blacklinesafety

EXO Translator

Technical User Manual

blacklinesafety

Contents

WARNINGS

- WARNING: The EXO Translator connections are compliance reviewed to IEC/CSA 62368-1 and are not certified as intrinsically safe. It it is important that you comply with the electrical connection requirements described in the EXO Technical User Manual and EXO 8 Technical User Manual.
- WARNING: When EXO is configured for use with EXO Translator, the EXO Power/debug port is no longer available for trickle charging or solar panel charging.
- WARNING: Only use the Blackline Safety-supplied cable to connect the EXO Translator Input port with EXO Power/debug port. Splitting power and communications with a customer-supplied cable is not recommended.

1 OVERVIEW

The EXO Translator is a wired communications box that translates a single gas reading and status message from Universal Asynchronous Receiver Transmitter (UART) format to either the Modbus (RS-485) or Message Queuing Telemetry Transport (MQTT) message format.

Use this accessory to connect EXO and EXO 8 devices to remote confined space monitoring systems and allow a central operating center service to directly monitor personnel and gas levels, access controls, and trigger alarms when necessary.

2 WHAT'S IN THE BOX

The EXO Translator comes with:

- EXO Translator unit (ACC-G7EXO-TRANSLATOR)
- Cable (EXO to EXO Translator unit) (ACC-G7EXO-TRANSLATOR-C1)
- EXO Translator Technical User Manual

NOTE: Blackline Safety does not provide power and Modbus cables. For more information and cabling suggestions, see the relevant sections in this user manual.

3 HARDWARE

3.1 EXO TRANSLATOR

PoE/Data Port	Connection to power supply + [Optional] MQTT data connection to confined space monitoring system.
Modbus Port	Modbus data connection to confined space monitoring system.
Input Port	Data connection to EXO Power/debug port (1m [3.3ft] cable provided by Blackline Safety [ACC-G7EXO-TRANSLATOR-C1]) and charges EXO device.
Mounting Bracket	Bracket to mechanically secure the EXO Translator.

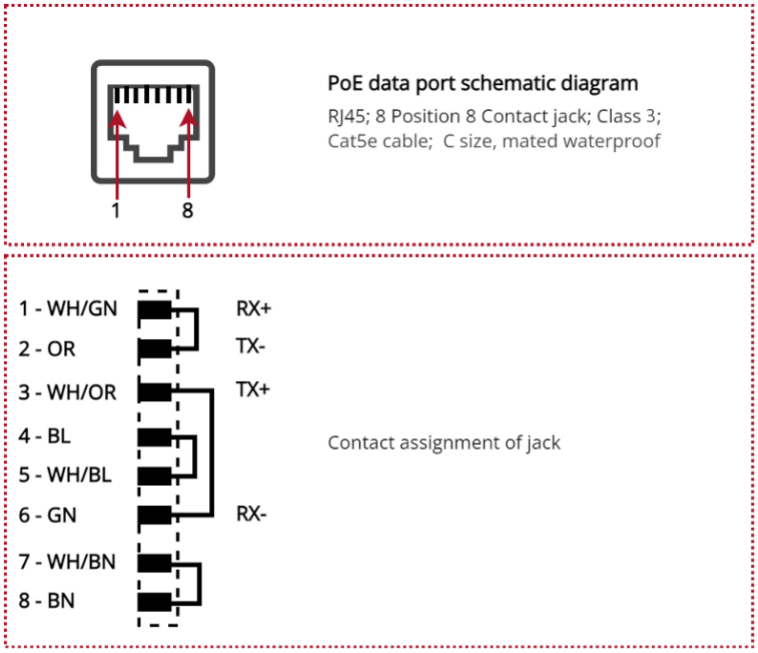
4 CONNECTION DETAILS

4.1 POWER OVER ETHERNET (POE)/DATA PORT

The Power over Ethernet (PoE) data port connects the EXO Translator to a power supply. The port uses PoE, enabling the implementation of MQTT data connections to the confined space monitoring system using the same port if required.

4.1.1 CONNECTOR SPECIFICATIONS

The following diagram describes the standard IEEE 802.3af PoE/data port configuration:



EXO Translator PoE data port aligns with the standard IEEE802.3af, power class 3 parameters:

	Max. Input Voltage	Min. Input Voltage	Max. Current	Max. Input Power
PoE Port	57 Vdc	37 Vdc	350 mA	12.95 W

NOTE: The EXO Translator PoE connection is active. If the incoming power does not meet the device's requirements, it will not power up.

⚠ WARNING: The EXO Translator connections are compliance reviewed to IEC/CSA 62368-1 and are not certified as intrinsically safe. It it is important that you comply with the electrical connection requirements described in the EXO Technical User Manual and EXO 8 Technical User Manual.

4.1.2 CABLING

Blackline Safety does not provide a power cable. If implementing MQTT, use a PoE switch to enable power and data communications between the confined space monitoring system and the EXO Translator.

4.1.3 MQTT MESSAGE PROTOCOL

MQTT Input Registers

Address	PLC Address	Register Type	Register Description	Notes
0	30001	Unsigned int	Translator status	See the Enumerated Fields tab for a list of values.
1	30002			
2	30003	Unsigned int	Translator version	Firmware version (Major.Minor.Build) of the Translator, converted using: Version = Major * 2^{24} + Minor * 2^{16} + Build. For example, v1.2.3 → 16908291.
3	30004			
4	30005	Unsigned int	EXO error code	Most recent error code reported by EXO. Will read as 0 if no errors have been reported.
5	30006			
6	30007		Reserved for future use	Placeholder for future data fields if needed. Will always read as 0.
7	30008			
8	30009	Unsigned int	EXO status timestamp	Timestamp of most recent $EXO message. Upper 15 bits are days since 2010-01-01, lower 17 bits are seconds since 00:00:00 UTC.
9	30010			
10	30011	Unsigned int	EXO unit ID	Device ID of the EXO. 10-digit number beginning with 358.
11	30012			
12	30013	Unsigned int	EXO battery level	Battery level in percent from 0 to 100. A value of 255 means the battery level is unknown.
13	30014			
14	30015	Unsigned int	EXO charging status	1 if the EXO is charging, 0 otherwise.
15	30016			
16	30017	Signed int	GPS latitude	Last known latitude in (degrees × 10^7). A value of 0x7FFFFFFF indicates unknown location.
17	30018			
18	30019	Signed int	GPS longitude	Last known longitude in (degrees × 10^7). A value of 0x7FFFFFFF indicates unknown location.
19	30020			
20	30021	Signed int	GPS altitude	Last known altitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.
21	30022			
22	30023	Unsigned int	GPS beacon ID	

Address	PLC Address	Register Type	Register Description	Notes
23	30024			Device ID of the last registered Blackline GPS beacon. 10-digit number beginning with 1370 or 1371.
24	30025	Unsigned int	Network signal strength	Network RSSI normalized to a value from 0 to 10.
25	30026			
26	30027	Unsigned int	EXO alarm status	See the MQTT Enumerated Fields tables for a list of values.
27	30028			
28	30029		Reserved for future use	Placeholder for future data fields if needed. Will always read as 0.
29	30030			
30	30031		Reserved for future use	Placeholder for future data fields if needed. Will always read as 0.
31	30032			
32	30033	Unsigned int	EXO measurement timestamp	Timestamp of most recent $GAS message. Upper 15 bits are days since 2010-01-01, lower 17 bits are seconds since 00:00:00 UTC.
33	30034			
34	30035	Floating point	Temperature	Sensor temperature in °C.
35	30036			
36	30037	Floating point	Pressure	Sensor pressure in hPa.
37	30038			
38	30039	Floating point	Humidity	Sensor humidity in %.
39	30040			
40	30041	Signed int	Next bump due	Number of days until the next bump test. Negative values indicate the test is overdue.
41	30042			
42	30043	Unsigned int	Pump active inlet	The numbered pump inlet that is active. A value of 0 indicates diffusion, and 5 indicates purging.
43	30044			
44	30045	Floating point	Pump flow rate	The flow rate of the pump.
45	30046			
46	30047		Reserved for future use	Placeholder for future data fields if needed. Will always read as 0.
47	30048			
48	30049		Reserved for future use	Placeholder for future data fields if needed. Will always read as 0.
49	30050			
50	30051	Unsigned int	Gas sensor 1: status	See the MQTT Enumerated Fields tables for a list of values.
51	30052			
52	30053	Unsigned int	Gas sensor 1: type	See the MQTT Enumerated Fields tables for a list of values.
53	30054			

Address	PLC Address	Register Type	Register Description	Notes
54	30055	Floating point	Gas sensor 1: reading	Gas reading, with units noted in the following register.
55	30056			
56	30057	Unsigned int	Gas sensor 1: units	See the MQTT Enumerated Fields tables for a list of values.
57	30058			
58	30059	Signed int	Gas sensor 1: next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
59	30060			
60	30061	Unsigned int	Gas sensor 2: status	See the MQTT Enumerated Fields tables for a list of values.
61	30062			
62	30063	Unsigned int	Gas sensor 2: type	See the MQTT Enumerated Fields tables for a list of values.
63	30064			
64	30065	Floating point	Gas sensor 2: reading	Gas reading, with units noted in the following register.
65	30066			
66	30067	Unsigned int	Gas sensor 2: units	See the MQTT Enumerated Fields tables for a list of values.
67	30068			
68	30069	Signed int	Gas sensor 2: next calibration due	Number of days until the next calibration for this sensor.Negative values indicate the calibration is overdue.
69	30070			
70	30071	Unsigned int	Gas sensor 3: status	See the MQTT Enumerated Fields tables for a list of values.
71	30072			
72	30073	Unsigned int	Gas sensor 3: type	See the MQTT Enumerated Fields tables for a list of values.
73	30074			
74	30075	Floating point	Gas sensor 3: reading	Gas reading, with units noted in the following register.
75	30076			
76	30077	Unsigned int	Gas sensor 3: units	See the MQTT Enumerated Fields tables for a list of values.
77	30078			
78	30079	Signed int	Gas sensor 3: next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
79	30080			
80	30081	Unsigned int	Gas sensor 4: status	See the MQTT Enumerated Fields tables for a list of values.
81	30082			
82	30083	Unsigned int	Gas sensor 4: type	See the MQTT Enumerated Fields tables for a list of values.
83	30084			
84	30085	Floating point	Gas sensor 4: reading	Gas reading, with units noted in the following register.
85	30086			
86	30087	Unsigned int		

Address	PLC Address	Register Type	Register Description	Notes
87	30088		Gas sensor 4: units	See the MQTT Enumerated Fields tables for a list of values.
88	30089	Signed int	Gas sensor 4: next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
89	30090			
90	30091	Unsigned int	Gas sensor 5: status	See the MQTT Enumerated Fields tables for a list of values.
91	30092			
92	30093	Unsigned int	Gas sensor 5: type	See the MQTT Enumerated Fields tables for a list of values.
93	30094			
94	30095	Floating point	Gas sensor 5: reading	Gas reading, with units noted in the following register.
95	30096			
96	30097	Unsigned int	Gas sensor 5: units	See the MQTT Enumerated Fields tables for a list of values.
97	30098			
98	30099	Signed int	Gas sensor 5: next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
99	30100			

MQTT Topics

MQTT Topic List		
Default Topic Name	Description	Notes
/fail	Errors reported by translator	MQTT topics all take the form _____Serial Number_____, where the blank fields are configurable in the configuration page. The default prefix is blank, and the default suffix is listed here. An example serial number is 2046SBI12345.
/measurement	Measurement data from EXO	
/status	Status information from EXO	
/error	Errors reported by EXO	

/trans_fail_message Payload			
Key	Data Type	Key Description	Notes
ver	Integer	Translator version	Firmware version (Major.Minor.Build) of the Translator, converted using: Version = Major * 2^{24} + Minor * 2^{16} + Build. For example, v1.2.3 → 16908291
ecd	Integer	Error code	See the MQTT Enumerated Fields tables (Translator Status - Bit Mask) for a list of values.

/error_message Payload			
Key	Data Type	Key Description	Notes
ver	Integer	Translator version	Firmware version (Major.Minor.Build) of the Translator, converted using: Version = Major * 2^{24} + Minor * 2^{16} + Build. For example, v1.2.3 → 16908291
ecd	Integer	Error code	Error code reported by EXO. Will read as 0 if no errors have been reported.

/exo_message Payload			
Key	Data Type	Key Description	Notes
ver	Integer	Translator version	Firmware version (Major.Minor.Build) of the Translator, converted using: Version = Major * 2^{24} + Minor * 2^{16} + Build. For example, v1.2.3 → 16908291.
tms	String	Timestamp of the EXO message	Date and UTC time of the EXO device location, in the format of "YYYY-MM-DD HH:MM:SS".
uid	Integer	Unit ID	Device ID of the EXO. 10-digit number beginning with 358.
btl	Integer	Battery level	Battery level in percent from 0 to 100. A value of 255 means the battery level is unknown.
chs	Integer	Charging status	1 if the EXO is charging, 0 otherwise.
lat	Integer	Last known GPS latitude	Last known latitude in (degrees × 10^7). A value of 0x7FFFFFFF indicates unknown location.
lot	Integer	Last known GPS longitude	Last known longitude in (degrees × 10^7). A value of 0x7FFFFFFF indicates unknown location.
alt	Integer	Last known GPS altitude	Last known altitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.
bid	Integer	Last known beacon ID	Device ID of the last registered Blackline GPS beacon. 10-digit number beginning with 1370 or 1371.
nss	Integer	Network signal strength	Network RSSI normalized to a value from 0 to 10.
asm	Integer	Alarm status mask	See the MQTT Enumerated Fields tables (EXO Alarm Status - Bit Mask) for a list of values.

/gas_message Payload			
Key	Data Type	Key Description	Notes
ver	Integer	Translator version	Firmware version (Major.Minor.Build) of the Translator, converted using: Version = Major * 2^{24} + Minor * 2^{16} + Build. For example, v1.2.3 → 16908291.

/gas_message Payload			
Key	Data Type	Key Description	Notes
tms	String	Timestamp of the gas message	Date and UTC time of the EXO device location, in the format of "YYYY-MM-DD HH:MM:SS".
tmp	Float	Sensor temperature	Sensor temperature in °C.
prs	Float	Sensor pressure	Sensor pressure in hPa.
hmd	Float	Sensor humidity in %	Sensor humidity in %.
nbt	Integer	Days until next bump due	Number of days until the next bump test. Negative values indicate the test is overdue.
aci	Integer	Current inlet that is active (0-5)	The numbered pump inlet that is active. A value of 0 indicates diffusion, and 5 indicates purging.
pfr	Float	Flow rate	The flow rate of the pump.
sn1st	Integer	Gas sensor 1 status	See the MQTT Enumerated Fields tables (EXO Alarm Status - Bit Mask) for a list of values.
sn1gt	Integer	Gas sensor 1 gas type	See the MQTT Enumerated Fields tables (Gas Types) for a list of values.
sn1rd	Float	Gas sensor 1 reading	Gas reading, with units noted in the following register.
sn1ut	Integer	Gas sensor 1 reading units	See the MQTT Enumerated Fields tables (Measurement Units) for a list of values.
sn1nc	Integer	Gas sensor 1 next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
sn2st	Integer	Gas sensor 2 status	See the MQTT Enumerated Fields tables (EXO Alarm Status - Bit Mask) for a list of values.
sn2gt	Integer	Gas sensor 2 gas type	See the MQTT Enumerated Fields tables (Gas Types) for a list of values.
sn2rd	Float	Gas sensor 2 reading	Gas reading, with units noted in the following register.
sn2ut	Integer	Gas sensor 2 reading units	See the MQTT Enumerated Fields tables (Measurement Units) for a list of values.
sn2nc	Integer	Gas sensor 2 next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
sn3st	Integer	Gas sensor 3 status	See the MQTT Enumerated Fields tables (EXO Alarm Status - Bit Mask) for a list of values.
sn3gt	Integer	Gas sensor 3 gas type	See the MQTT Enumerated Fields tables (Gas Types) for a list of values.
sn3rd	Float	Gas sensor 3 reading	Gas reading, with units noted in the following register.
sn3ut	Integer	Gas sensor 3 reading units	See the MQTT Enumerated Fields tables (Measurement Units) for a list of values.

/gas_message Payload			
Key	Data Type	Key Description	Notes
sn3nc	Integer	Gas sensor 3 next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
sn4st	Integer	Gas sensor 4 status	See the MQTT Enumerated Fields tables (EXO Alarm Status - Bit Mask) for a list of values.
sn4gt	Integer	Gas sensor 4 gas type	See the MQTT Enumerated Fields tables (Gas Types) for a list of values.
sn4rd	Float	Gas sensor 4 reading	Gas reading, with units noted in the following register.
sn4ut	Integer	Gas sensor 4 reading units	See the MQTT Enumerated Fields tables (Measurement Units) for a list of values.
sn4nc	Integer	Gas sensor 4 next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
sn5st	Integer	Gas sensor 5 status	See the MQTT Enumerated Fields tables (EXO Alarm Status - Bit Mask) for a list of values.
sn5gt	Integer	Gas sensor 5 gas type	See the MQTT Enumerated Fields tables (Gas Types) for a list of values.
sn5rd	Float	Gas sensor 5 reading	Gas reading, with units noted in the following register.
sn5ut	Integer	Gas sensor 5 reading units	See the MQTT Enumerated Fields tables (Measurement Units) for a list of values.
sn5nc	Integer	Gas sensor 5 next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.

MQTT Enumerated Fields

Translator Status - Bit Mask		
Value	Description	Notes
0x 0000 0001	EXO is unresponsive	No transmissions received from the EXO in the last five seconds.
0x 0000 0002	Checksum error	Latest transmission from the EXO had an invalid checksum.
0x 0000 0004	Parsing error	Latest transmission from the EXO could not be parsed.

EXO Alarm Status - Bit Mask		
Value	Description	Notes
0x 0000 0001	Emergency alert	

EXO Alarm Status - Bit Mask		
Value	Description	Notes
0x 0000 0002	Pump low flow warning	
0x 0000 0004	Cartridge error warning	
0x 0000 0008	Cartridge not recognized	
0x 0000 0010	Message warning	
0x 0000 0020	Incoming call warning	
0x 0000 0040	Comms lost warning	
0x 0000 0080	Low battery warning	
0x 0000 0100	Hardware test fail alarm	
0x 0000 0200	Firmware not certified warning	
0x 0000 0400	Pump failure alarm	
0x 0000 0800	Tipped over warning	

Sensor Status - Bit Mask		
Value	Description	Notes
0x 0000 0001	Sensor under limit	
0x 0000 0002	Low gas alarm	
0x 0000 0004	Low gas alert	
0x 0000 0008	Gas alarm	
0x 0000 0010	Gas alert	
0x 0000 0020	TWA alert	
0x 0000 0040	STEL alert	
0x 0000 0080	Sensor over limit	
0x 0000 0400	Sensor calibration overdue	
0x 0000 0800	Sensor is attached	If this is not set, the sensor should be ignored.
0x 2000 0000	Sensor error	
0x 4000 0000	Sensor is unresponsive	
0x 8000 0000	Sensor is disabled	

Measurement Units		
Value	Description	Notes
0	PPM	Parts per million
1	VOL	Percentage by volume
2	LE	Percentage of Lower Explosive Limit
3	MM3	

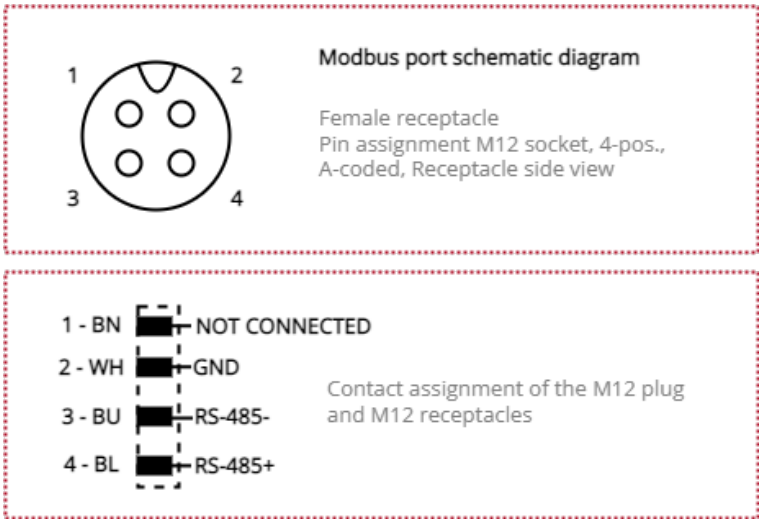
Gas Types		
Value	Description	Notes
0	FRESH_AIR	Fresh air
1	H2S	Hydrogen sulfide
2	CO	Carbon monoxide
3	O2	Oxygen
4	CO2	Carbon dioxide
5	LEL	Combustible gas
6	N2	Nitrogen
7	NH3	Ammonia
8	SO2	Sulfur dioxide
9	CL2	Chlorine
10	VOC_PPM	Volatile organic compounds, parts per million
11	HCN	Hydrogen cyanide
12	H2	Hydrogen
13	CLO2	Chlorine dioxide
14	O3	Oxone
15	For future use: VOC_PPB	Volatile organic compounds, parts per billion
16	NO2	Nitrogen dioxide
17	NN_LEL	Combustible gas, Nevada Nano MPS sensor
18	HF	Hydrogen fluoride

4.2 MODBUS PORT

The Modbus data port allows you to connect the EXO Translator to the remote confined space monitoring system using Modbus.

4.2.1 CONNECTOR SPECIFICATIONS

The following diagram describes the Modbus port pin configuration:



NOTE: The EXO Translator connection is compliance reviewed to IEC/CSA 62368-1. The RS-485 bus is internally terminated.

4.2.2 CABLING

A Modbus cable is not provided.

4.2.3 MODBUS MESSAGE PROTOCOLS

Modbus Input Registers

Address	PLC Address	Register Type	Register Description	Notes
0	30001	32-bit unsigned int	Translator status	See the Modbus Enumerated Fields tables for a list of values.
1	30002			

Address	PLC Address	Register Type	Register Description	Notes
2	30003	32-bit unsigned int	Translator version	Current firmware version (Major.Minor.Build) of the Translator, converted to an integer using the formula Version = Major * 2^{24} + Minor * 2^{16} + Build. For example, version 1.2.3 → 16908291
3	30004			
4	30005	32-bit unsigned int	EXO error code	Most recent error code reported by EXO. Reads as 0 if no errors are reported.
5	30006			
6	30007		Reserved for future use	Placeholder for future data fields if needed. Reads as 0.
7	30008			
8	30009	32-bit unsigned int	EXO status timestamp	Timestamp of most recent $EXO message. Upper 15 bits are days since 2010-01-01, lower 17 bits are seconds since 00:00:00 UTC.
9	30010			
10	30011	32-bit unsigned int	EXO unit ID	Device ID of the EXO. 10-digit number beginning with 358.
11	30012			
12	30013	32-bit unsigned int	EXO battery level	Battery level in percent from 0 to 100. A value of 255 means the battery level is unknown.
13	30014			
14	30015	32-bit unsigned int	EXO charging status	1 if the EXO is charging, 0 otherwise.
15	30016			
16	30017	32-bit signed int	GPS latitude	Last known latitude in (degrees × 10^7). A value of 0x7FFFFFFF indicates unknown location.
17	30018			
18	30019	32-bit signed int	GPS longitude	Last known longitude in (degrees × 10^7). A value of 0x7FFFFFFF indicates unknown location.
19	30020			
20	30021	32-bit signed int	GPS altitude	Last known altitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.
21	30022			
22	30023	32-bit unsigned int	GPS beacon ID	Device ID of the last registered Blackline GPS beacon. 10-digit number beginning with 1370 or 1371.
23	30024			
24	30025	32-bit unsigned int	Network signal strength	Network RSSI normalized to a value from 0 to 10.
25	30026			
26	30027	32-bit unsigned int	EXO alarm status	See the Modbus Enumerated Fields tables for a list of values.
27	30028			

Address	PLC Address	Register Type	Register Description	Notes
28	30029		Reserved for future use	Placeholder for future data fields if needed. Reads as 0.
29	30030			
30	30031		Reserved for future use	Placeholder for future data fields if needed. Reads as 0.
31	30032			
32	30033	32-bit unsigned int	EXO measurement timestamp	Timestamp of most recent $GAS message. Upper 15 bits are days since 2010-01-01, lower 17 bits are seconds since 00:00:00 UTC.
33	30034			
34	30035	32-bit floating point	Temperature	Sensor temperature in °C.
35	30036			
36	30037	32-bit floating point	Pressure	Sensor pressure in hPa.
37	30038			
38	30039	32-bit floating point	Humidity	Sensor humidity in %.
39	30040			
40	30041	32-bit signed int	Next bump due	Number of days until the next bump test. Negative values indicate the test is overdue.
41	30042			
42	30043	32-bit unsigned int	Pump active inlet	The numbered pump inlet that is active. A value of 0 indicates diffusion, and 5 indicates purging.
43	30044			
44	30045	32-bit floating point	Pump flow rate	The flow rate of the pump.
45	30046			
46	30047		Reserved for future use	Placeholder for future data fields if needed. Reads as 0.
47	30048			
48	30049		Reserved for future use	Placeholder for future data fields if needed. Reads as 0.
49	30050			
50	30051	32-bit unsigned int	Gas sensor 1: status	See the Modbus Enumerated Fields tables for a list of values.
51	30052			
52	30053	32-bit unsigned int	Gas sensor 1: type	See the Modbus Enumerated Fields tables for a list of values.
53	30054			
54	30055	32-bit floating point	Gas sensor 1: reading	Gas reading, with units noted in the following register.
55	30056			
56	30057	32-bit unsigned int	Gas sensor 1: units	See the Modbus Enumerated Fields tables for a list of values.
57	30058			
58	30059	32-bit signed int	Gas sensor 1: next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
59	30060			

Address	PLC Address	Register Type	Register Description	Notes
60	30061	32-bit unsigned int	Gas sensor 2: status	See the Modbus Enumerated Fields tables for a list of values.
61	30062			
62	30063	32-bit unsigned int	Gas sensor 2: type	See the Modbus Enumerated Fields tables for a list of values.
63	30064			
64	30065	32-bit floating point	Gas sensor 2: reading	Gas reading, with units noted in the following register.
65	30066			
66	30067	32-bit unsigned int	Gas sensor 2: units	See the Modbus Enumerated Fields tables for a list of values.
67	30068			
68	30069	32-bit signed int	Gas sensor 2: next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
69	30070			
70	30071	32-bit unsigned int	Gas sensor 3: status	See the Modbus Enumerated Fields tables for a list of values.
71	30072			
72	30073	32-bit unsigned int	Gas sensor 3: type	See the Modbus Enumerated Fields tables for a list of values.
73	30074			
74	30075	32-bit floating point	Gas sensor 3: reading	Gas reading, with units noted in the following register.
75	30076			
76	30077	32-bit unsigned int	Gas sensor 3: units	See the Modbus Enumerated Fields tables for a list of values.
77	30078			
78	30079	32-bit signed int	Gas sensor 3: next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
79	30080			
80	30081	32-bit unsigned int	Gas sensor 4: status	See the Modbus Enumerated Fields tables for a list of values.
81	30082			
82	30083	32-bit unsigned int	Gas sensor 4: type	See the Modbus Enumerated Fields tables for a list of values.
83	30084			
84	30085	32-bit floating point	Gas sensor 4: reading	Gas reading, with units noted in the following register.
85	30086			
86	30087	32-bit unsigned int	Gas sensor 4: units	See the Modbus Enumerated Fields tables for a list of values.
87	30088			
88	30089	32-bit signed int	Gas sensor 4: next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
89	30090			
90	30091	32-bit unsigned int	Gas sensor 5: status	See the Modbus Enumerated Fields tables for a list of values.
91	30092			

Address	PLC Address	Register Type	Register Description	Notes
92	30093	32-bit unsigned int	Gas sensor 5: type	See the Modbus Enumerated Fields tables for a list of values.
93	30094			
94	30095	32-bit floating point	Gas sensor 5: reading	Gas reading, with units noted in the following register.
95	30096			
96	30097	32-bit unsigned int	Gas sensor 5: units	See the Modbus Enumerated Fields tables for a list of values.
97	30098			
98	30099	32-bit signed int	Gas sensor 5: next calibration due	Number of days until the next calibration for this sensor. Negative values indicate the calibration is overdue.
99	30100			

Modbus Enumerated Fields

Translator Status - Bit Mask		
Value	Description	Notes
0x 0000 0001	EXO is unresponsive	No incoming messages in last 5s.
0x 0000 0002	Checksum error	Latest message had invalid checksum.
0x 0000 0004	Parsing error	Latest message could not be parsed.

EXO Alarm Status - Bit Mask		
Value	Description	Notes
0x 0000 0001	Emergency alert	
0x 0000 0002	Pump low flow warning	
0x 0000 0004	Cartridge error warning	
0x 0000 0008	Cartridge not recognized	
0x 0000 0010	Message warning	
0x 0000 0020	Incoming call warning	
0x 0000 0040	Comms lost warning	
0x 0000 0080	Low battery warning	
0x 0000 0100	Hardware test fail alarm	
0x 0000 0200	Firmware not certified warning	
0x 0000 0400	Pump failure alarm	
0x 0000 0800	Tipped over warning	

Measurement Units		
Value	Description	Notes
0	PPM	Parts per million
1	VOL	Percentage by volume
2	LE	Percentage of Lower Explosive Limit
3	MM3	

Sensor Status - Bit Mask		
Value	Description	Notes
0x 0000 0001	Sensor under limit	
0x 0000 0002	Low gas alarm	
0x 0000 0004	Low gas alert	
0x 0000 0008	Gas alarm	
0x 0000 0010	Gas alert	
0x 0000 0020	TWA alert	
0x 0000 0040	STEL alert	
0x 0000 0080	Sensor over limit	
0x 0000 0400	Sensor calibration overdue	
0x 0000 0800	Sensor is attached	If this is not set, the sensor should be ignored.
0x 2000 0000	Sensor error	
0x 4000 0000	Sensor is unresponsive	
0x 8000 0000	Sensor is disabled	

Gas Types		
Value	Description	Notes
0	FRESH_AIR	Fresh air
1	H2S	Hydrogen sulfide
2	CO	Carbon monoxide
3	O2	Oxygen
4	CO2	Carbon dioxide
5	LEL	Combustible gas
6	N2	Nitrogen
7	NH3	Ammonia
8	SO2	Sulfur dioxide
9	CL2	Chlorine
10	VOC_PPM	Volatile organic compounds, parts per million
11	HCN	Hydrogen cyanide

Gas Types		
Value	Description	Notes
12	H2	Hydrogen
13	CLO2	Chlorine dioxide
14	O3	Ozone
15	VOC_PPB	Volatile organic compounds, parts per billion
16	NO2	Nitrogen dioxide
17	NN_LEL	Combustible gas, Nevada Nano MPS sensor
18	HF	Hydrogen fluoride

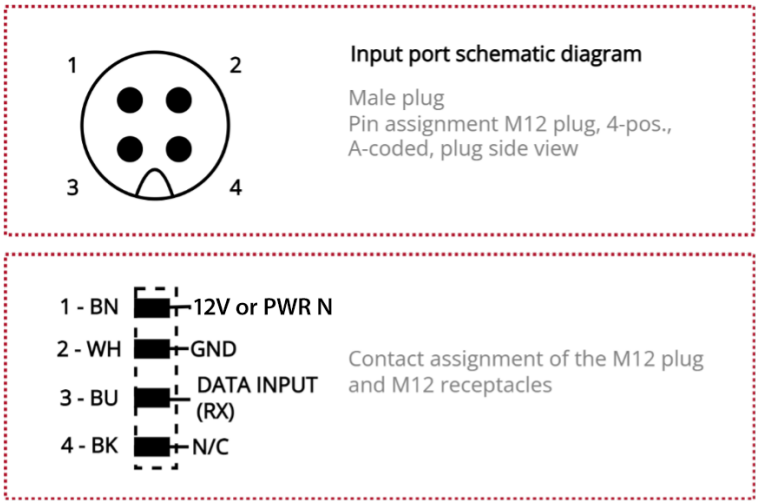
4.3 INPUT PORT

The Input data port allows you to connect the EXO Translator to the EXO Power/debug port using the Blackline Safety supplied cable.

NOTE: Based on this configuration, the EXO Power/debug port is no longer available for use with the trickle charger or solar panel.

4.3.1 CONNECTOR SPECIFICATIONS

The following diagram describes the Input port pin configuration:



4.3.2 CABLING

The Blackline Safety-supplied cable connects the EXO Translator Input port to the EXO Power/debug port.

- ⚠ WARNING: When EXO is configured for use with EXO Translator, the EXO Power/debug port is no longer available for trickle charging or solar panel charging.
- ⚠ WARNING: Only use the Blackline Safety-supplied cable to connect the EXO Translator Input port with EXO Power/debug port. Splitting power and communications with a customer-supplied cable is not recommended.

5 CONFIGURING EXO TRANSLATOR

Configure the EXO Translator device settings, update device firmware, and administer the device password from the EXO Update Device Configuration page.

5.1 CONFIGURING EXO TRANSLATOR DEVICE SETTINGS

The Update Device Configuration page displays the settings related to the selected communication protocol (Modbus or MQTT). You can connect multiple EXO Translators on the same network.

When EXO Translators are turned on and added to the network, they have an automatically assigned IP address that can only be seen with network scanner software. Additionally, the hostname of each Translator is not linked to the IP address and is incremented by one as more translators are added to the network.

When EXO Translator is turned off or removed from the system and then re-added, it may be difficult to determine the IP address and/or hostname, which can delay troubleshooting in the field. To address this potential issue, you can toggle between a dynamic or static IP address for the unit.

To configure EXO Translator device settings:

1. Connect the power-over-Ethernet (PoE)/data port on EXO Translator to a powered Ethernet connection. All three Translator LEDs power on during the unit's start-up sequence. Once start-up is complete, the two blue LEDs turn off and the power LED remains on.
2. Using a computer connected to the same network as the Translator, open a web browser, then navigate to http://[current_IP_address]:9000/config/, replacing [current_IP_address] with your network's IP address.

   NOTE: The default username and password are the device serial number. The device serial number can be found on the device label (####SBI#####). For more information on changing the device password, refer to Updating EXO Translator Device Password.

3. If applicable, enter the username and password, then select **OK**. The Configuration page opens and displays the device's current settings, as well as the active firmware version, operating system, and device serial number.
4. Select **Click here to update IP Address**. The Current IPv4 Address Configuration page opens.
5. Select **Update**. The Change IPv4 Address Configuration page opens.
6. From the IP Schema drop-down menu, select **DHCP** or **Static**.
   - If you select Static, enter the **IP Address**, **Subnet**, and **Gateway**.
7. Select **Save & Reboot** to apply the updated settings.
8. Wait two minutes, then perform one of the following steps, depending on whether you selected Static or DHCP:
   - If you selected Static, open a web browser, then navigate to http://[static_IP_address]:9000/config/. The Configuration page with the static IP address opens.
   - If you selected DHCP, open a web browser, then navigate to http://beaglebone.local:9000/config/. The Configuration page with the new dynamic IP address opens.
9. From the updated Configuration page, choose which interface to configure by selecting Modbus or MQTT from the **Interface to use** field. The Configuration page displays the settings related to the interface selected.
10. If you selected Modbus, configure the Modbus connection using the following settings:

Setting	Available Values	Default Value	Notes
Baud rate	9600, 19200, 57600, 115200	115200	
Stop bits	1,2	1	Modbus standards use two stop bits with no parity, or one stop bit with even or odd parity. Other combinations will function but may not be compatible with endpoint devices.
Parity	None, even, odd	None	
Word Order	Big Endian, Little Endian	Big Endian	Each translator data field is made up of two 16-bit data words. **Word Order** determines the order of words within a data field, while **Byte Order** determines the order of bytes within a word.
Byte Order	Big Endian, Little Endian	Big Endian	
Modbus Slave ID	1-255	1	

NOTE: If you selected Modbus, the translator is configured to output data using the Modbus remote terminal unit (RTU) protocol through the RS-485 output connection.

11. If you selected MQTT, configure the MQTT connection using the following settings:

Setting	Available Values	Default Values	Notes
MQTT_Device ID	Cannot be modified.	Device serial number	The MQTT device ID is included in all topics, but the prefix and suffix can be customized.
Broker IP	Any valid IPv4 address	0.0.0.0	
Broker Port	1-65536	1883	
Translation Fail Topic	Any text prefix		This topic is used to publish any error messages generated by the Translator.
	Any text suffix	/fail	
EXO Measurement Topic	Any text prefix		This topic is used to publish measurements provided by EXO.
	Any text suffix	/measurement	
EXO Status Topic	Any text prefix		This topic is used to publish status messages provided by EXO.
	Any text suffix	/status	
EXO Error Topic	Any text prefix		This topic is used to publish error messaged generated by EXO.
	Any text suffix	/error	

NOTE: If you selected MQTT, the Translator publishes to the broker specified in the configuration over the same Ethernet connection that is used for power. The translator always publishes under the device identifier corresponding to its serial number.

12. To save the selected settings, select **Update Config**.

NOTE: Navigating away from the Configuration page without updating the configuration discards any changes made to the Translator configuration parameters without saving them.

13. [Optional] To revert settings to their default values, select **Reset to default**.

IMPORTANT: After reverting settings to their default values, select **Update Config** to save the default settings.

5.2 UPDATING EXO TRANSLATOR DEVICE FIRMWARE

To update EXO Translator device firmware:

1. Open an Update Device Configuration page that displays the current settings for the EXO Translator that you want to update, then select the **Click here to update firmware** link. The Update Device Firmware page opens.
2. Select **Choose File** to open a file selection dialog box.
3. Select a valid update file, then select **OK**.

4. Select **Update Firmware**. Once the update is successfully installed, the EXO Translator restarts.

5.3 UPDATING EXO TRANSLATOR DEVICE PASSWORD

To update the device password:

1. Open an Update Device Configuration page that displays the current settings for the EXO Translator you want to update, then select the **Click here to update firmware** link. The Update Device Firmware page opens.
2. Select **Change Password**. The Password Administration Page opens.
3. Type the device's old password, then enter the new password (with confirmation).
4. Select **CHANGE MY PASSWORD**.

5.4 RESETTING EXO TRANSLATOR FACTORY DEFAULTS

If your EXO Translator configuration is left in an indeterminate state, or the configuration interface password is lost, the configuration can be reset to the factory default.

To reset the device factory defaults:

1. Hold the EXO Translator reset button for ten seconds. The device restarts and configuration settings are reset to their factory default.

   NOTE: The configuration password is also reset to the default, device serial number (####SBI#####).

6 SUPPORT

6.1 LEARN MORE

Visit Support.BlacklineSafety.com to find support and training materials for EXO Translator.

6.2 TECHNICAL SUPPORT

Contact our Technical Support team for assistance.

North America (24 hours)

Toll Free: 1-877-869-7212 | support@blacklinesafety.com

United Kingdom (8am-5pm GMT)

+44 1787 222684 | eusupport@blacklinesafety.com

International (24 hours)

+1-403-451-0327 | support@blacklinesafety.com

7 SPECIFICATIONS

7.1 DETAILED SPECIFICATIONS

Size & weight
Material: Polycarbonate Plastic
Size: 150 mm × 225 mm × 65 mm (at largest depth), 5.9″ × 8.9″ × 2.6″ (at largest depth)
Weight: Standalone: 750 g (26.5 oz)

Approvals
RoHS, REACH, CE
IEC/CSA 62368-1

Input port
Compliance reviewed to IEC/CSA 62368-1; 1 m (3.28 ft) cable provided by Blackline Safety. Four pins per interface port
Pin 1: 12V
Pin 2: Ground
Pin 3: Receive Voc=5.5V, Isc=250mA, Co=12.3uF, Lo=0H
Pin 4: Not connected

Input port cable: CBL 4POS FMALE TO FMALE
Manufacturer: Amphenol LTW
Part Number: M12A04FR-12AFR-SD001
Connectors: Right-angle plugs; 4-pos; female sockets; M12 shell; A orientation; free-hanging inline mount
Cable Length: 1 m (3.28 ft)
Cable Material: Polyvinyl chloride (PVC); round
Shielding: Unshielded
Ingress protection: IP68/IP69K dust tight, water resistant, waterproof

Power over Ethernet (PoE) data port
8p8c (RJ45, Ethernet); Cat5e; circular threaded coupling
Manufacturer: Amphenol LTW
Part Number: RCP-5SPFFP-SCM7B10
Shielding: Shielded
Ingress protection: Industrial Environments - IP67

Environmental
Storage temperature: -40°C to +55°C
Operating temperature: -40°C to +55°C
Ingress Protection: IP65 dust tight, water resistant
Drop: 1m

Modbus port
Four pins per interface port, internally terminated (120ohms)
Shielding: Shielded
Ingress protection: Industrial Environments - IP67
Pin 1: Not connected
Pin 2: Ground
Pin 3: RS-485-
Pin 4: RS-485+

8 LEGAL NOTICES

Information in this document is subject to change without notice. This document is provided “as is” and Blackline Safety Corp. (“Blackline”) and its affiliated companies and partners assume no responsibility for any typographical, technical or other inaccuracies in this document. Blackline reserves the right to periodically change information that is contained in this document. However, Blackline makes no commitment to provide any such changes, updates, enhancements or other additions to this document to you in a timely manner or at all.

Compliance

The EXO Translator connection is compliance reviewed to IEC/CSA 62368-1.

Warning

Do not operate Blackline Safety products where you are not able to safely operate your mobile/cellular phone.

Electrical equipment may be hazardous if misused. Operation of this product, or similar products, must always be supervised by an adult. Do not allow children access to the interior of any electrical product and do not permit them to handle cables.

Do not operate or store Blackline products outside their specified operating or storage temperatures. Consult section 7 for more information.

Blackline products may contain an internal lithium-ion battery pack. Seek advice from your local electronics recycling authority regarding the disposal of your device. Do not dispose of Blackline products in your household trash.