Application Note

AT Command (ATC) Mode

Version 2.8

☞ *Caution: Specifications of the product's functions may be changed without prior notice.*

Sollae Systems

https://www.ezTCP.com

1   Contents

2   Overview

2.1 Introduction

  "ATC – AT Command" is one of the communication modes of ezTCP. You can configure ezTCP's environment variables in this mode and control the communication and connection with AT Command through the serial port.

  The ezTCP can communicate with various hosts by repeating the connection and disconnection process in AT command communication mode. Always excepting, it does not support TCP multiple connections and UDP communication.

2.2 AT Command

2.2.1 AT Command format

  AT Command starts with 'AT' and it ends with '<CR>'.

  The form is as the following.

AT	Command	<CR>(0x0d)

  Multiple commands can be used at once.

AT	Command 1	Command 2	……	Command n	<CR>(0x0d)

  Response messages form for AT Command is as the following

<CR>(0x0d)	<LF>(0x0a)	Response message	<CR>(0x0d)	<LF>(0x0a)

☞ *When ezTCP power on, it echoes received AT Command and sends response messages as letter form. To avoid this echo, you can use "ATE0" command. And you can use "ATV0" command for numeric form response messages.*

2.2.2 Response messages

Literal Response (ATV1 - default setting)	Numerical Response (ATV0)	Description
OK	0	Command OK
ERROR	4	Command Error
CONNECT	1	TCP Connected
NO CARRIER	3	TCP Disconnected
NO ANSWER	8	No response from the remote host(PING test)
Set values	Set values	Response for query of currently setting values (Ex. AT+PRIP?)

Table 2-1 Response Message

2.2.3 Basic AT Command set

Command	Description	Comments
A	Passive connection	Wait for connection request from remote hosts. If you send any serial data before the connection is established, ezTCP gives up waiting for connection and returns "NO CARRIER" response message.
D	Active connection	ezTCP tries to connect to a remote host If you send any serial data before the connection is established, ezTCP gives up trying to connect and returns "NO CARRIER" response message.
E	Echo	Decide whether to echo received AT Commands to serial port E0- No Echo, E1-Echo (default)
H	off-hook	TCP Connection Close
I	Information	Returns the information of ezTCP I3 – firmware revision, I7 – MAC address
O	Online	Go back On-line state from Command state
Q	Quiet Mode	Decide how to send response messages Q0 – sends response messages (default) Q1 – doesn't send response message
S	S Register	S2: Escape Code, default value 43 (0x2b, '+') S3: Carriage Return Code, default value 13 (0x0d) S4: Line Feed Code, default value 10 (0x0a) S5: Backspace Code, default value 8 (0x08) S9: Timeout for PING Test, default value 6 (6 sec) S12: Guard Time of Escape Code, default value 50 (500 ms)
V	Verbose	Response messages format V0 – Numeric result codes V1 – Literal result codes (default)
Z	Reset	Reset AT Command settings

Table 2-2 Basic AT command set

☞ *ATS Commands are available except for EZL-200F / 400S / 410*

2.2.4 Common Extended AT Command set

Command	Description	Note
+PLIP	local IP address	ex) at+plip=10.1.0.1<CR>
+PSM	subnet mask	ex) at+psm=255.255.255.0<CR>
+PGIP	default router	ex) at+pgip=10.1.0.254<CR>
+PNIP	domain name server	ex) at+pnip=8.8.8.8<CR>
+PLP	listening TCP port	ex) at+plp=1470<CR>
+PTO	timeout	Unit: sec
+PRIP	remote host's IP address	ex) at+prip=10.1.0.2<CR>
+PRHN	remote host's host(domain) name	ex) at+prhn="example.phpoc.com"<CR> refer to 4.2.2
+PRP	remote host's TCP port	ex) at+prp=1470<CR>
+PWP	write configuration	ex) at+pwp<CR> refer to 2.2.7
+PRC	enable ezConfig function	1: ON, 0: OFF
+PARP	temporary obtain an IP address from the first received packet	1: ON, 0: OFF
+PDC	obtain an IP automatically via DHCP	1: ON, 0: OFF
+PPE	obtain an IP automatically via PPPoE	1: ON, 0: OFF
+PPID	PPPoE ID	ex) at+ppid="abcdefg"<CR>
+PPPW	PPPoE password	ex) at+pppw="0123456"<CR>
+PPNG	ping test	ex) at+ppng=10.1.0.2<CR>
+PSE	Sending Escape Character option	1: ON, 0: OFF
+PAN	obtain address of DNS automatically	1: ON, 0: OFF
+PRST	Reboot ezTCP	ex) at+prst<CR>
+PLS	Ethernet Link Status	ex) at+pls<CR> Unit: Mbps
+PSSL	Enable SSL	1: ON, 0: OFF

Table 2-3 Common extended AT command set

☞ *The above commands set parameters temporary. "AT+PWP" command is required to save the parameters permanently. The detailed items saved permanently by this command refer to 2.2.7*

● Available common extended AT commands by products

Command	CSE-M32/H20/H21/M73A/H25 CSE-M53N/H53N/H55N2 CIE-M10/H10A/H14A CSE-M24/CSC-H64 CSW-M83/M85/H85K2/H85F/H85N	EZL-50L/50M/70/200L EZL-200F EZL-80/80c EZL-410/400S
+PLIP		
+PSM		
+PGIP		
+PLP		
+PTO	O	
+PRIP		
+PRP		
+PARP		
+PDC		
+PWP		
+PNIP		
+PAN	O	X
+PRHN		
+PRST		
+PPNG	O	△ (Except EZL-200F)
+PSE	O	△ (EZL-50L/50M/70/200L Only)
+PPE	△ (Except CSW-XXX series)	△ (EZL-200F Only)
+PPID	△ (Except CSW-XXX series)	X
+PPPW	△ (Except CSW-XXX series)	X
+PLS	△	X
+PSSL		
+PRC	X	O

Table 2-4 Available common extended AT commands by products

☞ *Some of commands in above table might not be supported if you use a firmware which is one of the old versions.*

☞ *"AT+PLS" command is available on CIE-M10/H10A/H14A, CSE-M32/H20/H21, CSE-M73A/H25 only.*

☞ *"AT+PSSL" command is available on CSE-M53N/H53N/H55N2, CSE-M73A/H25 only.*

☞ *EZL-410/400S only supports "+PLP, +PTO, +PRIP, +PRP".*

2.2.5   WLAN Extended AT Command Set

Command	Description	Note
+WCCT	WLAN Topology	0: Ad-hoc, 1: Infrastructure, 2: Soft AP
+WCH	WLAN Channel	e.g.) at+wch=3<CR>
+WSSID	SSID	e.g.) at+wssid="sollae"<CR>
+WANT	Antenna	0: Internal, 1: External
+WPA	WPA mode	0: Disable, 1: EAP-TLS, 3: EAP-TTLS, 5: PEAP
+WPP	WPA Passphrase	e.g.) at+wpp="0123456789"<CR>
+WPSK	compute PSK	Compute PSK by combination of SSID and WPA passphrase. (Requires 4~5 seconds)
+WLS	Link Speed	Unit: 100Kbps
+WLQ	Link Quality	Unit: %
+WRSSI	RSSI	Unit: dBm
+WUID	WPA-Enterprise User ID	e.g.) at+wuid="user"<CR>
+WUPW	WPA Enterprise User Password	e.g.) at+wupw="password"<CR>

Table 2-5 WLAN extended AT command set

☞ *Note that AT+PWP command is required to apply a new PSK key which is computed by the +WPSK command.*

● Available WLAN extended AT commands by products

Division	CSW-M85	CSW-M83/H85K2/H85F CSC-H64	CSW-H80
+WANT	O	X	
+WCCT			
+WSSID			
+WPA			
+WPP			
+WPSK		O	X
+WLS			
+WLQ			
+WRSSI			
+WUID			
+WUPW			

Table 2-6 Available WLAN extended AT commands by products

☞ *Some of commands in above table might not be supported if you use a firmware which is one of the old versions.*

2.2.6 IPv6 Extended AT Command Set

Command	Description	Note
+PIP6	IPv6	0: Disable, 1: Enable
+PEUI	EUI-64 creation	0: MAC address, 1: Random
+PGUA	Global Unicast Address	0: Auto, 1: Static
+PLIP6	Local IPv6 Address	e.g.) at+plip6="2001::1234:5678"<CR>
+PPFX	Length of Prefix	e.g.) at+ppfx=64<CR>
+PGIP6	Gateway IPv6 Address	
+PRIP6	Peer IPv6 Address	

Table 2-7 IPv6 extended AT command set

☞ *IPv6 Extended AT Command can be configured in case of support to IPv6.*

2.2.7 Save environment value

The below shows the parameters are saved permanently by "AT+PWP" command.

Command	Description	Note
+PLIP	local IP address	
+PSM	subnet mask	
+PGIP	default router	
+PNIP	domain name server	
+PLP	listening TCP port	
+PTO	timeout	
+PRIP	remote host's IP address	
+PRP	remote host's TCP port	
+PRC	enable ezConfig function	
+PARP	obtain an IP address from the first received packet	
+PDC	obtain an IP automatically via DHCP	
+PPE	obtain an IP automatically via PPPoE	
+PPID	PPPoE ID	
+PPPW	PPPoE password	
+PAN	obtain address of DNS automatically	
+PSSL	Enable SSL	
+WCCT	WLAN Topology	
+WCH	WLAN Channel	
+WSSID	SSID	
+WANT	Antenna	
+WPA	WPA mode	
+WPP	WPA Passphrase	
+WPSK	compute PSK	
+WUID	WPA Enterprise User ID	
+WUPW	WPA Enterprise User Password	
+PLIP6	Local IPv6 Address	When "+PGUA" value is 1
+PGIP6	Gateway IPv6 Address	When "+PGUA" value is 1

Table 2-8 the parameters saved by "AT+PWP" command

☞ *For EZL-50 / 50A / 50R, values of +PRIP and +PRP are not saved by AT+PWP command.*

3 Operation State

3.1 On-line State and Command State

ATC mode has Command State and On-line State.

Command State	When TCP connection is not established, AT commands can be used.
On-line State	During TCP connection, all of the data are converted to TCP/IP format.

Table 3-1 Two states in ATC mode

● Command State

The ezTCP is in Command State right after power on. Incoming serial data is treated as AT command

● On-line State

When TCP connection is established, it automatically operates in On-line State. Incoming serial data is sent to the remote host.

3.1.1 Changing to Command State from On-line State

In order to change to Command State from On-line State, Escape Code (default: '+') must be sent 3 times according to the below sequence.

From last sent data to first '+' input	More than 500ms
'+' input interval	0~500ms
Delay time after last '+' input	More than 500ms

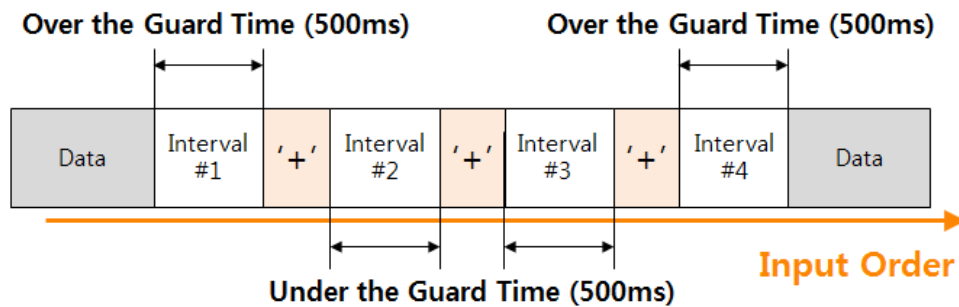Table 3-2 turn to the Command State

Figure 3-1 using Escape Codes

☞ *Received escape codes (default: "+++") can be sent to the TCP session, because they are also handled as the data at on-line state. To prevent sending escape codes to the remote host "AT+PSE=0" command is required.*

☞ *The guard time can be changed with ATS command. (except for EZL-200F / 400S / 410)*

3.1.2 Changing to On-line State from Command State

When the device is changed to Command State from On-line State during TCP connection, ATO command is used to go back On-line State.

3.1.3 An example of Changing states

Data (▶: Command, ◀: Response message)			Description
Data Communication (During TCP connection)			
	+++	▶	Change to Command State
◀	<CR><LF>OK<CR><LF>		Conversion to Command State complete
~ Command State (wait for user AT command) ~			
	ATO<CR>	▶	Go back On-line State
◀	<CR><LF>CONNECT<CR><LF>		Conversion to On-line State complete

Table 3-3 an example of changing states

4　Command Usage

4.1　Configuration with AT Commands

4.1.1　an Example of TCP/IP Configuration

Data (▶ : Command, ◀ : Response message)		Description
	AT+PLIP=10.1.0.1<CR>	▶	LOCAL IP address setting
◀	<CR><LF>OK<CR><LF>		Command process OK
	AT+PGIP=10.1.0.254<CR>	▶	GATEWAY IP address setting
◀	<CR><LF>OK<CR><LF>		Command process OK
	AT+PSM=255.255.255.0<CR>	▶	SUBNET MASK setting
◀	<CR><LF>OK<CR><LF>		Command process OK
	AT+PLP=1470<CR>	▶	LOCAL PORT setting
◀	<CR><LF>OK<CR><LF>		Command process OK
	AT+PTO=10<CR>	▶	TIME OUT setting
◀	<CR><LF>OK<CR><LF>		Command process OK
	AT+PWP<CR>	▶	Save setting values to product (Saved even after reset)
◀	<CR><LF>OK<CR><LF>		Command process OK
◀	<CR><LF>NO CARRIER<CR><LF>		System reset

Table 4-1 an example of TCP/IP configuration

4.1.2 An Example of S Register Configuration

Data (▶: Command, ◀: Response message)		Description
	ATZ<CR>	▶	Initializing Basic Command set
◀	<CR><LF>OK<CR><LF>		Command process OK
	ATS2?<CR>	▶	Print Escape Code
◀	<CR><LF>43<CR><LF>		43 = 0x2b = '+'
◀	<CR><LF>OK<CR><LF>		Command process OK
	ATS2=33<CR>	▶	Change the Escape Code to 33 (33 = 0x21 = '!')
◀	<CR><LF>OK<CR><LF>		Command process OK
	ATS3?<CR>	▶	Print Carriage Return Code
◀	<CR><LF>13<CR><LF>		13 = 0x0d
◀	<CR><LF>OK<CR><LF>		Command process OK
	ATS4?S5?<CR>	▶	Print Line Feed and Backspace code
◀	<CR><LF>10<CR><LF>		10 = 0x0a
◀	<CR><LF>8<CR><LF>		8 = 0x08
◀	<CR><LF>OK<CR><LF>		Command process OK
	ATS9?<CR>	▶	Print Timeout for PING Test
◀	<CR><LF>6<CR><LF>		6 seconds
◀	<CR><LF>OK<CR><LF>		Command process OK
	ATS9=3<CR>	▶	Change Timeout to 3 seconds
◀	<CR><LF>OK<CR><LF>		Command process OK
	ATS12?<CR>	▶	Print Guard Time for Escape Code
◀	<CR><LF>50<CR><LF>		500ms (unit: 10ms)
◀	<CR><LF>OK<CR><LF>		Command process OK
	ATS12=100<CR>	▶	Change Guard Time to 1000ms (1sec)
◀	<CR><LF>OK<CR><LF>		Command process OK

Table 4-2 an example of S register configuration

☞ *ATS Commands are available except for EZL-200F / 400S / 410*

4.2 TCP Connection

4.2.1 Active connection – TCP Client

ezTCP operates as TCP client like "TCP Client – COD" communication mode. In the below table, the processes of connecting to a TCP server which has an IP address of 10.1.0.2 and Port number of 1470 are shown.

	Data (▶: Command, ◀: Response message)		Description
	AT+PRIP=10.1.0.2\<CR>	▶	Setting the remote IP address to connect
◀	\<CR>\<LF>OK\<CR>\<LF>		Command process Ok
	AT+PRP=1470\<CR>	▶	Setting the remote port number to connect
◀	\<CR>\<LF>OK\<CR>\<LF>		Command process Ok
	ATD\<CR>	▶	Connecting to the remote host
	Try connection to the remote host		
◀	\<CR>\<LF>CONNECT\<CR>\<LF>		TCP connection success
	Data Communication		

Table 4-3 active connection

The example below is multiple commands usage for the identical operation of the example above.

	Data (▶: Command, ◀: Response message)		Description
	AT+PRIP=10.1.0.2+PRP=1470D\<CR>	▶	Setting the remote host parameters and connecting to the remote host
	Try connection to the remote host		
◀	\<CR>\<LF>CONNECT\<CR>\<LF>		TCP connection success
	Data Communication		

Table 4-4 active connection with multiple commands at once

4.2.2 TCP Client via hostname

The below shows and an example usage when the product operates as a TCP client and try to connect to server using hostname.

Data (▶: Command, ◀: Response message)			Description
	AT+PRIP=0.0.0.0<CR>	▶	Setting the remote IP address to 0.0.0.0
◀	<CR><LF>OK<CR><LF>		Command process Ok
	AT+PRHN="example.phpoc.com"	▶	
◀	<CR><LF>OK<CR><LF>		Command process Ok
DNS Query/Response			
	AT+PRIP?<CR>	▶	Check the remote IP address
◀	<CR><LF>0.0.0.0<CR><LF> <CR><LF>OK<CR><LF>		"+PRHN" command is processing Command process Ok
Wait for DNS Query/Response processing time			
	AT+PRIP?<CR>	▶	Check the remote IP address
◀	<CR><LF>3.34.12.17<CR><LF> <CR><LF>OK<CR><LF>		"+PRHN" command is finished Command process Ok
	AT+PRP=80<CR>	▶	Setting the remote port number to connect
◀	<CR><LF>OK<CR><LF>		Command process Ok
	ATD<CR>	▶	Connecting to the remote host
Try connection to the remote host			
◀	<CR><LF>CONNECT<CR><LF>		TCP connection success
Data Communication			

Table 4-5 active connection via hostname

4.2.3 Passive connection – TCP Server

An ezTCP operates as a TCP server like the "TCP Server – T2S" communication mode. Below is an example of setting the TCP server on the 1470 port.

Data (▶: Command, ◀: Response message)		Description
AT+PLP=1470<CR>	▶	LOCAL PORT setting
◀ OK<CR><LF>		Command process OK
ATA<CR>	▶	TCP Listen
Wait for connection request from the remote host		
A remote host connects to ezTCP.		
◀ CONNECT<CR><LF>		TCP connection OK
Data Communication		

Table 4-6 passive connection

The example below is multiple commands usage for the identical operation of the example above.

Data (▶: Command, ◀: Response message)		Description
AT+PLP=1470A<CR>	▶	LOCAL PORT setting & TCP Listen
Wait for connection request from the remote host		
A remote host connects to ezTCP.		
◀ CONNECT<CR><LF>		TCP connection OK
Data Communication		

Table 4-7 passive connection with multiple commands at once

4.3 TCP disconnection

4.3.1 Active disconnection

When ezTCP tries to close TCP connection,

Data (▶ : Command, ◀ : Response message)		Description
Data Communication (During TCP connection)		
	+++ ▶	Change to Command State from On-line State
◀	<CR><LF>OK<CR><LF>	Changed to Command State
	ATH<CR> ▶	Close TCP connection
◀	<CR><LF>OK<CR><LF>	Command process OK
◀	<CR><LF>NO CARRIER<CR><LF>	TCP connection is closed

Table 4-8 active disconnection

4.3.2 Passive disconnection

When the remote host tries to close the connection

Date (▶ : Command, ◀ : Response message)		Description
Data Communication (During TCP connection)		
The remote host request to close the connection		
◀	<CR><LF>NO CARRIER<CR><LF>	TCP connection is closed

Table 4-9 passive disconnection

☞ *Caution: The ATA or ATD command is required to establish a new connection after a TCP connection is closed.*

4.4 WLAN Configuration

4.4.1 WLAN connection

Date (▶ : Command, ◀ : Response message)			Description
	AT+WCCT=1<CR>	▶	WLAN Topology (1: Infrastructure)
◀	<CR><LF>OK<CR><LF>		Command process OK
	AT+WSSID="sollae"<CR>	▶	WLAN SSID
◀	<CR><LF>OK<CR><LF>		Command process OK
	AT+WANT=0<CR>	▶	Select an Antenna (0: Internal)
◀	<CR><LF>OK<CR><LF>		Command process OK
	AT+WPP="0123456789"<CR>	▶	Set the WPA passphrase
◀	<CR><LF>OK<CR><LF>		Command process OK
	AT+ WPSK<CR>	▶	compute PSK
◀	<CR><LF>OK<CR><LF>		Command process OK
	AT+PWP<CR>	▶	Write the configuration
◀	<CR><LF>OK<CR><LF>		Command process OK
◀	NO CARRIER<CR><LF>		
WLAN connection is Established			
	AT+WRSSI<CR>	▶	View RSSI
◀	-17<CR><LF>		-17dBm
◀	<CR><LF>OK<CR><LF>		Command process OK

Table 4-10 WLAN connection

5   Revision History

Date	Version	Comments	Author
2004.08.16	1.0	○ Initial Release	
2008.10.28	1.1	○ Rebuild	
2009.02.19	1.2	○ Add Basic Command' Q' ○ Add Return Code 'NO ANSWER' ○ Add detail description for operation state and example	
2009.12.09	1.3	○ Style of this document has been changed. ○ Form of Revision History has been modified. ○ Some extended AT command have been added. ○ Description about Available AT commands by products has been added. ○ Figures of each examples have been added.	Roy LEE
2011.04.26	1.4	○ ATS command has been added ○ CSE-H55 has been added	Roy LEE
2012.02.06	1.5	○ Add WLAN extended AT command set ○ Add Ipv6 extended AT command set	Roy LEE
2012.03.30	1.6	○ Add AT commands(+PRST, +PLS)	Andy LEE
2012.04.18	1.7	○ Update the products list for ATS command ○ Add AT commands(+WID) ○ Modify +WKEY example ○ Modify +WEP bit ○ Add +WPSK example ○ Modify the typo	Amy KIM
2012.07.05	1.8	○ Update 'Available common extended AT commands by products' ○ Add default value of Basic AT Commands ○ More detailed examples of Basic AT Commands ○ Change sub-title to 'Application Note'	Andy LEE
2012.07.31	1.9	○ Add captions to every table ○ Modify WLAN extended AT commands(Table 1-3, 1-6) ○ Modify table 1-5	Roy LEE
2012.09.20	2.0	○ Modify description of +WPP and +WPSK commands ○ Remove duplicated figures ○ Correct some errors and expressions	Roy LEE
2012.12.02	2.1	○ Update 'Available common extended AT commands by products'	Andy LEE
2013.10.28	2.2	○ Correct an error in Table 1-4 and 1-5	Roy LEE
2013.12.18	2.3	○ Add a note about supporting extended commands	Roy LEE

2015.10.19	2.4	○ Add new products: CSE-M24, CSC-H64 ○ Update product list for command "AT+PLS" ○ Remove commands: +WEP, +WKEY, +WID and etc. ○ Add a command: +WCH ○ Correct some errors and expressions	Roy LEE
2016.04.28.	2.5	○ Usage for multiple commands at once ○ Modify WLAN connection example (delete +WPA, +WCIP) ○ Style of this document has been changed. ○ Modify table 2-5 ○ Modify the typo	Andy Lee
2018.06.18	2.6	○ Move 2.2.6 Response Messages to 2.2.2 ○ Modify the typo	Jack Kim
2021.01.04.	2.7	○ Add "AT+PSSL" command (2.2.2) ○ Update table 2-4 ○ Add the detailed information for "AT+PWP" command (2.2.7) ○ Add a usage example for TCP client using "AT+PRHN" command (4.2.2)	Andy Lee
2022.11.15	2.8	○ Add a description about passive disconnection	Peter Lee