EXO Translator

Technical User Manual

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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.

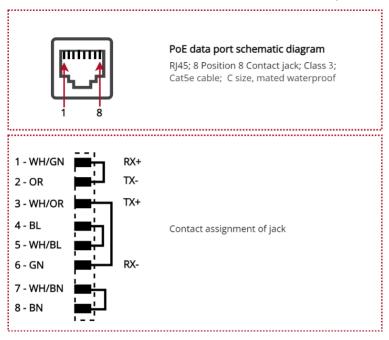
4 CONNECTION DETAILS

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 1 30001 2 1 30002 Unsigned int Translator status See the Enumerated Fields tab for a list of values. 2 30003 2 30003 2 1 30003 3 30004 Unsigned int Translator version Firmware version (Major. Minor. Build) of the Translator, converted using: Version = Major * 22* + Minor * 21* + Build. For example, v1.2.3 → 15908291. 4 30005 3 30006 Unsigned int EXO error code Most recent error code reported by EXO. Will read as 0 if no errors have been reported. 6 30007 7 30008 Reserved for future use Paceholder for future data fields if needed. Will always read as 0. 8 30009 9 30010 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 00:00:00:00 UTC. 10 30011 9 30012 Unsigned int EXO unit ID Device ID of the EXO. 10-digit number beginning with 358. 13 30014 9 30014 Unsigned int EXO battery level Battery level in percent from 0 to 100. Avalue of 255 means the battery level is unknown. 14 30015 9 30014 Unsigned int EXO charging status 1 if the EXO is charging. 0 otherwise.						
1 30002 Unsigned int	Address		Register Type	Register Description	Notes	
1 30002 2 30003 3 30004 Unsigned int EXO error code EXO error code EXO error code Unsigned int EXO battery level Unsigned int Unsigned int Unsigned int Unsigned int Unsigned int EXO battery level Unsigned int Unsigned int Unsigned int Unsigned int Unsigned int Unsigned int EXO charging status Unsigned int Unsigned int Unsigned int Unsigned int EXO charging status Unsigned int Unsigned int Unsigned int EXO charging status Unsigned int Unsigned int Unsigned int EXO charging status Unsigned int Unsigned int Unsigned int Unsigned int EXO charging status Unsigned int Unsigned int Unsigned int EXO charging status Unsigned int Unsigned int Unsigned int Unsigned int EXO charging status Unsigned int Unsi	0	30001	- Unsigned int	Translator status		
3	1	30002	Onsigned int	Translator Status	for a list of values.	
South Provided in the served for future use South Provided in the served for future use Placeholder for future data fields if needed. Will always read as 0.			Unsigned int	Translator version	(Major.Minor.Build) of the Translator, converted using: Version = Major * 2 ²⁴ + Minor * 2 ¹⁶ + Build. For example, v1.2.3	
5 30006 Onsigned int EXO error code Will read as 0 if no errors have been reported. 6 30007 7 30008 8 30009 9 30010 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. 10 30011 Unsigned int EXO unit ID Device ID of the EXO. 10-digit number beginning with 35s. 12 30013 Battery level in percent from 0 to 100. A value of 255 means the battery level is unknown. 14 30015 Unsigned int EXO charging status I if the EXO is charging, 0 otherwise. 16 30017 Avalue of 0x7FFFFFFF indicates unknown location. 17 30018 Signed int GPS latitude GPS latitude Indicates unknown logation. 20 30021 Signed int GPS altitude GPS altitude In sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.	4	30005				
Reserved for future use If needed. Will always read as 0.	5	30006	Unsigned int	EXO error code	Will read as 0 if no errors have	
Signed int Sig	6	30007		Reserved for future use		
9 30010 Unsigned int EXO status timestamp message. Upper 15 bits are days since 2010-01-01, lower 17 bits are seconds since 00:00:00 UTC. 10 30011 11 30012 Unsigned int EXO unit ID 12 30013 13 30014 Unsigned int EXO battery level Battery level in percent from 0 to 100. A value of 255 means the battery level is unknown. 14 30015 15 30016 16 30017 17 30018 Signed int GPS latitude GPS latitude GPS longitude EXO status timestamp Device ID of the EXO. 10-digit number beginning with 358. Battery level in percent from 0 to 100. A value of 255 means the battery level is unknown. 1 if the EXO is charging, 0 otherwise. Last known latitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. 18 30019 Signed int GPS longitude GPS longitude Last known longitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. Last known altitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.	7	30008		Reserved for fatare ase	if needed. Will always read as 0.	
9 30010 Unsigned int Status timestamp since 2010-01-01, lower 17 bits are seconds since 00:00:00 UTC. 10 30011 11 30012 Unsigned int EXO unit ID EXO unit ID Device ID of the EXO. 10-digit number beginning with 358. Battery level in percent from 0 to 100. A value of 255 means the battery level is unknown. 14 30015 15 30016 Unsigned int EXO battery level EXO battery level 1 if the EXO is charging, 0 otherwise. 1 if the EXO is charging, 0 otherwise. 1 ast known latitude in (degrees × 107). A value of 0x7FFFFFF indicates unknown location. 18 30019 Signed int GPS longitude GPS longitude GPS altitude Last known longitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. Last known longitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. Last known altitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.	8	30009	-		·	
11 30012 Unsigned int EXO unit ID 10-digit number beginning with 358. 12 30013 13 30014 Unsigned int EXO battery level Battery level in percent from 0 to 100. A value of 255 means the battery level is unknown. 14 30015 15 30016 16 30017 17 30018 Signed int GPS latitude GPS latitude GPS longitude 10 digit number beginning with 358. Battery level in percent from 0 to 100. A value of 255 means the battery level is unknown. 1 if the EXO is charging, 0 otherwise. Last known latitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. Last known longitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. 20 30021 Signed int GPS altitude GPS altitude Last known altitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.	9	30010	Unsigned int	EXO status timestamp	since 2010-01-01, lower 17 bits	
11 30012 12 30013 13 30014 Unsigned int EXO battery level Battery level in percent from 0 to 100. A value of 255 means the battery level is unknown. 1 if the EXO is charging, 0 otherwise. 1 if the EXO is charging, 0 otherwise. Last known latitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. 18 30019 Signed int GPS longitude Unsigned int GPS longitude Unsigned int GPS latitude Unsigned int GPS latitude Unsigned int GPS latitude Unsigned int Signed int GPS latitude Unsigned int Unsigned int Signed int GPS latitude Unsigned int Signed int GPS latitude Unsigned int Signed int Signed int GPS longitude Unsigned int Signed int Signed int GPS latitude Unsigned int Signed int Signed int Signed int GPS altitude Unsigned int Signed int	10	30011				
13 30014 Unsigned int EXO battery level 100. A value of 255 means the battery level is unknown. 14 30015 15 30016 16 30017 17 30018 Signed int GPS latitude GPS longitude GPS longitude 100. A value of 255 means the battery level is unknown. 1 if the EXO is charging, 0 otherwise. Last known latitude in (degrees × 10²). A value of 0x7FFFFFFF indicates unknown location. Last known longitude in (degrees × 10²). A value of 0x7FFFFFFF indicates unknown location. Signed int GPS longitude GPS longitude 100. A value of 0x7FFFFFFF indicates unknown latitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.	11	30012	Unsigned int	EXO unit ID		
30014 Unsigned int EXO battery level A value of 255 means the battery level is unknown. 14	12	30013		EXO battery level		
Unsigned int EXO charging status otherwise. 16 30017 17 30018 Signed int GPS latitude GPS latitude GPS latitude GPS longitude Last known latitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. Last known longitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. Last known longitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. 20 30021 Signed int GPS altitude GPS altitude GPS altitude GPS altitude GPS altitude	13	30014	Unsigned int		A value of 255 means the battery	
15 30016 16 30017 17 30018 Signed int GPS latitude GPS latitude GPS latitude Last known latitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. Last known longitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. 20 30021 Signed int GPS longitude GPS altitude GPS altitude GPS altitude GPS altitude	14	30015	Unsigned int	EVO charging status	1 if the EXO is charging, 0	
Signed int GPS latitude 107). A value of 0x7FFFFFF indicates unknown location. Last known longitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. Last known longitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. Last known altitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.	15	30016	Onsigned int	LAO CHarging Status	otherwise.	
A value of 0x7FFFFFF indicates unknown location. Signed int GPS latitude A value of 0x7FFFFFFF indicates unknown location. Last known longitude in (degrees × 107). A value of 0x7FFFFFFF indicates unknown location. Last known altitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.	16	30017				
Signed int GPS longitude × 107). A value of 0x7FFFFFFF indicates unknown location. Last known altitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.	17	30018	Signed int	GPS latitude	A value of 0x7FFFFFF indicates	
19 30020 Signed int GPS longitude A value of 0x7FFFFFFF indicates unknown location. 20 30021 Signed int GPS longitude A value of 0x7FFFFFFF indicates unknown location. Last known altitude above main sea level, in meters. A value of 0x7FFFFFFF indicates unknown location.	18	30019				
Signed int Signed int GPS altitude Sea level, in meters. A value of 0x7FFFFFF indicates unknown location.	19	30020	Signed int	GPS longitude	A value of 0x7FFFFFF indicates	
21 30022 Signed Int GPS altitude A value of 0x7FFFFFF indicates unknown location.	20	30021				
22 30023 Unsigned int GPS beacon ID	21	30022	Signed int	GPS altitude	A value of 0x7FFFFFF indicates	
	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 25	30025 30026	- Unsigned int	Network signal strength	Network RSSI normalized to a value from 0 to 10.
26 27	30027 30028	- Unsigned int	EXO alarm status	See the MQTT Enumerated Fields tables for a list of values.
28 29	30029 30030		Reserved for future use	Placeholder for future data fields if needed. Will always read as 0.
30	30031		Reserved for future use	Placeholder for future data fields if needed. Will always read as 0.
32	30033			Timestamp of most recent \$GAS
33	30034	Unsigned int	EXO measurement timestamp	message. Upper 15 bits are days since 2010-01-01, lower 17 bits are seconds since 00:00:00 UTC.
34	30035	El	Temperature	
35	30036	Floating point		Sensor temperature in °C.
36	30037	El	D	6
37	30038	Floating point	Pressure	Sensor pressure in hPa.
38	30039	Floating point	Humidity	Sensor humidity in %.
39	30040	Floating point		
40	30041		Next bump due	Number of days until the next bump test. Negative values indicate the test is overdue.
41	30042	Signed int		
42	30043			The numbered pump inlet that is
43	30044	Unsigned int	Pump active inlet	active. A value of 0 indicates diffusion, and 5 indicates purging.
44	30045	5 Floring point	Dump flow rate	The flow rate of the numb
45	30046	Floating point	Pump flow rate	The flow rate of the pump.
46	30047		Reserved for future use	Placeholder for future data fields
47	30048		ivezerven ioi infrare aze	if needed. Will always read as 0.
48	30049		Reserved for future use	Placeholder for future data fields
49	30050		iveserved for future use	if needed. Will always read as 0.
50	30051	- Unsigned int	Gas sensor 1:	See the MQTT Enumerated Fields
51	30052	OHSIGNEU IIIL	status	tables for a list of values.
52	30053	- Unsigned int	Gas sensor 1:	See the MQTT Enumerated Fields
53	30054	OHSIGNED INC	type	tables for a list of values.



Address	PLC Address	Register Type	Register Description	Notes
54	30055	Floating point	Gas sensor 1:	Gas reading, with units noted in
55	30056	riodeling point	reading	the following register.
56	30057	Unsigned int	Gas sensor 1:	See the MQTT Enumerated Fields
57	30058		units	tables for a list of values.
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.
60	30061	l la siera a disat	Gas sensor 2:	See the MQTT Enumerated Fields
61	30062	Unsigned int	status	tables for a list of values.
62	30063	Unsigned int	Gas sensor 2:	See the MQTT Enumerated Fields
63	30064	- Unsigned int	type	tables for a list of values.
64	30065	Floating point	Gas sensor 2:	Gas reading, with units noted in
65	30066	Floating point	reading	the following register.
66	30067	- Unsigned int	Gas sensor 2:	See the MQTT Enumerated Fields
67	30068	Orisigned int	units	tables for a list of values.
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.
70 71	30071 30072	Unsigned int	Gas sensor 3:	See the MQTT Enumerated Fields tables for a list of values.
72	30072		Gas sensor 3:	See the MQTT Enumerated Fields
73	30074	Unsigned int	type	tables for a list of values.
74	30075		Gas sensor 3:	Gas reading, with units noted in
75	30076	Floating point	reading	the following register.
76	30077		Gas sensor 3:	See the MQTT Enumerated Fields
77	30078	- Unsigned int	units	tables for a list of values.
78	30079			Number of days until the next
79	30080	Signed int	Gas sensor 3: next calibration due	calibration for this sensor. Negative values indicate the calibration is overdue.
80	30081	I I a de la constante	Gas sensor 4:	See the MQTT Enumerated Fields
81	30082	- Unsigned int	status	tables for a list of values.
82	30083	Ungigned int	Gas sensor 4:	See the MQTT Enumerated Fields
83	30084	Unsigned int	type	tables for a list of values.
84	30085	Floating as is t	Gas sensor 4:	Gas reading, with units noted in
85	30086	Floating point	reading	the following register.
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			Number of days until the next
89	30090	Signed int	Gas sensor 4: next calibration due	calibration for this sensor. Negative values indicate the calibration is overdue.
90	30091	Unsigned int	Gas sensor 5:	See the MQTT Enumerated Fields
91	30092	- Unsigned int	status	tables for a list of values.
92	30093	Unsigned int	Gas sensor 5:	See the MQTT Enumerated Fields
93	30094	Unsigned int	type	tables for a list of values.
94	30095	Floating point	Gas sensor 5:	Gas reading, with units noted in
95	30096	Floating point	reading	the following register.
96	30097	l la siera ad int	Gas sensor 5:	See the MQTT Enumerated Fields
97	30098	Unsigned int	units	tables for a list of values.
98	30099			Number of days until the next
99 30100 Signed int		Gas sensor 5: next calibration due	calibration for this sensor. Negative values indicate the calibration is overdue.	

MQTT Topics

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

/trans	/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 * 2²⁴ + Minor * 2¹⁶ + 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.			



/erro	/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_	/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_me	/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_m	/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_m	/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	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		



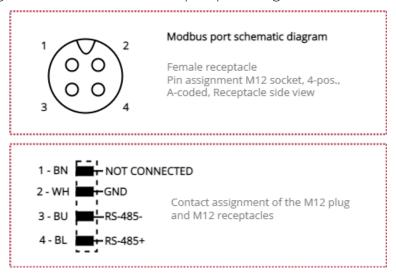
Gas Types				
Value	Description	Notes		
0	FRESH_AIR	Fresh air		
1	H2S	Hydrogen sulfide		
2	СО	Carbon monoxide		
3	O2	Oxygen		
4	CO2	Carbon dioxide		
5	LEL	Combustible gas		
6	N2	Nitrogen		
7	NH3	Ammonia		
8	SO2	Sulfur dioxide		
9	CL2	Chlorine		
10	VOC_PPM	Volatile organic compounds, parts per million		
11	HCN	Hydrogen cyanide		
12	H2	Hydrogen		
13	CLO2	Chlorine dioxide		
14	03	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	Translator status	See the Modbus Enumerated Fields
1	30002	int	ITATISIALUI SLALUS	tables for a list of values.



Address	PLC Address	Register Type	Register Description	Notes
3	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
4	30005	32-bit unsigned	EXO error code	Most recent error code reported by EXO.
5	30006	int	LAO error code	Reads as 0 if no errors are reported.
6	30007		Reserved for future use	Placeholder for future data fields if
7	30008		Reserved for future use	needed. Reads as 0.
9	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.
10	30011	32-bit unsigned	EXO unit ID	Device ID of the EXO.
11	30012	int	EXO UTILLID	10-digit number beginning with 358.
12	30013	32-bit unsigned		Battery level in percent from 0 to 100.
13	30014	int	EXO battery level	A value of 255 means the battery level is unknown.
14	30015	32-bit unsigned	EXO charging status	1 if the EXO is charging, 0 otherwise.
15	30016	int	LAO Charging Status	The LAO is charging, o otherwise.
16	30017			Last known latitude in (degrees × 107).
17	30018	32-bit signed int	GPS latitude	A value of 0x7FFFFFFF indicates unknown location.
18	30019			Last known longitude in (degrees × 10 ⁷).
19	30020	32-bit signed int	GPS longitude	A value of 0x7FFFFFFF indicates unknown location.
20	30021			Last known altitude above main sea level,
21	30022	32-bit signed int	GPS altitude	in meters. A value of 0x7FFFFFFF indicates unknown location.
22	30023			Device ID of the last registered Blackline
23	30024	32-bit unsigned int	GPS beacon ID	GPS beacon. 10-digit number beginning with 1370 or 1371.
24	30025	32-bit unsigned	Network signal	Network RSSI normalized to a value from
25	30026	int	strength	0 to 10.
26	30027	32-bit unsigned	EXO alarm status	See the Modbus Enumerated Fields
27	30028	int		tables for a list of values.

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



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

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

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	СО	Carbon monoxide	
3	02	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	03	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	

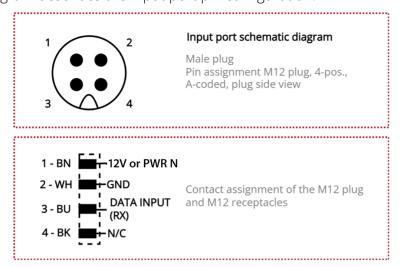
4.3 INPUT PORT

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
Parity	None, even, odd	None	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.
Word Order	Big Endian, Little Endian	Big Endian	Each translator data field is made up of two 16-bit data words.
Byte Order	Big Endian, Little Endian	Big Endian	Word Order determines the order of words within a data field, while Byte Order determines the order of bytes within a word.
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	
Translation Fall Topic	Any text suffix	/fail	messages generated by the Translator.	
EXO Measurement	Any text prefix		This topic is used to publish	
Topic	Any text suffix	/measurement	measurements provided by EXO.	
TVO Status Tania	Any text prefix		This topic is used to publish status	
EXO Status Topic	Any text suffix	/status	messages provided by EXO.	
EVO Error Tonic	Any text prefix		This topic is used to publish error	
EXO Error Topic	Any text suffix	/error	messaged generated by EXO.	

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),

 $5.9" \times 8.9" \times 2.6"$ (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

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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.