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Communication Protocol Specification For UXM Series LA Type

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APPROVED	CHECKED	DRAFTED	DESIGNED	TITLE	UXM Series LA Type Communication Protocol Specification		
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1. Introduction

This document describes the specification of the communication protocol and control commands related to the UXM Series LA type sensor. This specification is partly compliant with the Sensor Communication Interface Protocol (SCIP). Due to the nature of the sensor, some limitations are introduced to SCIP. For more information, please refer to the separate C-42-03320B(1) or C-42-04022(1). From now onward to distinguish this communication specification from SCIP, it will be referred as “SCIP-LA”.

2. Communication interface

The communication interface of this sensor is Ethernet interface.

- Ethernet 100BASE-T

TCP/IP is used for communication. The factory default for the network address settings are listed below.

IP address	: 192.168.0.10
Subnet mask	: 255.255.255.0
Default gateway	: 192.168.0.1
Port number	: 10940(Fixed)

Please refer to the product specification for more information related to the communication.

3. Communication sequence

A basic communication is described as the host sends a request message to the sensor, then the sensor reply with a response message to the host. There are two communication patterns: One response per request and multiple responses per request. The first is called “Handshake” and the second is called “Continuous”.

4. Communication format

All characters used for communication are ASCII code in addition to CR, LF.

(HOST→SENSOR)

Command	Parameter	String	Termination char (LF or CR or CR+LF)

Command : Consists of 2 characters. Each command will be explained later.
Parameter : Depending on command, a parameter may be required. It will be explained in the section of each command.
String : It is an optional item. Refer to the separate document (First page footnote) for more details.
Termination char : Either LF(0aH), CR(0dH) or CR+LF could be the termination character.

(SENSOR→HOST)

Command	Parameter	String	LF

Status	SUM	LF

Data	SUM	LF	LF

Command : The echo back of the data sent by the host to the sensor.
Parameter : The echo back of the data sent by the host to the sensor.
String : The echo back of the data sent by the host to the sensor.
Status : Shows whether the processing of the command was successful or not.
LF : LF(0aH) is used as a delimiter
SUM : Used as a check code. Refer to the separate document (First page footnote) for more details.
Data : If the data section includes more than 64bytes, LF will be inserted after every 64bytes.
LFLF : The sensor sends 2 times LF to notify the host of the termination of the response.

5. Communication commands

The following commands are used for measurement acquisition:

- Distance acquisition command（GD,MD）
- Distance and intensity acquisition command (GE,ME)

The following commands are used for information acquisition

- Version acquisition（VV）
- Sensor's parameters acquisition (PP)
- Sensor's state information acquisition (II)

The following commands are used for sensor's state change

- Transition to measurement state（BM）
- Stop continuous mode and move to Normal measurement state[3](QT)
- Sensor reboot (RB)

[3] Only the steps of predefined area will return to measurement status.

【GD Command】
The latest distance data is returned when this command is received. Before using this command, make sure the laser is activated for all steps and the measurement is started using “BM” command. Those steps whose distance cannot be measured will return as error code. Please refer to the product specification for distance error code.

(HOST→SENSOR)

“GD”	Start step	End step	Cluster count	String	Termination char

Start step : 4 digits decimal number representing the start step of distance acquisition of the area.
End step : 4 digits decimal number representing the end step of distance acquisition of the area.
Cluster count : 2 digits decimal number representing the cluster count step. Default value is “00”.
Set a suitable value to reduce the load during communication.
String/Termination char: Refer to the Communication Format Section.

Example) Use command **“GD0000010000↵”** to obtain distance data of all steps from step 0 to step 100

(SENSOR→HOST)

“GD”	Start step	End step	Cluster count	String	LF

Status	SUM	LF

Time stamp	SUM	LF

Data	SUM	LF

Data	SUM	LF	LF

Status: Typically “00” is returned.

Time stamp: Sensor has an internal counter, its value is known as time stamp. Time stamp is a 24 bit integer value represented using 4 characters encoding. When this 24 bit counter runs over, it counts back from zero.

Data: 3 character encoded distance data. When the total data exceeds 64 bytes, LF mark and SUM are inserted after each block of 64 bytes.

In SCIP, a character encoding method is used in order to compress the data sent to the host. It is defined as follows. Numbers are divided in groups of 6 bits. 30h value is added to each group. The result 6 bits encoding is ordered from high-order to low-order bits. After encoding, if the number of generated characters is two, then it is called “two characters encoding”. If three characters, then it is called “three characters encoding” and if four characters, then it is called as “four characters encoding”.

Example) Decoding of 3 character encoded distance data having “1Dh”as encoded value.

‘1’ (31h) ‘D’ (44h) ‘h’ (68h)
↓ Subtract 30h
1h 14h 38h
↓ Merge
000001 010100 111000
↓ Decimal Value
5432mm

【MD Command】
The distance data obtained within the specified condition is returned when this MD command is received.

(HOST→SENSOR)

"MD"	Start step	End step	Cluster count	Scan Interval	No. of scans	String	Termination char

Start step/End step/Cluster count: Refer to the GD command section.
Scan Interval : 1 digit decimal number representing the number of scan to skip. Default value is'0'.
Set suitable value to reduce the load during communication.
Number of scans: 2 digit decimal number representing the requested number of scan data.
Use "00" to obtain continuous unlimited scans.

Example) Use command**"MD0000010000000⏎"** to obtain unlimited distance data of all steps from step 0 to step 100 without skipping scans

- Initial response after the command is received

(SENSOR→HOST)

"MD"	Start step	End step	Cluster count	Scan interval	No. of scans	String	LF

Status	SUM	LF	LF

Status: Typically "00" is returned.

- Continuous response of distance data

(SENSOR→HOST)

"MD"	Start step	End step	Cluster count	Scan interval	Remaining scan	LF

Status	SUM	LF

Time stamp	SUM	LF

Data	SUM	LF

Data	SUM	LF	LF

Status: Typically "99" is returned.

Time stamp/Data: Refer to the GD command section.

【GE Command】
GE command works the same way as GD command. The difference with GD command is that GE command returns not only distance data but also intensity.

(HOST→SENSOR)

"GE"	Start step	End step	Cluster count	String	Termination char

Start step/End step/Cluster count: Refer to the GD command section.

(SENSOR→HOST)

"GE"	Start step	End step	Cluster count	String	LF

Status	SUM	LF

Time stamp	SUM	LF

Data	SUM	LF

Data	SUM	LF	LF

Data: It is consists of distance data (Refer to the GD Command section) and intensity. All data are 3 characters encoded.

Intensity is the reflected strength of the laser. The reflected laser intensity value is represented by 18-bit data. It is a relative number without a unit. Intensity may differ depending upon the distance, material and detection angle of the object. Therefore, users should check the detection capability verification test.

【ME Command】

ME command works the same way as MD command. The difference is similar to GE command as ME command returns also intensity.

(HOST→SENSOR)

"ME"	Start step	End step	Cluster count	Scan interval	Number of scans	String	Termination char

Start step/End step/Cluster count: Refer to the GD command section.
Scan interval/Number of scans: Refer to the GE command section.

- Initial response after the command is received.

(SENSOR→HOST)

"ME"	Start step	End step	Cluster count	Scan interval	Number of scans	String	LF

Status	SUM	LF	LF

Status: Typically "00" is returned.

- Continuous response of distance data and intensity

(SENSOR→HOST)

"ME"	Start step	End step	Cluster count	Scan interval	Remaining scan	LF

Status	SUM	LF

Time stamp	SUM	LF

Data	SUM	LF	LF

Status: Typically "99" is received.

Time stamp: Refer to the GD command section.

Data: Refer to the GE command section

【BM Command】
This command is used to switch the sensor to measurement state, emission of the laser and to start measurement. However, in SCIP-LA, this command is used to switch from current area limited measurement into full field measurement state.

(HOST→SENSOR)

"BM"	String	LF	Termination char

(SENSOR→HOST)

"BM"	String	LF

Status	SUM	LF	LF

Status: Typically "00" is returned.

Example) **"BM↵"**

【QT Command】
In SCIP-LA, this command is used to stop transmitting the data during continuous mode. Also, returns to normal state during the measurement of data with laser activated for all steps.

(HOST→SENSOR)

"QT"	String	Termination char

(SENSOR→HOST)

"QT"	String	LF

Status	SUM	LF	LF

Status: Typically "00" is returned.

Example) **"QT↵"**

【VV Command】

This command is used to obtain version information of the sensor.

(HOST→SENSOR)

"VV"	String	Termination char

(SENSOR→HOST)

"VV"	String	LF

Status	SUM	LF

Vendor information	;	SUM	LF

Product information	;	SUM	LF

Firmware version	;	SUM	LF

Protocol version	;	SUM	LF

Serial number	;	SUM	LF	LF

Status: Typically "00" is returned.

Example) **"VV⏎"**

【PP Command】

This command is used to obtain the information of sensor's parameter.

(HOST→SENSOR)

"PP"	String	Termination char

(SENSOR→HOST)

"PP"	String	LF

Status	SUM	LF

Sensor model	;	SUM	LF

Minimum measureable distance(mm)	;	SUM	LF

Maximum measureable distance(mm)	;	SUM	LF

Angular resolution (No. of partitions 360 degrees)	;	SUM	LF

Starting step No.	;	SUM	LF

End step No.	;	SUM	LF

Step number of the front direction	;	SUM	LF

Standard scanning speed (rpm)	;	SUM	LF

Status: Typically "00" is returned.

Example) **"PP⏎"**

【II Command】

This command is used to obtain status information of the sensor. Also, error number is returned during error state.

(HOST→SENSOR)

"II"	String	Termination char

(SENSOR→HOST)

"II"	String	LF

Status	SUM	LF

Sensor model	;	SUM	LF

Status of the laser	;	SUM	LF

Scanning speed	;	SUM	LF

Measurement mode	;	SUM	LF

Speed of serial communication	;	SUM	LF

Time stamp	;	SUM	LF

Status of sensor	;	SUM	LF	LF

Status: Typically "00" is returned.

During the error state of the sensor, error code is displayed after "STAT" in such a case, consider reporting it to our company including the contents of "II", "VV" command response.

Example) **"II↵"**

【RB Command】

This command is used to reboot the sensor. However, it requires a special procedure to use it. Within 1 second, 2 request messages should be sent and their corresponding response message should be received. Otherwise, the sensor continues to be in the same state and does not reboot. However, in SCIP-LA, this RB command is only valid when sensor stops due to error.

(HOST→SENSOR)

"RB"	String	Termination char

(SENSOR→HOST)

"RB"	String	LF

Status	SUM	LF	LF

Status: Typically, the 1st time "01" is returned. The 2nd time "00" is returned.

6. Response to Invalid Commands

This sensor is not compatible with multi echo function. Therefore, commands related to multi echo function such as "HD", "HE", "ND", "NE" will not be accepted. Also, this sensor is a long distance type sensor. It will not answer to distance command of 2 characters encoding such as "MS" and "GS".