

# Communication reference of Raynger MX4/MX6

(Firmware Revision >3.30)

## 1 Basics

### 1.1 RS232 interface parameters

Baudrate:	9600
Data bits:	8
Parity:	none
Stop bits:	1
Protocol:	none

Note:

There is no way to wake up the unit if it is turned of. You must do it by pulling the trigger before you send a command. After releasing the trigger or after the last command the unit powered off after 7 sec. To prevent this you must set the lock switch or send a periodic ping signal (e.g. ?DI).

Only for MX4 standard: If the switch 9 (Digi/Ana) is set, the interface is switched from RS232 to the analog output. In this case there is no possibility to communicate with the MX. The output rate of the analog value is 31.25 msec.

Only for MX4 with Bluetooth® wireless technology: The switch 8 is used for AutoOff function. In position “On” and after releasing the trigger the unit always powered off after 7 sec. A periodic ping signal has no action. Exception is the active burstmode. The switch 9 is used for Master/ Slave function. No analog output is available.

### 1.2 Communication via terminal program

It is possible to communicate between the MX and a simple terminal program (e.g. hyper terminal). So you can experiment with the different commands and see what will happen.

All commands consist of a request and an answer. Both ends with CR and LF (0D<sub>hex</sub>+0A<sub>hex</sub>).

The following table contains all public commands used for the MX communication:

## 2 List of all public MX commands

	MX-Commands	Comments
<b>Control character</b>		
?	Ask parameter value	?T asks for current Target-Temp.
=	Set parameter value	E=.9 sets Emissivity
!	Acknowledge parameter change	!E0.90 could be the answer
*	Error string (Not acknowledged)	*Range Check Error
\$	Define or request burst output string format	\$=D@UTGHLIPX enables all possible Par.
CR	End of input command	always CR+LF
ESC	Abort Burst or Stream actions	Stop burst mode

MX-Commands		Comments
<b>One character commands (for faster bursts)</b>		
@	Time	?@ or "@=11:59:10AM"
C	Celsius Temperature Units	only in Burststr: "C T238.1"
D	Date	?D or "Date=98/03/12"
E	Emissivity	?E or "E=.9"
F	Fahrenheit Temperature Units	only in Burststr: "F T460.6"
G	Average Temperature	?G->"G238.1" ,moving average, 2s to 90%
H	Highest Temp. (Max/Peak)	?H, Maximum since start of measurement
I	Internal Temperature	"?I", internal temperature (heatsink)
L	Lowest Temp. (Min/Valley)	?L, Minimum since start of measurement
P	Power	"?P", device specific energy value
S	Status (Target T./Internal T. out of Limits)	"?S", (two digits for out-of-limits-bits and alert-bits)
T	Target Temperature	?T, Object temperature
U	Device Unit	?U, "U=F" or "U=C"
X	TC-J, TC-K, NTC Temp.	?X, Temperature of external probe
Y <sup>1)</sup>	TC Plug Temperature	?Y, Temperature of internal TC/TH plug
<b>Two character commands</b>		
AH	Alarm High Threshold Temperature	?AH, "AH=37", Alarm if above this Temp.
AL	Alarm Low Threshold Temperature	?AL, "AL=21", Alarm if below this Temp.
B\$	Get Burst string contents	?B\$ gives a current Burststring, (no Set command)
BM	Burst Mode (on/off)	BM=1 starts BurstMode
CL	Clear Log Data	"CL" clear all logger data
CY	Cycle Time for LCD bar graph	"?CY", "CY=0.1", the cycle time for LCD bar graph
D\$	Device String for User Infos	"?D\$", "D\$=xyz", user defined string
DB	Function Byte	"?DB", "DB=FFFE"
DC	Device Calibration Date	?DC, date of the last calibration
DD	Read Device Date of Production	?DD
DF	Restore Device Factory Defaults	DF, same as switch "SetDefault"
DG	Device Energy Gain	?DG, "DG=1.000", for two point calibration
DH	Read Device High Range Limit	?DH
DI	Read Device Burn-ID	"?DI", Device Burn-ID
DL	Read Device Low Range Limit	?DL
DM	Read Device Model Type	?DM, MX: "!DMAdvanced Model"
DO	Device Energy Offset	?DO, "DO=0", for two point calibration
DR	Read Device Firmware Revision Number	?DR, for instance "!DR 1.0"
DS	Read Device Serial Number	?DS, for instance "!DS 730001"
DV	Read Device Hardware Version Number	?DV, for instance "!DV 1.2"
EC	Error Code (EEPROM-area-error-bits)	?EC, -> "!EC 0000", Hexword
EL	EEPROM-Parameter Load	EL, reload EEPROM-values
ES	EEPROM-Parameter Store	ES, store current values to EEPROM
ET	Energy-to-Temp-Conversion	"ET=1234" -> "!ET023.7"
KC	Key Code (Scancode of keys)	?KC, -> "!KC 1000", Hexword (setable if UI=0)
L\$	Logg. Name String	"?L\$", "L\$=Log.1" (of current logger number via "LN")
L@	Logg. Time	"?L@", logging time of the logger record (defined with "LN")
LC	Logg. Count	"?LC", "LC=100", number of available logger records
LD	Logg. Date	"?LD", logging date of the logger record (defined with "LN")
LI <sup>1)</sup>	Logg. Image Number	"?LI", index of the related image
LM <sup>1)</sup>	Logg. Image Memory	"LM", clear image memory
LN	Logg. Storage Number	"?LN", "LN=1", no. of the logger record
LR <sup>1)</sup>	Logg. Image Resolution	"LM=L" -> QVGA, "LM=H" -> VGA
LS	Logg. Selected	"?LS", "LS=1", Index of the last selected entry
M\$	Material Name String	"?M\$", "M\$=Alu", name string of the Material (defined with "MN")
MC	Material Table Count	"?MC", "MC=30", number of available entries in the material table
ME	Material Emissivity	?ME, "ME=.9", Emissivity (of current material entry via "MN")
MF	Mode Flags	?MF, "IMF 0300", Hexword (setable)
MN	Material Table Index Number	?MN, "MN=1", Number of material entry for M\$ and ME
MS	Material Table Index Selected	?MS, "MS=1", Number of selected material entry in current logger
OH	Output High Value	?OH, "OH=100", end value of LCD-bargraph
OL	Output Low Value	?OL, "OL=23.7", begin-value of LCD-bargraph
SW	Switch Code	"?SW" -> "ISW 4C00", Hexword (setable if UI=0)
TE	Temp-to-Energy-Conversion	"TE=23.7" -> "!TE=1234"
TO	Temperature Offset	"?TO", "TO=0.0", Offset, which is added after temp-calculation
UI	User Interface Lockout	"?UI", "UI=0" disables keys, switches and switch off, "UI=1" enables
XI	Intern Temp. of Plug	"?XI", Temperature of Thermocouple-plug

<sup>1)</sup> MX6 only

### 3 Basics of parameter handling

#### 3.1 Asking for a parameter value

To read out a parameter use a quotation mark followed by the command character(s). The answer is an exclamation mark followed by the command character(s) and the requested value.

Example	Request	Answer
Asking for temperature	?T	!T026.8
Asking for date	?D	!D01.05.98
Asking for device firmware Revision No.	?DR	!DR 1.05
Asking for burst string contents	?B\$	!T026.4 I023.9 P02525

#### 3.2 Setting a parameter value:

To set a parameter use the command character(s) followed by a equation mark. The answer is an exclamation mark followed by the command character(s) and the new value. If the setting was failed try it again.

Example	Command	Answer
Setting date	D=01.05.98	!D01.05.98
Setting temperature unit	U=F	!UF
Start burst mode	BM=1	T026.8 I024.8 P02530 T026.7 I024.8 P02530 T026.6 I024.7 P02530 ...

#### 3.3 Burst mode handling:

The burst mode will start if you send the command BM=1 and runs automatically until the MX is receiving an ESC or probably any other character. When the burst mode is active the MX sends burst strings with an interval of 31.25msec. You can define the burst string with the command \$=D@UTGHLIPX. To define the burst string you must choose any of the following characters:

D	MX date
@	MX time
U	temperature unit
T	target temperature
G	average temperature
H	highest temperature
L	lowest temperature
I	internal temperature
P	energy value
X	probe temperature (TC, NTC)

Examples:

	action	Request	answer
date, time, target temp.	define	<a href="#">\$=D@TU</a>	!\$D@TU
and unit:	start	BM=1	D01.05.98 @13:45:59 C T027.2 ...
	stop	ESC	!BM0
time, target, lowest	define	<a href="#">\$=@THL</a>	!\$@THL
and highest temp.	start	BM=1	@13:49:16 T027.2 H027.8 L023.8 ...
	stop	ESC	!BM0
target, average, lowest, highest,	define	<a href="#">\$=TGHLXU</a>	!\$TGHLXU
probe temp., unit	start	BM=1	C T027.3 G027.3 H027.8 L023.8 X024.3 ...
	stop	ESC	!BM0

The burst string can also be polled with the command ?B\$. The definition of the burst string is the same as in burst mode.

## 4 Controlling the switches, buttons and modes

### 4.1 Setting and reading the switches (SW) and buttons (KC)

During the user interface is off (off: UI=0, on UI=1) the remote computer may have the control over the functions of the dip switches and buttons:

The hex code is a OR function of the following hex values:

	Switch	Value		Button	Value
1	Lock	8000 <sub>hex</sub>		Trigger	0200 <sub>hex</sub>
2	°C/°F	1000 <sub>hex</sub>		Down	0040 <sub>hex</sub>
3	Buzzer	0200 <sub>hex</sub>		Enter	0080 <sub>hex</sub>
4	Backlight	0040 <sub>hex</sub>		Up	0100 <sub>hex</sub>
5	Set Default	4000 <sub>hex</sub>			
6	Ltd. Access	0020 <sub>hex</sub>		Laser	0020 <sub>hex</sub>
7	Laserflash	0100 <sub>hex</sub>		Display	0010 <sub>hex</sub>
8	Printer	0800 <sub>hex</sub>		Data	0008 <sub>hex</sub>
9	Digi/Ana	2000 <sub>hex</sub>		Setup	0004 <sub>hex</sub>
10	Time/Date	0400 <sub>hex</sub>		Mode	0002 <sub>hex</sub>
11	NTC/TC	0080 <sub>hex</sub>		Emiss.	0001 <sub>hex</sub>
12	TC-J/TC-K	0010 <sub>hex</sub>			

Example: To set NTC/TC-switch you must set the user interface off (UI=0) and read the switches code (?SW). Calculate the new value with an OR function (value OR 0080<sub>hex</sub>) and write it back (SW=value).

To emulate the display button request: UI=0 KC=10.

### 4.2 Setting and reading the mode flags (MF)

	function	value	comment
display modi	Max	0001 <sub>hex</sub>	if display in maximum mode
	Min	0002 <sub>hex</sub>	if display in minimum mode
	Dif	0003 <sub>hex</sub>	if display in difference mode
	Avg	0004 <sub>hex</sub>	if display in average mode
	Ext	0005 <sub>hex</sub>	if display in external mode (probe temperature)
	Range	0006 <sub>hex</sub>	if display in range mode
	Int	0007 <sub>hex</sub>	if display in internal mode (internal temperature)
	Laser	0100 <sub>hex</sub>	if Laser on
	AutoRng	0200 <sub>hex</sub>	if auto range in display
	LogMode	0400 <sub>hex</sub>	if in data logger mode
	x	0800 <sub>hex</sub>	not in use
		1000 <sub>hex</sub>	reserved
		2000 <sub>hex</sub>	reserved
		4000 <sub>hex</sub>	reserved
		8000 <sub>hex</sub>	reserved

Example: To set the MX you must read the mode flags (?MF). Calculate the new value with and AND/OR function and write it back (MF=value). Exception is the laser flag (operational safety).

### 4.3 **Function Byte:**

Depending from the hardware different capabilities are available from the MX. For example the MX4 does not support a camera. To prevent the software from malfunction the capabilities can be requested from the device with the function byte (command ?DB) the returned value is a OR function of the following hex values:

Button	Value
Camera	0080 <sub>hex</sub>
Probe	0040 <sub>hex</sub>
Logger	0020 <sub>hex</sub>
mV output	0010 <sub>hex</sub>
TCK probe	0008 <sub>hex</sub>
TCJ probe	0004 <sub>hex</sub>
NTC probe	0002 <sub>hex</sub>
reserved	0001 <sub>hex</sub>

## 5 **Material table, logger data transfer**

### 5.1 **Reading the material table**

First you must read out the number of valid table entries. Then set the actual entry and read out the material name and emissivity for this entry. Do it for all entries. The entry 0 is always the free configurable material.

Function	request	answer
read number of entries in material table	?MC	!MC10
set material entry number=0 (Free)	MN=0	!MN00
read material name string of material entry 0	?M\$	!M\$Free
read emissivity of material entry 0	?ME	!ME0.95
set material entry number=1	MN=1	!MN01
read material name string of material entry 1	?M\$	!M\$AL,oxidiz.
read emissivity of material entry 1	?ME	!ME0.30
set material entry number=2	MN=2	!MN02
read material name string of material entry 2	?M\$	!M\$Asbestos
read emissivity of material entry 2	?ME	!ME0.95
...	...	...
set material entry number=10	MN=10	!MN10

### 5.2 **Setting the material table**

First you must set the number of valid table entries. Then set the actual entry and set the material name and emissivity for this entry. Do it for all entries. The entry 0 is always the free configurable material. The maximum number of entries is 30.

Function	request	answer
set number of entries in material table	MC=30	!MC30
set material entry number=1	MN=1	!MN01
set material name string of material entry 1	M\$=AL,oxidiz	!M\$AL,oxidiz
set emissivity of material entry 1	ME=0.300	!ME0.30
set material entry number=2	MN=2	!MN02
set material name string of material entry 2	M\$=Asbestos	!M\$Asbestos
set emissivity of material entry 2	ME=0.950	!ME0.95
...	...	...
set material entry number=30	MN=30	!MN30

### 5.3 Reading the logger data

First you must read out the number of valid table entries. Then set the actual entry and read out the index of the Logger Record Name String, the Logger Image Index, the material table entry, the emissivity and so on. Do it for all entries. The data is only valid if the IR temperature reading contains a valid value. Otherwise there is no reason to read out the other values (see record 2). With the index of the material table entry you can get the material name in the material table.

Generally the Logger Image Index contains several information:

Index	Information
0	configured for no image
255	configured for image, no image taken yet
1..106	Index of taken image in the memory

Function	request	answer
read number of available records	?LC	!LC10
set logger record number=1	LN=1	!LN01
read index in material table of record 1	?MS	!MS00
read logger image index of record 1 (MX6)	?LI	!LI01
read logger record name string of record 1	?L\$	!L\$Loc. 1
read emissivity of record 1	?E	!E0.95
read high alarm value of record 1	?AH	!AH050.0
read low alarm of record 1	?AL	!AL000.0
read temperature value of record 1	?T	!T027.3
read logging date of record 1	?LD	!LD20.04.98
read logging time of record 1	?L@	!L@ 17:15:26
read highest temperature of record 1	?H	!H023.5
read lowest temperature of record 1	?L	!L022.6
read average temperature of record 1	?G	!G023.0
read internal temperature of record 1	?I	!I025.3
read probe temperature of record 1	?X	!X024.7
Set logger record number=2	LN=2	!LN02
read index in material table of record 2	?MS	!MS00
read logger image index of record 2 (MX6)	?LI	!LI02
read logger record name string of record 2	?L\$	!L\$Loc. 2
read emissivity of record 2	?E	!E0.95
read high alarm value of record 2	?AH	!AH050.0
read low alarm of record 2	?AL	!AL000.0
read temperature value of record 2	?T	!T-----
Set logger record number=3	LN=3	!LN03
...	...	...
Set logger record number=10	LN=10	!LN10