.
- Option function setting is not changed.
- No parameter

Transfer format: Command block

LTI?

Get elapsed time since start of measurement or memory store

LTI?

NL-21/NL-31 response data to LTI?

Response data d1,d2,d3

d1:   Hours

d2:   Minutes

d3:   Seconds

Maximum: 200:00:00

Transfer format: Response block

OUT

Set NL-21/NL-31 output signal output to AC or DC

OUTp1

p1 = 0: AC OUT

p1 = 1: DC OUT

Transfer format: Command block

Get AC/DC output setting

OUT?

NL-21/NL-31 response data to OUT?

Response data d1

d1: Corresponds to p1

Transfer format: Response block

VER?

Get version information

VER?

NL-21/NL-31 response data to VER?

Response data d1,d2

d1:   Sound level meter model

Example: NL-21

d2:   Software version

Example: 1.00

Transfer format: Response block

Filter commands

OPT

Set optional function

OPTp1

p1 = 0:   No optional functions

p1 = 1:   1/1 octave filter

p1 = 2:   1/3 octave filter

p1 = 3:   Universal filter

Transfer format: Command block

Get optional function setting

OPT?

NL-21/NL-31 response data to OPT?

Response data d1

d1:   Corresponds to p1

Transfer format: Response block

FLB

Set center frequency of 1/1 octave and 1/3 octave filter

This command is only accepted when bandpass filter option is enabled.

FLBp1

1/1 octave filter

p1 = 0:	All-pass (no filtering)		
p1 = 1:	16 Hz	p1 = 2:	31.5 Hz
p1 = 3:	63 Hz	p1 = 4:	125 Hz
p1 = 5:	250 Hz	p1 = 6:	500 Hz
p1 = 7:	1 kHz	p1 = 8:	2 kHz
p1 = 9:	4 kHz	p1 = 10:	8 kHz

1/3 octave filter

p1 = 0: All-pass (no filtering)			
p1 = 1: Not accepted		p1 = 2:	12.5 Hz
p1 = 3:	16 Hz	p1 = 4:	20 Hz
p1 = 5:	25 Hz	p1 = 6:	31.5 Hz
p1 = 7:	40 Hz	p1 = 8:	50 Hz
p1 = 9:	63 Hz	p1 = 10:	80 Hz
p1 = 11:	100 Hz	p1 = 12:	125 Hz
p1 = 13:	160 Hz	p1 = 14:	200 Hz
p1 = 15:	250 Hz	p1 = 16:	315 Hz
p1 = 17:	400 Hz	p1 = 18:	500 Hz
p1 = 19:	630 Hz	p1 = 20:	800 Hz
p1 = 21:	1 kHz	p1 = 22:	1.25 kHz
p1 = 23:	1.6 kHz	p1 = 24:	2 kHz
p1 = 25:	2.5 kHz	p1 = 26:	3.15 kHz
p1 = 27:	4 kHz	p1 = 28:	5 kHz
p1 = 29:	6.3 kHz	p1 = 30:	8 kHz
p1 = 31:	10 kHz	p1 = 32:	12.5 kHz
p1 = 33:	16 kHz		

p1 = 32, 33 are valid only for NL-31.

Transfer format: Command block

Get octave filter setting

FLB?

> Response data d1

> d1:   Corresponds to p1

Transfer format: Response block

FLU

Set frequencies for universal filter

This command is only accepted when bandpass filter option is enabled.

p1 is lower limit frequency, p2 is upper limit frequency.

FULp1,p2

p1 = 0:	None	p1 = 1:	10 Hz
p1 = 2:	12.5 Hz	p1 = 3:	16 Hz
p1 = 4:	20 Hz	p1 = 5:	25 Hz
p1 = 6:	31.5 Hz	p1 = 7:	40 Hz
p1 = 8:	50 Hz	p1 = 9:	63 Hz
p1 = 10:	80 Hz	p1 = 11:	100 Hz
p1 = 12:	125 Hz	p1 = 13:	160 Hz
p1 = 14:	200 Hz	p1 = 15:	250 Hz
p1 = 16:	315 Hz	p1 = 17:	400 Hz
p1 = 18:	500 Hz	p1 = 19:	630 Hz
p1 = 20:	800 Hz	p1 = 21:	1 kHz
p1 = 22:	1.25 kHz	p1 = 23:	1.6 kHz
p1 = 24:	2 kHz	p1 = 25:	2.5 kHz
p1 = 26:	3.15 kHz	p1 = 27:	4 kHz
p1 = 28:	5 kHz	p1 = 29:	6.3 kHz
p1 = 30:	8 kHz	p1 = 31:	10 kHz
p1 = 32:	12.5 kHz	p1 = 33:	16 kHz

p1 = 31, 32, 33 are valid only for NL-31.

Transfer format: Command block

Get universal filter setting

FLU?

NL-21/NL-31 response data to FLU?

Response data d1,d2

d1,d2: Correspond to p1,p2

Transfer format: Response block

Measurement data retrieve commands
DOD?

Get level value shown on display

DODp1?

p1 omitted: Get data shown on screen

p1 = 0:	L_p (sound level)	p1 = 1:	L_{eq}
p1 = 2:	L_E	p1 = 3:	L_{max}
p1 = 4:	L_{min}	p1 = 5:	L_{N1}
p1 = 6:	L_{N2}	p1 = 7:	L_{N3}
p1 = 8:	L_{N4}	p1 = 9:	L_{N5}
p1 = 10:	L_y (selected auxiliary processing value)		

Response data d1,d2

d1:   Level value

d2:   Over-range information (yes: 1, no: 0 [space])

d3:   Under-range information (yes: 1, no: 0 [space])

Transfer format: Response block

DOR?

Get data stored in memory

DORp1?

1 to 100 when stored in manual mode (not significant)

When Auto 1: 1 to 7200000 (specifying the number of requested data)

When Auto 2: 1 to 99999 (specifying the number of requested data)

When manual store

d,d2 ... d16

d1:	L_p		
d2:	Sound level over-range information (yes: 1, no: 0)		
d3:	Sound level under-range information (yes: 1, no: 0)		
d4:	L_{eq}	d5:	L_E
d6:	L_{max}	d7:	L_{min}
d8:	L_{N1}	d9:	L_{N2}
d10:	L_{N3}	d11:	L_{N4}
d12:	L_{N5}		
d13:	L_y (0.0 if no data)		

d14:   Processing over-range information (yes: 1, no: 0)

d15:   Processing under-range information (yes: 1, no: 0)

d16:   Processing pause information (yes: 1, no: 0)

Auto 1 store

d1,d2,d3,d4

d1:   Level value

d2:   Over-range information (yes: 1, no: 0)

d3:   Under-range information (yes: 1, no: 0)

d4:   Pause information (yes: 1, no: 0)

Auto 2 store

d1,d2, ... d19

d1:   Data number (1 to 99999)

d2:   Measurement start date (4-digit year/month/day)

d3:   Measurement start time (hours:minutes:seconds)

d4:   Measurement time (hours:minutes:seconds)

d7: L_{eq} d8: L_E

d9: L_{max} d10: L_{min}

d11: L_{N1} d12: L_{N2}

d13: L_{N3} d14: L_{N4}

d15: L_{N5}

d16: L_y (0.0 if no data)

d17:   Processing over-range information (yes: 1, no: 0)

d18:   Processing under-range information (yes: 1, no: 0)

d19:   Processing pause information (yes: 1, no: 0)

Transfer format: Response block

DRD?

Set continuous output of sound level or short-term value L_{eq}

DRDp1?

p1 = 1:	100 ms	p1 = 2:	200 ms
p1 = 3:	1 s	p1 = 4:	$L_{eq,\ 1\ sec}$
p1 = 5:	100 msec (L_p, L_{eq}, L_{max}, L_{min}, L_y)		

Response data format

For response data p1 = 1 to 4

d1,d2,d3

d1:   XXX.X (level value)

d2:   Over-range information (yes: 1, no: 0)

d3:   Under-range information (yes: 1, no: 0)

For response data p1 = 5

d1,d2,d3,d4,d5,d6,d7

d1:   XXX.X L_p value (instantaneous value)

d2:   XXX.X L_{eq} for 100 ms interval

d3:   XXX.X L_{max} for 100 ms interval

d4:   XXX.X L_{min} for 100 ms interval

d5:   XXX.X auxiliary processing value for 100 ms interval ("--.--" if not selected)

d6:   Over-range information (yes: 1, no: 0)

d7:   Under-range information (yes: 1, no: 0)

Transfer format: Response block

Communication control commands

BRT

Set baud rate

BRTp1

p1 = 2:   4800 bps

p1 = 3:   9600 bps

p1 = 4:   19200 bps

The baud rate setting is changed after a confirmation response.

Transfer format: Command block

EST?

Get error information

EST?

NL-21/NL-31 response data to EST?

Response data d1

d1:   Error processing or command processing error

(see page 12)

Recorded 4-digit error code

Transfer format: Response block

IDX

Set index number

IDXp1

p1 = 1 to 255, default: 1

Transfer format: Command block

Get index number

IDX?

NL-21/NL-31 response data to IDX?

Response data d1

d1 = Corresponds to p1 (selected index number)

Transfer format: Response block

RET

Set response processing for commands to On or Off

RETp1

p1 = 0:   Enable response processing

p1 = 1:   Disable response processing

Transfer format: Command block

Get response processing setting

RET?

NL-21/NL-31 response data to RET?

Response data d1

d1 = Corresponds to p1

Transfer format: Response block

RMT

Set remote/local mode

RMTp1

p1 = 0:   Set to local mode

p1 = 1:   Set to remote mode

Transfer format: Command block

Get remote/local mode setting

RMT?

NL-21/NL-31 response data to RMT?

Response data d1

d1 = Corresponds to p1

Transfer format: Response block

XON

Select control mode

XONp1

p1 = 0:   Use RTS/CTS control (no X parameter control)

p1 = 1:   Use X parameter control

(no RTS/X parameter control)

Transfer format: Command block

Get control mode setting

XON?

NL-21/NL-31 response data to XON?

Response data d1

d1:   Corresponds to p1

Transfer format: Response block

Examples for Control Via External Commands

This section contains several examples for controlling operation of the sound level meter via commands. Some initial steps are common to all operations:

- Check baud rate setting
- Check index number
- Enable or disable response sequence (with RET command)
- Select X parameter or RTS/CTS control (with XON command)

To check whether a setting was made properly, using a request command after sending a setting command is recommended.

Example: Get sound pressure level (sound exposure level)

(Measured with frequency weighting "F", dynamic characteristics "Fast", level range "20 to 110 dB")

Power ON

⬇

Settings
- WGT2   (F characteristics)
- TMC0   (Fast)
- RNG11   (20 to 110 dB)
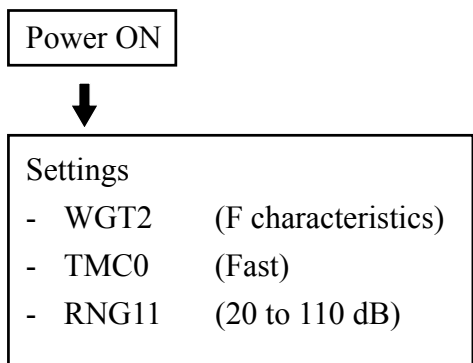
Establish above settings to prepare sound level meter for measurement

⬇

DOD?   (Get display value)

Example: Get sound pressure level (continuous)

(Measured with frequency weighting "A", dynamic characteristics "Slow", level range "40 to 130 dB")

```
Power ON
```

↓

```
Settings
-  WGT0      (A characteristics)
-  TMC1      (Slow)
-  RNG13     (40 to 130 dB)
```

Establish above settings to prepare sound level meter for measurement

↓ (For continuous output at 100 ms intervals)

DRD1?   (Stop with <SUB>)

Example: *L*eq measurement (sound exposure level)

(Measured with frequency weighting "C", dynamic characteristics "Fast", level range "20 to 80 dB", measurement time "10 s")

Power ON

⬇

Settings

- WGT1   (C characteristics)
- TMC0   (Fast)
- RNG8   (20 to 80 dB)
- MTI4   (Measurement time 10 s)

⬇

DPI1_1 (Set *L*eq to On)

⬇

DSP1 (Show *L*eq value on display)

⬇

SRT1 (Start processing)

⬇ (Waiting for measurement end, or stopped by SRT0)

DOD? (Get display value)

Manual store example

(Measured with frequency weighting "A", dynamic characteristics "Slow", file name "MAN_0001" [when storing on memory card], processing time "10 s", level range "20 to 100 dB")

> Power ON

↓

> Settings
> - WGT0   (A characteristics)
> - TMC1   (Slow)
> - RNG10   (20 to 100 dB)
> - MTI4   (Measurement time 10 s)
> - SMD0   (Store mode manual)
> - SNS0001   (File name setting; not needed when storing in internal memory)

Establish above settings to prepare sound level meter for manual store operation

↓

SRT1   (Start processing)

↓ (Measurement end, or stopped by SRT0)

STO1   (Perform store operation. Data are stored and address is incremented by one.)

Auto 1 store example

(Measured with frequency weighting "C", dynamic characteristics "Fast", file name "AU1_0001", store cycle "100 ms", measurement time "5 min", level range "40 to 130 dB")

```
Power ON, memory card inserted
```

⬇

```
Settings
-  CDV?       (Check for card presence)
-  WGT1       (C characteristics)
-  TMC0       (Fast)
-  RNG13      (40 to 130 dB)
-  MTI6       (Measurement time 5 min)
-  SMD1       (Store mode Auto 1)
-  SNS0001    (File name setting)
-  PLP2       (Store cycle 100 ms)
```

Establish above settings to prepare sound level meter for Auto 1 operation

⬇

STO1 (Perform store operation)

⬇

SRT0 (Stop measurement)

Auto 2 store example

(Measured with frequency weighting "F", dynamic characteristics "Fast", file name "AU2_0001", measurement time "10 min", level range "20 to 80 dB")

```
Power ON, memory card inserted
```

⬇

```
Settings
-  CDV?      (Check for card presence)
-  WGT2      (F characteristics)
-  TMC0      (Fast)
-  RNG8      (20 to 80 dB)
-  MTI7      (Measurement time 10 min)
-  SMD2      (Store mode Auto 2)
-  SNS0001   (File name setting)
```

Establish above settings to prepare sound level meter for Auto 2 operation

⬇

STO1 (Perform store operation)

(SRT0 can be used to stop measurement in progress)

Auto 1 timer mode store example

(Measured with frequency weighting "A", dynamic characteristics "Fast", file name "AU1_0001", store cycle "200 ms", measurement time "manual", level range "30 to 120 dB", measurement start time "04/01, 6:00", measurement end time "4/4, 22:00", no interval time)

Power ON, memory card inserted

Settings
- CDV?   (Check for card presence)
- WGT0   (A characteristics)
- TMC0   (Fast)
- RNG12   (30 to 120 dB)
- MTI0   (Measurement time manual)
- SMD3   (Store mode Auto 1)
- SNS0001   (File name setting)
- PLP3   (Store cycle 200 ms)
- TMT4_1_6_0_4_4_22_0_0

              (timer mode time settings)

              ("_" shows space)

Establish above settings to prepare sound level meter for Auto 1 timer mode operation

STO1 (Perform store operation)

Auto 2 timer mode store example

(Measured with frequency weighting "C", dynamic characteristics "Slow", file name "AU2_0001", measurement time "10 min", level range "30 to 120 dB", measurement start time "04/01, 6:00", measurement end time "4/4, 22:00", interval time "30 min")

Power ON, memory card inserted

⬇

Settings

- CDV?   (Check for card presence)
- WGT1   (C characteristics)
- TMC1   (Slow)
- RNG12   (30 to 120 dB)
- MTI7   (Measurement time 10 min)
- SMD4   (Store mode Auto 2)
- SNS0001 (File name setting)
- TMT4_1_6_0_4_4_22_0_4

        (timer mode time settings)

        ("_" shows space)

Establish above settings to prepare sound level meter for Auto 2 timer mode operation

⬇

STO1 (Perform store operation)