

ESX-2/ECi Serial Protocol

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Hardware interface - ESX-2

The ESX serial connection is by 2x5 0.254mm male box header, All I/O is at 3.3V logic levels. A mark is represented by 0V, space being 3.3V level

Interface equipment should not supply signal voltages to any I/O pins when 3V3 is not present on pin 10. Powering, or switching the interface equipment via pin 10 will fulfill this requirement.

Pin	Function
1	No connection
2	RXD, input 3.3V logic
3	TXD, output 3.3V logic
4	No connection
5	Common 0V return
6	IO1 control for RS-485 3.3V logic
7	No connection
8	No connection
9	No connection
10	3V3 power out, 50mA

Hardware interface – ECI

The ECI serial connection is by 3-pin terminal. I/O is by on-board driver. A mark is represented as -3V to -15V, space being +3V to +15V.

Pin	Function
1	Common 0V return
2	RXD, input
3	TXD, output

Communications

Communicates at 115,200 baud (default), 8 Data 1 Stop.

There are two modes of communication:

1. ASCII commands – this is the default mode of communications.
2. X-MODEM – used for uploading new firmware.

Flow control is implemented in-stream using X-ON/X-OFF. There is no hardware handshaking.

For transmission, If an X-OFF is received, the panel will stop transmitting within 16 characters, then wait for an X-ON. If no X-ON is received within 5 seconds, the panel will resume transmission until another X-OFF is received.

For reception, the panel will generate an X-OFF when the receive buffer reaches 80% full, generating an X-ON when the receive buffer falls below 20%. The receive buffer is 512 bytes.

Commands - operational

Applicable modes: as listed

The following table lists the commands available via serial port for general panel operations.

Note: some operations change, or are not available depending on the selected serial mode (refer mode command). In each case, the mode column indicates where these differences occur.

Mode	Command	Parameter(s)	Result
1,2,3	VERSION		Query system version
1,2,3	DEVICE ?	? = ?	Query virtual keypad device # Device 32
1,2,3	DEVICE x	x = 1 – 32	Set virtual keypad device #
1,3	ARMAWAY		Arm by arm button
1,3	ARMAWAY x	x = 1 – 2000	Arm away as user #, no pin
2	ARMAWAY x	x = 1-32	Arm away area #
1,3	ARMAWAY x pin	x = 1 – 2000 <user pin>	Arm away as user #, user pin is <user pin>
1,3	ARMSTAY		Arm stay by stay button
1,3	ARMSTAY x	x = 1 – 2000	Arm stay as user #, no pin
2	ARMSTAY x	x = 1 – 32	Arm stay area #
1,3	ARMSTAY x pin	x = 1-2000 <user pin>	Arm stay as user #, user pin is <user pin>
1,3	DISARM x pin	x = 1 – 2000 <user pin>	Disarm as user #, user pin is <user pin>
2	DISARM x pin	x = 1-32 <user pin>	Disarm partition #, user pin is <user pin>
1,2,3	BYPASS	x = 1 – 64	Bypass zone #
1,2,3	UNBYPASS	x = 1 – 64	Clear bypass zone #
1,2,3	OUTPUTON x	x = 1 – 32	Turn on output #
1,2,3	OUTPUTOFF x	x = 1 – 32	Turn off output #
1,2,3	OUTPUT x	x = 1 – 32	Query state of output #
1,2,3	MEM x	x = 1 – 10000	Query # most recent memory events
1,2,3	MEM x y	x = 1 – 10000 , y = 1 – 10000	Query # events, start # events from most recent
	CANCEL		Cancel ongoing command (eg MEM dump)
1,2,3	STATUS		Query system status
1,2,3	KEYS	(refer list of keys)	Process keys as-if pressed on a keypad
1,2,3	REBOOT		Re-start the panel

Mode	Command	Parameter(s)	Result
1,2,3	BAUD	<refer baud desc.>	Set serial bit rate
1,2,3	FIRMWARE	<refer firmware desc.>	Upload new firmware
1,2,3	MODE	1 – 3	Set handshake and message mode
1,2,3	EXIT		Exit IP-Serial mode (n/a for serial direct)

Status events/messages

Applicable modes: as listed

For modes 1 and 2, messages listed below are generated on change of relevant status. All status messages are re-issued if a 'STATUS' command is issued.

For mode 3, the status messages are normally suppressed unless a 'STATUS' command is issued, in which case the panel will send a list of current status using the messages listed below.

For mode 3, system events are communicated using CID events, however the events listed below will be reported in response to the 'STATUS' command'

System status messages

Mode	Message	Parameter(s)	Description
1,2	BF		System battery low/missing
1,2	BR		System battery restored
1,2	CAL		Communication to monitoring station started
1,2	CLF		Communication to monitoring station finished
1,2	DF		Dialer (comms) failed
1,2	DR		Dialer (comms) restored
1,2	FF		System fuse fault
1,2	FR		System fuse restore
1,2	LF		Dialer (comms) line fault
1,2	LR		Dialer (comms) line restored
1,2	MF		Mains power failure
1,2	MR		Mains power restore
1,2	PBFx	x = Pendant number	Pendant x battery low
1,2	PBRx	x = Pendant number	Pendant x battery restored
1,2	RIF		Receiver fault
1,2	RIR		Receiver restore

The above system messages may have a source qualifier appended to the message from the following table to indicate a peripheral source:

ZXx Zone expander x, example: BF OX1 = battery low on Zone expander #1
OXx Output expander x
PXx Prox expander x

Partition status messages

Mode	Message	Parameter(s)	Description
1,2	Ax	x = Partition number	Partition x has away-armed
2	AAx	x = Partition number	Partition x is in alarm
2	ARx	x = Partition number	Partition x is no longer in alarm
1,2	Dx	x = Partition number	Partition x has disarmed
1,2	EAx	x = Partition number	Partition x has started timing away-arm exit period
1,2	ESx	x = Partition number	Partition x has started timing stay-arm exit period
2	NRx	x = Partition number	Partition x is not ready (not sealed)
2	ROx	x = Partition number	Partition x is ready (sealed)
1,2	Sx	x = Partition number	Partition x has stay-armed

Zone status messages

Mode	Message	Parameter(s)	Description
1,2	ZAx	x = Zone number	Zone x is in alarm
1,2	ZBLx	x = Zone number	Radio zone x battery low
1,2	ZBRx	x = Zone number	Radio zone x battery restored
1,2	ZBYx	x = Zone number	Zone x bypassed
1,2	ZBYRx	x = Zone number	Zone x un-bypassed
2	ZCx	x = Zone number	Zone x closed (sealed)
1,2	ZIAx	x = Zone number	Zone x sensor-watch alarm
1,2	ZIRx	x = Zone number	Zone x sensor-watch restored
1,2	ZOx	x = Zone number	Zone x open (un-sealed)
1,2	ZRx	x = Zone number	Zone x alarm restored
1,2	ZTx	x = Zone number	Zone x trouble alarm
1,2	ZTRx	x = Zone number	Zone x trouble alarm restored
1,2	ZSAx	x = Zone number	Zone x supervise alarm
1,2	ZSRx	x = Zone number	Zone x supervise alarm restored

Output status messages

Mode	Message	Parameter(s)	Description
1,2	OOx	x = Output number	Output x on
2	AAx	x = Output number	Output x off

VERSION – Query panel version

Applicable modes: 1,2,3

Parameters: none

The VERSION command queries the panel version number.

Example (query ESX):

Remote	Panel	
VERSION\n		(query device version)
	OK Version "ESX-1 F/W Ver. 10.2.426 (GKRA6PJW)"\n	(response)

Example (query ECI):

Remote	Panel	
VERSION\n		(query device version)
	OK Version "ECi F/W Ver. 10.2.426 (GKRA6PJW)"\n	(response)

DEVICE – Set/Get serial port 'virtual keypad' number

Applicable modes: 1,2,3

Parameters: [keypad-number] or '?'

The DEVICE command queries the virtual keypad number if a '?' is specified, or sets the serial port 'virtual keypad' number if in range 1..32.

Example (query):

Remote	Panel	
DEVICE ?\n		(query device #)
	OK Device 32\n	(response)

Example (setting):

Remote	Panel	
DEVICE 21\n		(set device # to 21)
	OK Device 21\n	(response)

By default, the 'virtual keypad' device is #32.

ARMAWAY – Arm in away mode by button, area or user

Applicable modes: 1,2,3

Parameters (MODE 1,3): [user-number] [pin] arm user number

Parameters (MODE 1,3): [user-number] arm user number w/o pin

Parameters (MODE 2): [area-number] – arm area number

Parameters (MODE1,3) none – single button arm

The ARMAWAY command arms be either area (mode 2), or user number (modes 1,3), or as arm-button mode if no parameters given (modes 1,2,3).

Example (modes 1,3):

Remote	Panel	
ARMAWAY 1 123\n		(arm-away as user 1)
	OK ArmAway 1\n	(response)

Example (mode 2):

Remote	Panel	
ARMAWAY 2\n		(arm-away area 2)
	OK ArmAway 2\n	(response)

Example (modes 1,3):

Remote	Panel	
ARMAWAY\n		(arm-away in single-button mode)
	OK ArmAway\n	

ARMSTAY – Arm in stay mode by button, area or user

Applicable modes: 1,2,3

Parameters (MODE 1,3): [user-number] [pin] arm user number

Parameters (MODE 1,3): [user-number] arm user number w/o pin

Parameters (MODE 2): [area-number] – arm area number

Parameters (MODE1,3) none – single button arm

The ARMSTAY command arms be either area (mode 2), or user number (modes 1,3), or as arm-button mode if no parameters given (modes 1,2,3).

Example (modes 1,3):

Remote	Panel	
ARMSTAY 1 123\n		(arm-stay as user 1)
	OK ArmStay 1\n	(response)

Example (mode 2):

Remote	Panel	
ARMSTAY 2\n		(arm-stay area 2)
	OK ArmStay 2\n	(response)

Example (modes 1,3):

Remote	Panel	
ARMSTAY\n		(arm-stay in single-button mode)
	OK ArmStay\n	

DISARM – Disarm by area or user

Applicable modes: 1,2,3

Parameters (MODE 1, MODE 3): [user-number] [pin]

Parameters (MODE 2): [area-number] [pin]

The DISARM command disarms by either area (mode 2), or user number (modes 1,3).

Example (modes 1,3):

Remote	Panel	
DISARM 1 123\n		(disarm as user 1)
	OK Disarm 1\n	(response)

Example (mode 2):

Remote	Panel	
DISARM 2 123\n		(disarm area 2, find user by pin)
	OK Disarm 2\n	(response)

BYPASS – Bypass zone

Applicable modes: 1,2,3

Parameters: [zone-number]

The BYPASS command bypasses the specified zone.

Example:

Remote	Panel	
BYPASS 3\n		(bypass zone 3)
	OK Bypass 3\n	(response)

UNBYPASS – Remove zone bypass

Applicable modes: 1,2,3

Parameters: [zone-number]

The UNBYPASS command re-instates the specified zone.

Example:

Remote	Panel	
UNBYPASS 3\n		(re-instate zone 3)
	OK UnBypass 3\n	(response)

OUTPUTON – Turn an output on

Applicable modes: 1,2,3

Parameters: [output-number]

The OUTPUTON command turns the specified output off.

Example:

Remote	Panel	
OUTPUTON 3\n		(request output 3 on)
	OK OutputOff 3\n	(response)

OUTPUTOFF – Turn an output off

Applicable modes: 1,2,3

Parameters: [output-number]

The OUTPUTOFF command turns the specified output off.

Example:

Remote	Panel	
OUTPUTOFF 3\n		(request output 3 off)
	OK OutputOff 3\n	(response)

OUTPUT – Query current output state

Applicable modes: 1,2,3

Parameters: [output-number]

The OUTPUT command returns the current state of the output specified.

Example:

Remote	Panel	
OUTPUT 3\n		(request output 3 state)
	OK Output 3 Off\n	(response)

MEM – Query the panel memory

Applicable modes: 1,2,3

Parameters: [num-records] [<start-offset>]

The MEM command returns a list of memory events.

If only one parameter is given, it will list that many latest events.

If a second parameter is given, the list will start at an offset from the latest events, the offset being the number given as a second parameter.

Example:

Remote	Panel	
Mem 3\n		(request 3 latest memory events)
	OK Mem 3\n	(response)
	MEM Thu 22-OCT-20 16:49:26 Zone Re-Instated Area 1 Zone 7	
	MEM Thu 22-OCT-20 16:43:18 Clock Updated NTP	
	MEM Thu 22-OCT-20 16:42:56 Zone Bypassed Area 1 Zone 7	
	MEM END	

STATUS – Query the panel status

Applicable modes: 1,2,3

Parameters: none

The STATUS command returns a current status list for partitions, system, zones and outputs. Refer section '[Status/Events Messages](#)'

Example:

Remote	Panel	
Status\n		(request)
	OK Status\n	(response)
	ZO4\n	(Zone 4 is open)
	ZSA12	(Zone 12 has a supervise fault)

REBOOT – Re-start the panel

Parameters: none.

Use the REBOOT command to re-start the panel.

BAUD – Set serial bit rate

Parameter: baud-parameter

Use a direct value between 300 and 57,600 to set the bit rate. The following table may be useful for higher bit rates. The default bit rate at reset is 115200.

Baud-parameter	Bit rate
14	14400
19	19200
38	38400
57	57600
115	115200
230	230400
921	921600

FIRMWARE - Firmware Update

Firmware update is performed using the X-MODEM protocol. After sending the firmware command, the panel will reply with OK, and prepare for the update. Once ready to receive the update, the panel will further respond with 'READY', the XMODEM 'C' character will repeat until timeout (~10 seconds). Any other command will be not be accepted during the XMODEM session, and will cause the XMODEM session to abort. After XMODEM firmware update completes successfully, the panel will re-start. Should the XMODEM session not complete, the panel will reply with an error message.

Remote	Panel	
Firmware\n		(request)
	OK\n	(response)
	READY\n	(panel ready to accept XMODEM data)
	C	(panel sends C XMODEM start char.)
<send firmware>		(remote send firmware file using XMODEM)

MODE - Serial message mode

Applicable modes: 1,2,3

There are 3 modes for the serial communication. Mode 1 is default. The 'Mode' command can be used to select the message mode as per example:

Remote	Panel	
MODE 1\n		(request mode 1)
	OK\n	(response – acknowledged)
	Mode 1\n	(response – result)
OK\n		(remote acknowledges response)

Mode	Acknowledgement
'Mode 1'	No (default mode)
'Mode 2'	Yes (AAP mode)
'Mode 3'	Yes (Permaconn mode)

Once the mode has been set, it will persist as the current mode until either the panel defaulted, or a new mode is selected.

From version 10.2.433, Mode 1 line endings are as per ESX-1 ('\r\n' and '\n\r'). All other modes continue to use a line ending of '\n'.

EXIT - Exit serial session

Applicable modes: 1,2,3

Parameters: none

Exit the serial session and close the IP connection. Not applicable to local direct-serial connection.

Commands – Programming/Query

Applicable modes: 1,2,3

Refer to the panel programming manual for a list of program locations and use.

Example: Program location

Remote	Panel	
P1E3=789\n		(program user 3 code as '789')
	OK\n	(response – acknowledged)
	P1001E3=789\n	(response – result)

Example: Query location

Remote	Panel	
P1E3 ?\n		(query user 3 code)
	OK\n	(response – acknowledged)
	P1001E3=789\n	(response – result)

Message Processing

Applicable modes: 2,3

Each message will be acknowledged with either OK, or ERR x as per the following table.

Reply	Function
OK\n	Command accepted
ERR 1\n	Command not understood
ERR 2\n	Invalid parameter
ERR 3\n	Command not allowed at this time
ERR 4\n	Receive buffer overflow
ERR 5\n	Transmit buffer overflow
ERR 6\n	XMODEM session failed

The ECI panel also expects an 'OK\n' in response to any status message signalled. If the panel receives an 'ERR\n' message, the status message will be immediately repeated up to twice. The panel will wait for 500mS¹ for the reply. If no reply from the above table is received within 500mS, the panel will repeat the message a further two times. With no acknowledge after a total of 3 attempts will mark the interface as down, logged in the panel event log.

¹ Receiving an X-OFF character will cause the 500mS timed wait will be stretched until either X-ON is received, or the built-in X-OFF timeout (5 seconds) is exceeded, at which point the 500mS timing window will resume. Refer section 'Communications'.

Event reporting (EV)

Applicable modes: 3

Events which would normally be sent via dialer or IP-reporting will be reported to serial as CID format with the prefix 'EV'. Event reporting is only supported in mode 3.

Structure

EV	EV, Event message identifier	EV
ACCT	Account	4 digit account code
MT	Message type	2 digit message type (18)
Q	Event qualifier	1 digit qualifier. 1 or 3
XYZ	Event code	3 digit hex event code
GG	Group or partition number	2 digit group or partition number
CCC	Zone number	3 digit hex zone or user number
S	Checksum	1 digit checksum

EV ACCT MT QXYZ GG CCC S\n

Example signal

Panel	Remote
EV 0000181628000004\n	OK\n

Checksum calculation (as per SIA DC-05)

(Sum of all message digits + S) MOD 15 = 0

Note: a '0' shall be transmitted as a 10 (0x0A), and valued as a 10 for checksum purposes even though it is displayed and printed as '0'.

Example message: 1234 18 1131 01 015 8

where: 1234 = account number

18 = message type used to identify the message as Contact ID

1131 = The event qualifier (1) for a new event, followed by the event code.

01 = partition number

015 = the zone number

8 = the checksum

a) Add all the message digits together, using 10 for all '0' digits:

$$(1+2+3+4) + (1+8) + (1+1+3+1) + (10+1) + (10+1+5) = 52$$

b) Find the next highest multiple of 15, in this case 60.

c) Subtract the sum from this value (60 - 52 = 8).

d) Use the result for the checksum. If the result is 0, use the digit 'F' (15) for the checksum.

Operational notifications and commands

Applicable modes: 1,2,3

All existing commands as per document <RS232-BD-Elite SX.doc> are implemented with the addition of acknowledgements as per section '[Status/Event Messages](#)'. Commands are not case-sensitive.

Example, Zone 4 opening notification

Panel	Remote
ZO4\n	OK\n

Example, Zone 4 bypass request command

Remote	Panel	
BYPASS 4\n		(request)
	OK\n	(response - acknowledged)
	BYPASS 4\n	(response - result)

Example, Zone 4 bypass request but not allowed at this time (eg armed or config)

Remote	Panel	
BYPASS 4\n		(request)
	ERR 3\n	(response – refused)
OK\n		(remote acknowledges response)

Configuration commands

Applicable modes: 1,2,3

Individual config read commands take the form PxEy?\n, where x is the program location, y is the parameter – eg zone. The reply will be OK\n followed by the result.

Example, read user code

Remote	Panel	
P1E4?\n		(request)
	OK\n	(response)
	P1E4=123\n	(response - result)
OK\n		(remote acknowledges response)

Config writing commands are similar to read, with the '?' replaced with the parameter.

Example, write user code

Remote	Panel	
P1E4=123\n		(request)
	OK\n	(response)
	P1E4=123\n	(response - result)
OK\n		(remote acknowledges response)

Example, read user areas (boolean data, range 1..32)

Remote	Panel	(request)
P3E4?	OK\n	(response)
	P3E4=1,2,3,4,32	(response – result)
OK\n		(remote acknowledges response)

(note: a boolean location with no options set will return 0, example P3E4=0)

All configuration locations are covered in the ECI installation manual.

Changes and Errata

Changes relevant to ESX/ECi serial protocol.

Firmware Version	Item	Detail
v.10-2-396	Extra line feed	Removed extra line feed symbol in serial output stream.
v.10-2-393	Add program location 'Active areas'	Added program location P4076 for listing active areas. Usage: P4076E1? returns a coma seperated list of areas which are active (contain one or more enabled zones). Note: read-only location.
v.10-2-392	Add program location 'Zones in area'	Added program location P4075 for listing enabled zones in an area. Usage: P4075En? returns a coma seperated list of enabled zones in area 'n'. Note: read-only location.
v.10.2.426		Document re-organisation to more clearly show differences with the different serial handshaking modes.
V.10.2.427	VERSION	VERSION command now returns panel OEM specific name instead of Elite-SX.
V10.2.430	Contact-ID	Add explanation of checksum.
V10.2.433	Line endings	Line endings in MODE 1 now emulate ESX-1 panel. Refer note in 'MODE' section.
V10.2.441	Firmware Update by serial	The panel would switch the serial port over to XMODEM before the 'READY' text was transmitted, resulting in the 'READY' being transmitted after the XMODEM mode had timed out waiting for update.