

NMEA2000 to Modbus Gateway

Part No. 3155

User Manual

Revision 1.21

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1 Introduction

The Offshore System's NMEA2000 to Modbus Gateway (Part No 3155) makes NMEA2000 messages from Engine, Generators, Tanks, Batteries, AC Sources and Switch Banks available over a Modbus interface to PLC based vessel monitoring systems.

This unit is designed to operate in a protected marine environment such as an engine room or below decks. It is very important that it is installed and set up correctly according to this manual. Please read and follow the installation and setup instructions carefully to achieve the best results.

1.1 Firmware Revision

The information in this manual corresponds to firmware revision 1.05

1.2 Product Features

The 3155 NMEA2000 to Modbus Gateway has the following features:

- RS485 Modbus Interface RTU protocol
- NMEA2000 Interface
- DIN Rail mount enclosure
- Passes NMEA2000 messages from Engines, Generators, Batteries, AC Sources, Fuel Tanks, Fresh Water Tanks, Grey Water Tanks, Black Water Tanks and Oil Tanks to the Modbus Interface
- Has easy communications setup controls for the RS485 Interface
- Status and Warning lights for all data transfers
- Allows monitoring and Control of 8 switch banks of 28 switches (224 in total)

2 Installation

2.1 Unpacking the box

You should find the following items in the 3155 shipping box:

- 1 x 3155 NMEA2000 to Modbus Gateway
- 1 x 3155 User Manual (This document)

2.2 Choosing the mounting location

The unit is designed to be mounted on a DIN rail in an electrical cabinet with free air circulation in a dry location below decks. The cabinet may be located in an engine room providing the ambient temperature does not exceed 50°C (125°F). The location needs to allow for connection to the NMEA2000 interface cable and the RS485 Modbus cable.

2.3 Mounting the unit

The unit should be hooked over the top of the DIN rail and then pushed back into location until the red tab at the bottom of the rear of the unit snaps behind the lower edge of the DIN rail.



Figure 1 DIN Mounting

The unit can be dismounted from the DIN rail by using a screwdriver to release the red tab whilst lifting the unit upwards from the mounting rail.



Figure 2 DIN Dismounting

2.4 Connecting the RS485 Modbus Interface

The RS485 Modbus cable should be connected to the terminal block on the lower edge of the 3155 unit. Tighten the terminal block screws to grip the cable securely ensuring that a sound electrical connection has been made.

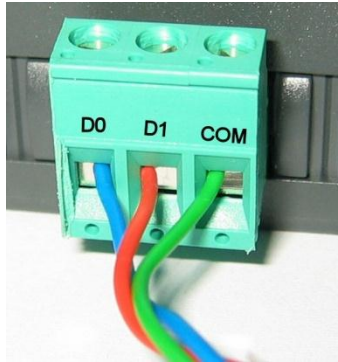


Figure 3 RS485 Connections

The RS485 Modbus Interface wires are connected as follows:

Description	EIA/TIA-485	Name	Modbus Name
Transceiver Terminal 1, V1 Voltage	B/B'	Data +	D0
Transceiver Terminal 0, V0 Voltage	A/A'	Data -	D1
Signal Ground	C/C'	Common	Common

2.5 Connecting the NMEA2000 Interface

The NMEA2000 interface cable on the unit should be connected to a nearby NMEA2000 Tee connector (part number 3802). The male end of the cable should be inserted into the female Tee connection noting the position of the keyway in the plug and the socket. The unit can be connected with power on or off without any damage. Ensure that the locking ring is securely tightened so that the connection remains sound.

3 Configuration

3.1 Modbus Communication Parameters

The 3155 NMEA2000 to Modbus Gateway Modbus interface communications parameters are by default set to 19,200 Baud, EVEN parity, 1 stop bit ex factory

The RS485 communications parameters can be changed at any time by setting the **ADDR** switch to the following number and pressing the **COM** push button with power on according to the following table:

ADDR switch position	Communications Parameters
0	19,200 Baud, Even Parity, 1 stop bit (Default)
1	19,200 Baud, Odd Parity, 1 stop bit
2	19,200 Baud, No Parity, 2 stop bits
3	9,600 Baud, Even Parity, 1 stop bit
4	9,600 Baud, Odd Parity, 1 stop bit
5	9,600 Baud, No Parity, 2 stop bits
6	4,800 Baud, Even Parity, 1 stop bit
7	4,800 Baud, Odd Parity, 1 stop bit
8	4,800 Baud, No Parity, 2 stop bits

Please note that if the chosen communications parameters are NOT set to the default then the DefCm green led will NOT be illuminated.

The unit can be reset to the default values at any time by pressing the **Set DefCom** push button when the unit has power on and the **ADDR** switch is set to “0”. When they are set to the default value the **DefCm** green LED is illuminated.

3.2 Modbus Slave Address

A single Modbus network may have a number of slave units attached and these units MUST have each a unique slave address. The 3155 NMEA2000 to Modbus Gateway Slave Address can be set from 16 decimal to 31 decimal by using the small rotary switch on the front panel labeled “Addr” as per the following table:

Switch Position	Decimal Address	Hex Address
0	16	0x10
1	17	0x11
2	18	0x12
3	19	0x13
4	20	0x14
5	21	0x15
6	22	0x16
7	23	0x17
8	24	0x18
9	25	0x19
A	26	0x1A
B	27	0x1B
C	28	0x1C
D	29	0x1D
E	30	0x1E
F	31	0x1F

3.3 Modbus Termination Resistor

Please note that this unit does NOT include any Modbus network termination resistor as the master normally includes this. If this is not the case then a RS485 termination resistor MUST be included in the Modbus Communication line.

3.4 NMEA Device Instance

NMEA2000 requires a unique Device Instance for each 3155 NMEA2000 to Modbus Gateway on a single network. This is settable from device instance 0 to Device Instance 15 using the lower small rotary switch on the front panel labeled “Addr”. This can be set at any time regardless if power is on or off. The switch counts from 0 – 9 then A – F being equivalent to Device Instance 0 – 15.

Please note that this switch also controls the Modbus Slave Address so a compromise address that suits both interfaces should be chosen.

4 Front Panel Indicators and Switches

The front panel has the following LEDs:

LED Name	Description
NMRx	Receiving an NMEA2000 message
NMTx	Transmitting an NMEA2000 message
MoRx	Receiving a Modbus message
MoTx	Transmitting a Modbus message
MoFlt	Invalid Modbus message
CmFlt	Communications error
	PGN became Data Not Available
DefCm	Default Communications Protocol in use

The rotary switch is used to set the communications protocol, the Modbus Slave Device Address and the NMEA2000 Instance. See 3.1 To 3.3 above

The pushbutton is used to capture the default communications protocol from the rotary switch.

5 Fault Finding / Troubleshooting

The front panel indicators should be used to assist in fault finding as follows:

5.1 Communications error Led

If the CmFlt led is lit this means that the unit detected an error in the communications parameters being used on the Modbus interface. Please check that the transmission protocol EXACTLY matches the Modbus Communications Parameters in section 3.1 above.

5.2 Invalid Modbus Message Error Led

If the MoFlt led is lit this means that the unit received a Modbus message that it could not carry out. This indicates that the communications protocol is probably correct but that the message content was invalid. This could be either the wrong Modbus command or wrong data length request.

5.3 Unmarked LED – PGN became Data Not Available

This green led comes on if any PGN that has been received is not received for a period of greater than 10 seconds. This led will stay illuminated until the next power ff poer on cycle occurs. This can indicate a failing or removed NMEA2000 device on the bus.

6 Data Naming Convention

Because it is easy to misunderstand base numbering system is being shown

In this document decimal / base 10 values are shown thus:-

10 = decimal value of ten

Hexadecimal / base 16 values are shown thus:-

0x10 = decimal value of sixteen.

7 Modbus Data Registers

The unit can receive NMEA2000 information from

- 3 Engines
- 8 Fuel Tanks
- 8 Fresh Water Tanks
- 8 Grey Water Tanks
- 8 Black Water Tanks
- 8 Oil Tanks
- 3 Generators
- 3 AC Sources
- 8 Battery Banks
- 4 Battery Chargers
- 8 Banks each of up to 28 switches (224 switches)

The unit can also control the 8 banks of 28 switches individually or collectively

Read access to all registers can only be made using the Modbus Function Code 04 Read Input Register command.

There is NO write access to any input registers except the Switch Bank Registers.

Note that if a NMEA2000 PGN is not available then the data fields will always read 0xFF which is the standard NMEA2000 value for “Data Not Available”

The information from the NMEA2000 connected devices is stored in 16 bit Input Registers that can be accessed from the Modbus Interface according to the following tables:

7.1 Engine Instance 0 Registers

Engine Instance 0 – Single or PORT Engine			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0000	0000	Engine Oil Pressure	Unsigned 16 bit integer Range 0 – 6,553,200 Pa Resolution 1x10E+2 Pa
0x0001	0001	Engine Oil Temp	Unsigned 16 bit integer Range 0 – 6,553.2 deg K Resolution 1x10E-1 deg K
0x0002	0002	Engine Temp	Unsigned 16 bit integer Range 0 – 655.32 deg K Resolution 1x10E-2 deg K
0x0003	0003	Alternator Voltage	Signed 16 bit integer Range ± 327.64 Volts Resolution 1x10E-2 Volts
0x0004	0004	Fuel Rate	Signed 16 bit integer Range ± 3.2764 cu-m/hour Resolution 1x10E-4 cu-m/hour
0x0005/ 0x0006	0005/ 0006	Total Engine Hours Addr 0005 = MSW Addr 0006 = LSW	Unsigned 32 bit integer Range 0 – 4.295x10E+9 seconds Resolution 1 second
0x0007	0007	Engine Coolant Pressure	Unsigned 16 bit integer Range 0 – 6,553,200 Pa Resolution 1 x 10E+2 Pa
0x0008	0008	Fuel Pressure	Unsigned 16 bit integer Range 0 – 65,532,000 Pa Resolution 1x10E+3 Pa
0x0009	0009	Engine Status 1	16 bit Status bitfield xxxx xxxx xxxx xx1 = Check Engine xxxx xxxx xxxx xx1x = Over Temperature xxxx xxxx xxxx x1xx = Low Oil Pressure xxxx xxxx xxxx 1xxx = Low Oil Level xxxx xxxx xxx1 xxxx = Low Fuel Pressure xxxx xxxx xx1x xxxx = Low System Voltage xxxx xxxx x1xx xxxx = Low Coolant Level xxxx xxxx 1xxx xxxx = Water Flow xxxx xxx1 xxxx xxxx = Water in Fuel xxxx xx1x xxxx xxxx = Charge Indicator xxxx x1xx xxxx xxxx = Preheat Indicator xxxx 1xxx xxxx xxxx = High Boost Pressure xxx1 xxxx xxxx xxxx = Rev Limit Exceeded xx1x xxxx xxxx xxxx = EGR System x1xx xxxx xxxx xxxx = Throttle Position Sensor 1xxx xxxx xxxx xxxx = Emergency Stop
0x000A	0010	Engine Status 2	16 bit Status bitfield xxxx xxxx xxxx xxx1 = Warning Level 1

			xxxx xxxx xxxx xx1x = Warning Level 2 xxxx xxxx xxxx x1xx = Power Reduction xxxx xxxx xxxx 1xxx = Maintenance Needed xxxx xxxx xxx1 xxxx = Engine Comm Error xxxx xxxx xx1x xxxx = Sub or Secondary Throttle xxxx xxxx x1xx xxxx = Neutral Start Protect xxxx xxxx 1xxx xxxx = Engine Shutting Down xxxx xxx1 xxxx xxxx = Reserved xxxx xx1x xxxx xxxx = Reserved xxxx x1xx xxxx xxxx = Reserved xxxx 1xxx xxxx xxxx = Reserved xxx1 xxxx xxxx xxxx = Reserved xx1x xxxx xxxx xxxx = Reserved x1xx xxxx xxxx xxxx = Reserved 1xxx xxxx xxxx xxxx = Reserved
0x000B	0011	Percent Engine Load Percent Engine Torque	2x Unsigned 8 bit integers Range $\pm 124\%$, Resolution 1% MSB = Load, LSB =Torque
0x000C	0012	Engine Speed	Unsigned 16 bit integer Range 0 – 16,383 RPM Resolution $\frac{1}{4}$ RPM
0x000D	0013	Engine Boost Pressure	Unsigned 16 bit integer Range 0 – 6,553,200 Pa Resolution 1×10^2 Pa
0x000E	0014	Engine Tilt/Trim	Signed 8 bit integer (LSB) Range $\pm 124\%$ Resolution 1%
0x000F	0015	Transmission Oil Pressure	Unsigned 16 bit integer Range 0– 6,553,200 Pa Resolution 1×10^2 Pa
0x0010	0016	Transmission Oil Temperature	Unsigned 16 bit integer Range 0 – 6,553.2 deg K Resolution 1×10^{-1} deg K

7.2 Engine Instance 1 Registers

Engine Instance 1 – STARBOARD Engine			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0011	0017	Engine Oil Pressure	Unsigned 16 bit integer Range 0 – 6,553,200 Pa Resolution 1x10E+2 Pa
0x0012	0018	Engine Oil Temp	Unsigned 16 bit integer Range 0 – 6,553.2 deg K Resolution 1x10E-1 deg K
0x0013	0019	Engine Temp	Unsigned 16 bit integer Range 0 – 655.32 deg K Resolution 1x10E-2 deg K
0x0014	0020	Alternator Voltage	Signed 16 bit integer Range $\pm$ 327.64 Volts Resolution 1x10E-2 Volts
0x0015	0021	Fuel Rate	Signed 16 bit integer Range $\pm$ 3.2764 cu-m/hour Resolution 1x10E-4 cu-m/hour
0x0016/ 0x0017	0022/ 0023	Total Engine Hours Addr 0020 = MSW Addr 0021 = LSW	Unsigned 32 bit integer Range 0 – 4.295x10E+9 seconds Resolution 1 second
0x0018	0024	Engine Coolant Pressure	Unsigned 16 bit integer Range 0 – 6,553,200 Pa Resolution 1 x 10E+2 Pa
0x0019	0025	Fuel Pressure	Unsigned 16 bit integer Range 0 – 65,532,000 Pa Resolution 1x10E+3 Pa
0x001A	0026	Engine Status 1	16 bit Status bitfield xxxx xxxx xxxx xx1 = Check Engine xxxx xxxx xxxx xx1x = Over Temperature xxxx xxxx xxxx x1xx = Low Oil Pressure xxxx xxxx xxxx 1xxx = Low Oil Level xxxx xxxx xxx1 xxxx = Low Fuel Pressure xxxx xxxx xx1x xxxx = Low System Voltage xxxx xxxx x1xx xxxx = Low Coolant Level xxxx xxxx 1xxx xxxx = Water Flow xxxx xxx1 xxxx xxxx = Water in Fuel xxxx xx1x xxxx xxxx = Charge Indicator xxxx x1xx xxxx xxxx = Preheat Indicator xxxx 1xxx xxxx xxxx = High Boost Pressure xxx1 xxxx xxxx xxxx = Rev Limit Exceeded xx1x xxxx xxxx xxxx = EGR System x1xx xxxx xxxx xxxx = Throttle Position Sensor 1xxx xxxx xxxx xxxx = Emergency Stop
0x001B	0027	Engine Status 2	16 bit Status bitfield xxxx xxxx xxxx xxx1 = Warning Level 1

			xxxx xxxx xxxx xx1x = Warning Level 2 xxxx xxxx xxxx x1xx = Power Reduction xxxx xxxx xxxx 1xxx = Maintenance Needed xxxx xxxx xxx1 xxxx = Engine Comm Error xxxx xxxx xx1x xxxx = Sub or Secondary Throttle xxxx xxxx x1xx xxxx = Neutral Start Protect xxxx xxxx 1xxx xxxx = Engine Shutting Down xxxx xxx1 xxxx xxxx = Reserved xxxx xx1x xxxx xxxx = Reserved xxxx x1xx xxxx xxxx = Reserved xxxx 1xxx xxxx xxxx = Reserved xxx1 xxxx xxxx xxxx = Reserved xx1x xxxx xxxx xxxx = Reserved x1xx xxxx xxxx xxxx = Reserved 1xxx xxxx xxxx xxxx = Reserved
0x001C	0028	Percent Engine Load Percent Engine Torque	2x Unsigned 8 bit integers Range $\pm 124\%$, Resolution 1% MSB = Load, LSB = Torque
0x001D	0029	Engine Speed	Unsigned 16 bit integer Range 0 – 16,383 RPM Resolution $\frac{1}{4}$ RPM
0x001E	0030	Engine Boost Pressure	Unsigned 16 bit integer Range 0 – 6,553,200 Pa Resolution 1×10^2 Pa
0x001F	0031	Engine Tilt/Trim	Signed 8 bit integer (LSB) Range $\pm 124\%$ Resolution 1%
0x0020	0032	Transmission Oil Pressure	Unsigned 16 bit integer Range 0– 6,553,200 Pa Resolution 1×10^2 Pa
0x0021	0033	Transmission Oil Temperature	Unsigned 16 bit integer Range 0 – 6,553.2 deg K Resolution 1×10^{-1} deg K

7.3 Engine Instance 2 Registers

Engine Instance 2 – THIRD Engine			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0022	0034	Engine Oil Pressure	Unsigned 16 bit integer Range 0 – 6,553,200 Pa Resolution 1x10E+2 Pa
0x0023	0035	Engine Oil Temp	Unsigned 16 bit integer Range 0 – 6,553.2 deg K Resolution 1x10E-1 deg K
0x0024	0036	Engine Temp	Unsigned 16 bit integer Range 0 – 655.32 deg K Resolution 1x10E-2 deg K
0x0025	0037	Alternator Voltage	Signed 16 bit integer Range ± 327.64 Volts Resolution 1x10E-2 Volts
0x0026	0038	Fuel Rate	Signed 16 bit integer Range ± 3.2764 cu-m/hour Resolution 1x10E-4 cu-m/hour
0x0027/ 0x0028	0039/ 0040	Total Engine Hours Addr 0035 = MSW Addr 0036 = LSW	Unsigned 32 bit integer Range 0 – 4.295x10E+9 seconds Resolution 1 second
0x0029	0041	Engine Coolant Pressure	Unsigned 16 bit integer Range 0 – 6,553,200 Pa Resolution 1 x 10E+2 Pa
0x002A	0042	Fuel Pressure	Unsigned 16 bit integer Range 0 – 65,532,000 Pa Resolution 1x10E+3 Pa
0x002B	0043	Engine Status 1	16 bit Status bitfield xxxx xxxx xxxx xx1 = Check Engine xxxx xxxx xxxx xx1x = Over Temperature xxxx xxxx xxxx x1xx = Low Oil Pressure xxxx xxxx xxxx 1xxx = Low Oil Level xxxx xxxx xxx1 xxxx = Low Fuel Pressure xxxx xxxx xx1x xxxx = Low System Voltage xxxx xxxx x1xx xxxx = Low Coolant Level xxxx xxxx 1xxx xxxx = Water Flow xxxx xxx1 xxxx xxxx = Water in Fuel xxxx xx1x xxxx xxxx = Charge Indicator

			xxxx x1xx xxxx xxxx = Preheat Indicator xxxx 1xxx xxxx xxxx = High Boost Pressure xxx1 xxxx xxxx xxxx = Rev Limit Exceeded xx1x xxxx xxxx xxxx = EGR System x1xx xxxx xxxx xxxx = Throttle Position Sensor 1xxx xxxx xxxx xxxx = Emergency Stop
0x002C	0044	Engine Status 2	16 bit Status bitfield xxxx xxxx xxxx xxx1 = Warning Level 1 xxxx xxxx xxxx xx1x = Warning Level 2 xxxx xxxx xxxx x1xx = Power Reduction xxxx xxxx xxxx 1xxx = Maintenance Needed xxxx xxxx xxx1 xxxx = Engine Comm Error xxxx xxxx xx1x xxxx = Sub or Secondary Throttle xxxx xxxx x1xx xxxx = Neutral Start Protect xxxx xxxx 1xxx xxxx = Engine Shutting Down xxxx xxx1 xxxx xxxx = Reserved xxxx xx1x xxxx xxxx = Reserved xxxx x1xx xxxx xxxx = Reserved xxxx 1xxx xxxx xxxx = Reserved xxx1 xxxx xxxx xxxx = Reserved xx1x xxxx xxxx xxxx = Reserved x1xx xxxx xxxx xxxx = Reserved 1xxx xxxx xxxx xxxx = Reserved
0x002C	0045	Percent Engine Load Percent Engine Torque	2x Unsigned 8 bit integers Range $\pm 124\%$, Resolution 1% MSB = Load, LSB = Torque
0x002E	0046	Engine Speed	Unsigned 16 bit integer Range 0 – 16,383 RPM Resolution $\frac{1}{4}$ RPM
0x002F	0047	Engine Boost Pressure	Unsigned 16 bit integer Range 0 – 6,553,200 Pa Resolution 1×10^2 Pa
0x0030	0048	Engine Tilt/Trim	Signed 8 bit integer (LSB) Range $\pm 124\%$ Resolution 1%
0x0031	0049	Transmission Oil Pressure	Unsigned 16 bit integer Range 0– 6,553,200 Pa Resolution 1×10^2 Pa
0x0032	0050	Transmission Oil Temperature	Unsigned 16 bit integer Range 0 – 6,553.2 deg K Resolution 1×10^{-1} deg K

7.4 Fuel Tank Registers

Fuel Tank Instance 0 Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0033	0051	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0034/ 0x0035	0052/ 0053	Tank Capacity 0052 = MSW 0053 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fuel Tank Instance 1 Registers			
0x0036	0054	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0037/ 0x0038	0055/ 0056	Tank Capacity 0055 = MSW 0056 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fuel Tank Instance 2 Registers			
0x0039	0057	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x003A/ 0x003B	0058/ 0059	Tank Capacity 0058 = MSW 0059 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fuel Tank Instance 3 Registers			
0x003C	0060	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x003D/ 0x003E	0061/ 0062	Tank Capacity 0061 = MSW 0062 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fuel Tank Instance 4 Registers			
0x003F	0063	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0040/ 0x0041	0064/ 0065	Tank Capacity 0064 = MSW 0065 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fuel Tank Instance 5 Registers			
0x0042	0066	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0043/ 0x0044	0067/ 0068	Tank Capacity 0067 = MSW 0068 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fuel Tank Instance 6 Registers			

Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0045	0069	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0046/ 0x0047	0070/ 0071	Tank Capacity 0070 = MSW 0071 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fuel Tank Instance 7 Registers			
0x0048	0072	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0049/ 0x004A	0073/ 0074	Tank Capacity 0073 = MSW 0074 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m

7.5 Fresh Water Tank Registers

Fresh Water Tank Instance 0 Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x004B	0075	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x004C/ 0x004D	0076/ 0077	Tank Capacity 0076 = MSW 0077 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fresh Water Tank Instance 1 Registers			
0x004E	0078	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x004F/ 0x0050	0079/ 0080	Tank Capacity 0079 = MSW 0080 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fresh Water Tank Instance 2 Registers			
0x0051	0081	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0052/ 0x0053	0082/ 0083	Tank Capacity 0082 = MSW 0083 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fresh Water Tank Instance 3 Registers			
0x0054	0084	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0055/ 0x0056	0085/ 0086	Tank Capacity 0085 = MSW 0086 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fresh Water Tank Instance 4 Registers			
0x0057	0087	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0058/ 0x0059	0088/ 0089	Tank Capacity 0088 = MSW 0089 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fresh Water Tank Instance 5 Registers			
0x005A	0090	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x005B/ 0x005C	0091/ 0092	Tank Capacity 0091 = MSW 0092 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fresh Water Tank Instance 6 Registers			

Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x005D	0093	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x005E/ 0x005F	0094/ 0095	Tank Capacity 0094 = MSW 0095 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Fresh Water Tank Instance 7 Registers			
0x0060	0096	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0061/ 0x0062	0097/ 0098	Tank Capacity 0097 = MSW 0098 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m

7.6 Grey Waste Water Tank Registers

Grey Water Tank Instance 0 Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0063	0099	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0064/ 0x0065	0100/ 0101	Tank Capacity 0100 = MSW 0101 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Grey Water Tank Instance 1 Registers			
0x0066	0102	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0067/ 0x0068	0103/ 0104	Tank Capacity 0103 = MSW 0104 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Grey Water Tank Instance 2 Registers			
0x0069	0105	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x006A/ 0x006B	0106/ 0107	Tank Capacity 0106 = MSW 0107 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Grey Water Tank Instance 3 Registers			
0x006C	0108	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x006D/ 0x006E	0109/ 0110	Tank Capacity 0108 = MSW 0110 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Grey Water Tank Instance 4 Registers			
0x006F	0111	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0070/ 0x0071	0112/ 0113	Tank Capacity 0112 = MSW 0113 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Grey Water Tank Instance 5 Registers			
0x0072	0114	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0073/ 0x0074	0115/ 0116	Tank Capacity 0115 = MSW 0116 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Grey Water Tank Instance 6 Registers			

Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0075	0117	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0076/ 0x0077	0118/ 0119	Tank Capacity 0118 = MSW 0119 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Grey Water Tank Instance 7 Registers			
0x0078	0120	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0079/ 0x007A	0121/ 0122	Tank Capacity 0121 = MSW 0122 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m

7.7 Oil Tank Registers

Oil Tank Instance 0 Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x007B	0119	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x007C/ 0x007D	0120/ 0121	Tank Capacity 0120 = MSW 0121 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Oil Tank Instance 1 Registers			
0x007E	0122	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x007F/ 0x0080	0123/ 0124	Tank Capacity 0123= MSW 0124 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Oil Tank Instance 2 Registers			
0x0081	0125	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0082/ 0x0083	0126/ 0127	Tank Capacity 0126 = MSW 0127 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Oil Tank Instance 3 Registers			
0x0084	0128	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0085/ 0x0086	0129/ 0130	Tank Capacity 0129 = MSW 0130 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Oil Tank Instance 4 Registers			
0x0087	0131	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0088/ 0x0089	0132/ 0133	Tank Capacity 0132 = MSW 0133 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Oil Tank Instance 5 Registers			
0x008A	0134	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x008B/ 0x008C	0135/ 0136	Tank Capacity 0135 = MSW 0136 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Oil Tank Instance 6 Registers			

Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x008D	0141	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x008E/ 0x008F	0142/ 0143	Tank Capacity 0142 = MSW 0143 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Oil Tank Instance 7 Registers			
0x0090	0144	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0091/ 0x0092	0145/ 0146	Tank Capacity 0145 = MSW 0146 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m

7.8 Black Water Tank Registers

Black Water Tank Instance 0 Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0093	0147	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0094/ 0x0095	0148/ 0149	Tank Capacity 0148 = MSW 0149 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Black Water Tank Instance 1 Registers			
0x0096	0150	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x0097/ 0x0098	0151/ 0152	Tank Capacity 0151 = MSW 0152 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Black Water Tank Instance 2 Registers			
0x0099	0153	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x009A/ 0x009B	0154/ 0155	Tank Capacity 0154 = MSW 0155 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Black Water Tank Instance 3 Registers			
0x009C	0156	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x009D/ 0x009E	0157/ 0158	Tank Capacity 0157 = MSW 0158 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Black Water Tank Instance 4 Registers			
0x009F	0159	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x00A0/ 0x00A1	0160/ 0161	Tank Capacity 0160 = MSW 0161 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Black Water Tank Instance 5 Registers			
0x00A2	0162	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x00A3/ 0x00A4	0163/ 0164	Tank Capacity 0163 = MSW 0164 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Black Water Tank Instance 6 Registers			

Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x00A5	0165	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x00A6/ 0x00A7	0166/ 0167	Tank Capacity 0166 = MSW 0167 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m
Black Water Tank Instance 7 Registers			
0x00A8	0168	Fluid Level	Signed 16 bit integer Range -131.072% to +131.056% Resolution 0.004%
0x00A9/ 0x00AA	0169/ 0170	Tank Capacity 0168 = MSW 0170 = LSW	Unsigned 32 bit integer Range 0 – 4.296x10E+5 cu m Resolution 1x10E-4 cu m

7.9 AC Instance 0 Registers

AC Instance 0 - Single or PORT AC Instance			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x00AB	0171	AC Type	Unsigned 16 bit integer Range 0 – 2, 0 = Bus, 1 = Utility, 2 = Generator Resolution 1
0x00AC	0172	Average Line to Line Voltage, AC, RMS	Unsigned 16 bit integer Range 0 – 64255 Volts Resolution 1 Volt
0x00AD	0173	Average Line to Neutral Voltage	Unsigned 16 bit Integer Range 0-64255 Volts Resolution 1 Volt
0x00AE	0174	Frequency	Unsigned 16 bit integer Range 0 – 501.99 Hertz Resolution 1/128 Hertz
0x00AF	0175	Current (Not available in Bus type)	Unsigned 16 bit integer Range 0 – 64255 Amps Resolution 1 Amp

7.10 AC Instance 1 Registers

AC Instance 1 - Second or STBD AC Instance			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x00B0	0176	AC Type	Unsigned 16 bit integer Range 0 – 2, 0 = Bus, 1 = Utility, 2 = Generator Resolution 1
0x00B1	0177	Average Line to Line Voltage, AC, RMS	Unsigned 16 bit integer Range 0 – 64255 Volts Resolution 1 Volt
0x00B2	0178	Average Line to Neutral Voltage	Unsigned 16 bit Integer Range 0-64255 Volts Resolution 1 Volt
0x00B3	0179	Frequency	Unsigned 16 bit integer Range 0 – 501.99 Hertz Resolution 1/128 Hertz
0x00B4	0180	Current (Not available in Bus type)	Unsigned 16 bit integer Range 0 – 64255 Amps Resolution 1 Amp

7.11 AC Instance 2 Registers

AC Instance 2 – Third AC Instance			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x00B5	0181	AC Type	Unsigned 16 bit integer Range 0 – 2, 0 = Bus, 1 = Utility, 2 = Generator Resolution 1
0x00B6	0182	Average Line to Line Voltage, AC, RMS	Unsigned 16 bit integer Range 0 – 64255 Volts Resolution 1 Volt
0x00B7	0183	Average Line to Neutral Voltage	Unsigned 16 bit Integer Range 0-64255 Volts Resolution 1 Volt
0x00B8	0184	Frequency	Unsigned 16 bit integer Range 0 – 501.99 Hertz Resolution 1/128 Hertz
0x00B9	0185	Current (Not available in Bus type)	Unsigned 16 bit integer Range 0 – 64255 Amps Resolution 1 Amp

7.12 AC Instance 3 Registers

AC Instance 3 – Fourth AC Instance			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x00BA	0186	AC Type	Unsigned 16 bit integer Range 0 – 2, 0 = Bus, 1 = Utility, 2 = Generator Resolution 1
0x00BB	0187	Average Line to Line Voltage, AC, RMS	Unsigned 16 bit integer Range 0 – 64255 Volts Resolution 1 Volt
0x00BC	0188	Average Line to Neutral Voltage	Unsigned 16 bit Integer Range 0-64255 Volts Resolution 1 Volt
0x00BD	0189	Frequency	Unsigned 16 bit integer Range 0 – 501.99 Hertz Resolution 1/128 Hertz
0x00BE	0190	Current (Not available in Bus type)	Unsigned 16 bit integer Range 0 – 64255 Amps Resolution 1 Amp

7.13 AC Instance 4 Registers

AC Instance 4 – Fifth AC Instance			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x00BF	0191	AC Type	Unsigned 16 bit integer Range 0 – 2, 0 = Bus, 1 = Utility, 2 = Generator Resolution 1
0x00C0	0192	Average Line to Line Voltage, AC, RMS	Unsigned 16 bit integer Range 0 – 64255 Volts Resolution 1 Volt
0x00C1	0193	Average Line to Neutral Voltage	Unsigned 16 bit Integer Range 0-64255 Volts Resolution 1 Volt
0x00C2	0194	Frequency	Unsigned 16 bit integer Range 0 – 501.99 Hertz Resolution 1/128 Hertz
0x00C3	0195	Current (Not available in Bus Type)	Unsigned 16 bit integer Range 0 – 64255 Amps Resolution 1 Amp

7.14 AC Instance 5 Registers

AC Instance 5 – Sixth AC Instance			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x00C4	0196	AC Type	Unsigned 16 bit integer Range 0 – 2, 0 = Bus, 1 = Utility, 2 = Generator Resolution 1
0x00C5	0197	Average Line to Line Voltage, AC, RMS	Unsigned 16 bit integer Range 0 – 64255 Volts Resolution 1 Volt
0x00C6	0198	Average Line to Neutral Voltage	Unsigned 16 bit Integer Range 0-64255 Volts Resolution 1 Volt
0x00C7	0199	Frequency	Unsigned 16 bit integer Range 0 – 501.99 Hertz Resolution 1/128 Hertz
0x00C8	0200	Current (Not available in Bus Type)	Unsigned 16 bit integer Range 0 – 64255 Amps Resolution 1 Amp

Memory addresses from 0x00C9 (0201) to 0X015E (350) reserved.

7.15 Battery Bank Registers

Battery Bank Instance 0 Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x015F	0351	Battery Voltage	Signed 16 bit integer Range ± 327.64 Volts Resolution 1×10^{-2} Volts
0x0160	0352	Battery Current	Signed 16 bit integer Range $\pm 3,276.4$ Amps Resolution 1×10^{-1} Amps
0x0161	0353	Battery Case Temp	Unsigned 16 bit integer Range $0 - 655.32$ $^{\circ}\text{K}$ Resolution 1×10^{-2} $^{\circ}\text{K}$
Battery Bank Instance 1 Registers			
0x0162	0354	Battery Voltage	Signed 16 bit integer Range ± 327.64 Volts Resolution 1×10^{-2} Volts
0x0163	0355	Battery Current	Signed 16 bit integer Range $\pm 3,276.4$ Amps Resolution 1×10^{-1} Amps
0x0164	0356	Battery Case Temp	Unsigned 16 bit integer Range $0 - 655.32$ $^{\circ}\text{K}$ Resolution 1×10^{-2} $^{\circ}\text{K}$
Battery Bank Instance 2 Registers			
0x0165	0357	Battery Voltage	Signed 16 bit integer Range ± 327.64 Volts Resolution 1×10^{-2} Volts
0x0166	0358	Battery Current	Signed 16 bit integer Range $\pm 3,276.4$ Amps Resolution 1×10^{-1} Amps
0x0167	0359	Battery Case Temp	Unsigned 16 bit integer Range $0 - 655.32$ $^{\circ}\text{K}$ Resolution 1×10^{-2} $^{\circ}\text{K}$
Battery Bank Instance 3 Registers			
0x0168	0360	Battery Voltage	Signed 16 bit integer Range ± 327.64 Volts Resolution 1×10^{-2} Volts
0x0169	0361	Battery Current	Signed 16 bit integer Range $\pm 3,276.4$ Amps Resolution 1×10^{-1} Amps
0x016A	0362	Battery Case Temp	Unsigned 16 bit integer Range $0 - 655.32$ $^{\circ}\text{K}$ Resolution 1×10^{-2} $^{\circ}\text{K}$

Battery Bank Instance 4 Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x16B	0363	Battery Voltage	Signed 16 bit integer Range ± 327.64 Volts Resolution 1×10^{-2} Volts
0x016C	0364	Battery Current	Signed 16 bit integer Range $\pm 3,276.4$ Amps Resolution 1×10^{-1} Amps
0x016D	0365	Battery Case Temp	Unsigned 16 bit integer Range 0 – 655.32 °K Resolution 1×10^{-2} °K
Battery Bank Instance 5 Registers			
0x016E	0366	Battery Voltage	Signed 16 bit integer Range ± 327.64 Volts Resolution 1×10^{-2} Volts
0x016F	0367	Battery Current	Signed 16 bit integer Range $\pm 3,276.4$ Amps Resolution 1×10^{-1} Amps
0x0170	0368	Battery Case Temp	Unsigned 16 bit integer Range 0 – 655.32 °K Resolution 1×10^{-2} °K
Battery Bank Instance 6 Registers			
0x0171	0369	Battery Voltage	Signed 16 bit integer Range ± 327.64 Volts Resolution 1×10^{-2} Volts
0x0172	0370	Battery Current	Signed 16 bit integer Range $\pm 3,276.4$ Amps Resolution 1×10^{-1} Amps
0x0173	0371	Battery Case Temp	Unsigned 16 bit integer Range 0 – 655.32 °K Resolution 1×10^{-2} °K
Battery Bank Instance 7 Registers			
0x0174	0372	Battery Voltage	Signed 16 bit integer Range ± 327.64 Volts Resolution 1×10^{-2} Volts
0x0175	0373	Battery Current	Signed 16 bit integer Range $\pm 3,276.4$ Amps Resolution 1×10^{-1} Amps
0x0176	0374	Battery Case Temp	Unsigned 16 bit integer Range 0 – 655.32 °K Resolution 1×10^{-2} °K

7.16 Battery Charger Instance 0 Registers

Battery Charger Instance 0			
First Connected Battery Data Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0177	0375	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x0178	0376	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute
Second Connected Battery Data Registers			
0x0179	0377	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float

			xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x017A	0378	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute
Third Connected Battery Data Registers			
0x017B	0379	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled

			xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x017C	0380	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute

7.17 Battery Charger Instance 1 Registers

Battery Charger Instance 1			
First Connected Battery Data Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x017D	0381	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error

			xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x017E	0382	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute
Second Connected Battery Data Registers			
0x017F	0383	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x0180	0384	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute
Third Connected Battery Data Registers			
0x0181	0385	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI

			xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x0182	0386	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute

7.18 Battery Charger Instance 2 Registers

Battery Charger Instance 2			
First Connected Battery Data Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0183	0387	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode

			xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x0184	0388	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute
Second Connected Battery Data Registers			
0x0185	0389	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x0186	0390	Equalisation Time	Unsigned 16 bit integer

		remaining	Range 0 – 65,532 Minutes Resolution 1 minute
Third Connected Battery Data Registers			
0x0187	0391	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x0188	0392	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute

7.19 Battery Charger Instance 3 Registers

Battery Charger Instance 3			
First Connected Battery Data Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0189	0393	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x018A	0394	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute
Second Connected Battery Data Registers			
0x018B	0395	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float

			xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x018C	0396	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute
Third Connected Battery Data Registers			
0x018D	0397	Operating State Charge Mode Charger Enab/Dis Equalisation Pend	16 bit field xxxx xxxx xxxx 0000 = Not Charging xxxx xxxx xxxx 0001 = Bulk xxxx xxxx xxxx 0010 = Absorption xxxx xxxx xxxx 0011 = Overcharge xxxx xxxx xxxx 0100 = Equalise xxxx xxxx xxxx 0101 = Float xxxx xxxx xxxx 0110 = No Float xxxx xxxx xxxx 0111 = Constant VI xxxx xxxx xxxx 1000 = Disabled xxxx xxxx xxxx 1001 = Fault xxxx xxxx xxxx 1110 = Error xxxx xxxx xxxx 1111 = Data not available xxxx xxxx 0000 xxxx = Standalone Mode xxxx xxxx 0001 xxxx = Primary Mode xxxx xxxx 0010 xxxx = Secondary Mode xxxx xxxx 0011 xxxx = Echo Mode xxxx xxxx 1110 xxxx = Error xxxx xxxx 1111 xxxx = Data not available

			xxxx xx00 xxxx xxxx = Charger Off/Disabled xxxx xx01 xxxx xxxx = Charger On/Enabled xxxx xx10 xxxx xxxx = Error xxxx xx11 xxxx xxxx = Unknown/Unavailable xxxx 00xx xxxx xxxx = Eq Pend Off/Disabled xxxx 01xx xxxx xxxx = Eq Pend On/Enabled xxxx 10xx xxxx xxxx = Eq Pend Error xxxx 11xx xxxx xxxx = Unknown/Unavailable
0x018E	0398	Equalisation Time remaining	Unsigned 16 bit integer Range 0 – 65,532 Minutes Resolution 1 minute

7.20 Switch Bank Status and Control Registers

The 3155 unit supports up to 8 banks each of 28 switches as grouped by the NMEA2000 standard. Each switch is accessible as either 224 (8 x 28) individual switches or grouped together in 8 Holding Registers designated as Instance 0 to Instance 7.

Note that the NMEA2000 standard assigns 2 bits to each switch with the following values which vary whether the switch is being read or set:

Bit Values	Controlling the Switch	Reading the Switch Status
0x00	Turn OFF	Off
0x01	Turn ON	On
0x10	Reserved/No Action	Error
0x11	No Action	Unavailable/Unknown

When controlling or reading the switches using the Holding Registers then these values MUST be used by the Modbus Master device.

Please note that these registers are read using command code 4 and written using command code 16. (decimal)

7.21 Switch Bank Holding Registers

Switch Bank Instance 0 Holding Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x018F	0399	Switches 1 – 8	16 bit field SSxx xxxx xxxx xxxx = Switch 1 bits xxSS xxxx xxxx xxxx = Switch 2 bits xxxx SSxx xxxx xxxx = Switch 3 bits

			xxxx xxSS xxxx xxxx = Switch 4 bits xxxx xxxx SSxx xxxx = Switch 5 bits xxxx xxxx xxSS xxxx = Switch 6 bits xxxx xxxx xxxx SSxx = Switch 7 bits xxxx xxxx xxxx xxSS = Switch 8 bits Values as per bit value table above
0x0190	0400	Switches 9 –16	16 bit field SSxx xxxx xxxx xxxx = Switch 9 bits xxSS xxxx xxxx xxxx = Switch 10 bits xxxx SSxx xxxx xxxx = Switch 11 bits xxxx xxSS xxxx xxxx = Switch 12 bits xxxx xxxx SSxx xxxx = Switch 13 bits xxxx xxxx xxSS xxxx = Switch 14 bits xxxx xxxx xxxx SSxx = Switch 15 bits xxxx xxxx xxxx xxSS = Switch 16 bits Values as per bit value table above
0x0191	0401	Switches 17 –24	16 bit field SSxx xxxx xxxx xxxx = Switch 17 bits xxSS xxxx xxxx xxxx = Switch 18 bits xxxx SSxx xxxx xxxx = Switch 19 bits xxxx xxSS xxxx xxxx = Switch 20 bits xxxx xxxx SSxx xxxx = Switch 21 bits xxxx xxxx xxSS xxxx = Switch 22 bits xxxx xxxx xxxx SSxx = Switch 23 bits xxxx xxxx xxxx xxSS = Switch 24 bits Values as per bit value table above
0x0192	0402	Switches 25 –28	16 bit field xxxx xxxx SSxx xxxx = Switch 25 bits xxxx xxxx xxSS xxxx = Switch 26 bits xxxx xxxx xxxx SSxx = Switch 27 bits xxxx xxxx xxxx xxSS = Switch 28 bits Values as per bit value table above
Switch Bank Instance 1 Holding Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0193	0403	Switches 1 – 8	16 bit field SSxx xxxx xxxx xxxx = Switch 1 bits xxSS xxxx xxxx xxxx = Switch 2 bits xxxx SSxx xxxx xxxx = Switch 3 bits xxxx xxSS xxxx xxxx = Switch 4 bits xxxx xxxx SSxx xxxx = Switch 5 bits xxxx xxxx xxSS xxxx = Switch 6 bits xxxx xxxx xxxx SSxx = Switch 7 bits xxxx xxxx xxxx xxSS = Switch 8 bits Values as per bit value table above
0x0194	0404	Switches 9 –16	16 bit field SSxx xxxx xxxx xxxx = Switch 9 bits

			xxSS xxxx xxxx xxxx = Switch 10 bits xxxx SSxx xxxx xxxx = Switch 11 bits xxxx xxSS xxxx xxxx = Switch 12 bits xxxx xxxx SSxx xxxx = Switch 13 bits xxxx xxxx xxSS xxxx = Switch 14 bits xxxx xxxx xxxx SSxx = Switch 15 bits xxxx xxxx xxxx xxSS = Switch 16 bits Values as per bit value table above
0x0195	0405	Switches 17 –24	16 bit field SSxx xxxx xxxx xxxx = Switch 17 bits xxSS xxxx xxxx xxxx = Switch 18 bits xxxx SSxx xxxx xxxx = Switch 19 bits xxxx xxSS xxxx xxxx = Switch 20 bits xxxx xxxx SSxx xxxx = Switch 21 bits xxxx xxxx xxSS xxxx = Switch 22 bits xxxx xxxx xxxx SSxx = Switch 23 bits xxxx xxxx xxxx xxSS = Switch 24 bits Values as per bit value table above
0x0196	0406	Switches 25 –28	16 bit field xxxx xxxx SSxx xxxx = Switch 25 bits xxxx xxxx xxSS xxxx = Switch 26 bits xxxx xxxx xxxx SSxx = Switch 27 bits xxxx xxxx xxxx xxSS = Switch 28 bits Values as per bit value table above
Switch Bank Instance 2 Holding Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x0197	0407	Switches 1 – 8	16 bit field SSxx xxxx xxxx xxxx = Switch 1 bits xxSS xxxx xxxx xxxx = Switch 2 bits xxxx SSxx xxxx xxxx = Switch 3 bits xxxx xxSS xxxx xxxx = Switch 4 bits xxxx xxxx SSxx xxxx = Switch 5 bits xxxx xxxx xxSS xxxx = Switch 6 bits xxxx xxxx xxxx SSxx = Switch 7 bits xxxx xxxx xxxx xxSS = Switch 8 bits Values as per bit value table above
0x0198	0408	Switches 9 –16	16 bit field SSxx xxxx xxxx xxxx = Switch 9 bits xxSS xxxx xxxx xxxx = Switch 10 bits xxxx SSxx xxxx xxxx = Switch 11 bits xxxx xxSS xxxx xxxx = Switch 12 bits xxxx xxxx SSxx xxxx = Switch 13 bits xxxx xxxx xxSS xxxx = Switch 14 bits xxxx xxxx xxxx SSxx = Switch 15 bits xxxx xxxx xxxx xxSS = Switch 16 bits Values as per bit value table above

0x0199	0409	Switches 17 –24	16 bit field SSxx xxxx xxxx xxxx = Switch 17 bits xxSS xxxx xxxx xxxx = Switch 18 bits xxxx SSxx xxxx xxxx = Switch 19 bits xxxx xxSS xxxx xxxx = Switch 20 bits xxxx xxxx SSxx xxxx = Switch 21 bits xxxx xxxx xxSS xxxx = Switch 22 bits xxxx xxxx xxxx SSxx = Switch 23 bits xxxx xxxx xxxx xxSS = Switch 24 bits Values as per bit value table above
0x019A	0410	Switches 25 –28	16 bit field xxxx xxxx SSxx xxxx = Switch 25 bits xxxx xxxx xxSS xxxx = Switch 26 bits xxxx xxxx xxxx SSxx = Switch 27 bits xxxx xxxx xxxx xxSS = Switch 28 bits Values as per bit value table above
Switch Bank Instance 3 Holding Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x019B	0411	Switches 1 – 8	16 bit field SSxx xxxx xxxx xxxx = Switch 1 bits xxSS xxxx xxxx xxxx = Switch 2 bits xxxx SSxx xxxx xxxx = Switch 3 bits xxxx xxSS xxxx xxxx = Switch 4 bits xxxx xxxx SSxx xxxx = Switch 5 bits xxxx xxxx xxSS xxxx = Switch 6 bits xxxx xxxx xxxx SSxx = Switch 7 bits xxxx xxxx xxxx xxSS = Switch 8 bits Values as per bit value table above
0x019C	0412	Switches 9 –16	16 bit field SSxx xxxx xxxx xxxx = Switch 9 bits xxSS xxxx xxxx xxxx = Switch 10 bits xxxx SSxx xxxx xxxx = Switch 11 bits xxxx xxSS xxxx xxxx = Switch 12 bits xxxx xxxx SSxx xxxx = Switch 13 bits xxxx xxxx xxSS xxxx = Switch 14 bits xxxx xxxx xxxx SSxx = Switch 15 bits xxxx xxxx xxxx xxSS = Switch 16 bits Values as per bit value table above
0x019D	0413	Switches 17 –24	16 bit field SSxx xxxx xxxx xxxx = Switch 17 bits xxSS xxxx xxxx xxxx = Switch 18 bits xxxx SSxx xxxx xxxx = Switch 19 bits xxxx xxSS xxxx xxxx = Switch 20 bits xxxx xxxx SSxx xxxx = Switch 21 bits xxxx xxxx xxSS xxxx = Switch 22 bits xxxx xxxx xxxx SSxx = Switch 23 bits

			xxxx xxxx xxxx xxSS = Switch 24 bits Values as per bit value table above
0x019E	0414	Switches 25 –28	16 bit field xxxx xxxx SSxx xxxx = Switch 25 bits xxxx xxxx xxSS xxxx = Switch 26 bits xxxx xxxx xxxx SSxx = Switch 27 bits xxxx xxxx xxxx xxSS = Switch 28 bits Values as per bit value table above

Switch Bank Instance 4 Holding Registers

Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x019F	0415	Switches 1 – 8	16 bit field SSxx xxxx xxxx xxxx = Switch 1 bits xxSS xxxx xxxx xxxx = Switch 2 bits xxxx SSxx xxxx xxxx = Switch 3 bits xxxx xxSS xxxx xxxx = Switch 4 bits xxxx xxxx SSxx xxxx = Switch 5 bits xxxx xxxx xxSS xxxx = Switch 6 bits xxxx xxxx xxxx SSxx = Switch 7 bits xxxx xxxx xxxx xxSS = Switch 8 bits Values as per bit value table above
0x01A0	0416	Switches 9 –16	16 bit field SSxx xxxx xxxx xxxx = Switch 9 bits xxSS xxxx xxxx xxxx = Switch 10 bits xxxx SSxx xxxx xxxx = Switch 11 bits xxxx xxSS xxxx xxxx = Switch 12 bits xxxx xxxx SSxx xxxx = Switch 13 bits xxxx xxxx xxSS xxxx = Switch 14 bits xxxx xxxx xxxx SSxx = Switch 15 bits xxxx xxxx xxxx xxSS = Switch 16 bits Values as per bit value table above
0x01A1	0417	Switches 17 –24	16 bit field SSxx xxxx xxxx xxxx = Switch 17 bits xxSS xxxx xxxx xxxx = Switch 18 bits xxxx SSxx xxxx xxxx = Switch 19 bits xxxx xxSS xxxx xxxx = Switch 20 bits xxxx xxxx SSxx xxxx = Switch 21 bits xxxx xxxx xxSS xxxx = Switch 22 bits xxxx xxxx xxxx SSxx = Switch 23 bits xxxx xxxx xxxx xxSS = Switch 24 bits Values as per bit value table above
0x01A2	0418	Switches 25 –28	16 bit field xxxx xxxx SSxx xxxx = Switch 25 bits xxxx xxxx xxSS xxxx = Switch 26 bits xxxx xxxx xxxx SSxx = Switch 27 bits xxxx xxxxxxxx xxSS = Switch 28 bits Values as per bit value table above

Switch Bank Instance 4 Holding Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x01A3	0419	Switches 1 – 8	16 bit field SSxx xxxx xxxx = Switch 1 bits xxSS xxxx xxxx = Switch 2 bits xxxx SSxx xxxx = Switch 3 bits xxxx xxSS xxxx = Switch 4 bits xxxx xxxx SSxx = Switch 5 bits xxxx xxxx xxSS xxxx = Switch 6 bits xxxx xxxx xxxx SSxx = Switch 7 bits xxxx xxxx xxxx xxSS = Switch 8 bits Values as per bit value table above
0x01A4	0420	Switches 9 –16	16 bit field SSxx xxxx xxxx xxxx = Switch 9 bits xxSS xxxx xxxx xxxx = Switch 10 bits xxxx SSxx xxxx xxxx = Switch 11 bits xxxx xxSS xxxx xxxx = Switch 12 bits xxxx xxxx SSxx xxxx = Switch 13 bits xxxx xxxx xxSS xxxx = Switch 14 bits xxxx xxxx xxxx SSxx = Switch 15 bits xxxx xxxx xxxx xxSS = Switch 16 bits Values as per bit value table above
0x01A5	0421	Switches 17 –24	16 bit field SSxx xxxx xxxx xxxx = Switch 17 bits xxSS xxxx xxxx xxxx = Switch 18 bits xxxx SSxx xxxx xxxx = Switch 19 bits xxxx xxSS xxxx xxxx = Switch 20 bits xxxx xxxx SSxx xxxx = Switch 21 bits xxxx xxxx xxSS xxxx = Switch 22 bits xxxx xxxx xxxx SSxx = Switch 23 bits xxxx xxxx xxxx xxSS = Switch 24 bits Values as per bit value table above
0x01A6	0422	Switches 25 –28	16 bit field xxxx xxxx SSxx xxxx = Switch 25 bits xxxx xxxx xxSS xxxx = Switch 26 bits xxxx xxxx xxxx SSxx = Switch 27 bits xxxx xxxx xxxx xxSS = Switch 28 bits Values as per bit value table above
Switch Bank Instance 6 Holding Registers			
Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x01A7	0423	Switches 1 – 8	16 bit field SSxx xxxx xxxx xxxx = Switch 1 bits xxSS xxxx xxxx xxxx = Switch 2 bits xxxx SSxx xxxx xxxx = Switch 3 bits xxxx xxSS xxxx xxxx = Switch 4 bits

			xxxx xxxx SSxx xxxx = Switch 5 bits xxxx xxxx xxSS xxxx = Switch 6 bits xxxx xxxx xxxx SSxx = Switch 7 bits xxxx xxxx xxxx xxSS = Switch 8 bits Values as per bit value table above
0x01A8	0424	Switches 9 –16	16 bit field SSxx xxxx xxxx xxxx = Switch 9 bits xxSS xxxx xxxx xxxx = Switch 10 bits xxxx SSxx xxxx xxxx = Switch 11 bits xxxx xxSS xxxx xxxx = Switch 12 bits xxxx xxxx SSxx xxxx = Switch 13 bits xxxx xxxx xxSS xxxx = Switch 14 bits xxxx xxxx xxxx SSxx = Switch 15 bits xxxx xxxx xxxx xxSS = Switch 16 bits Values as per bit value table above
0x01A9	0425	Switches 17 –24	16 bit field SSxx xxxx xxxx xxxx = Switch 17 bits xxSS xxxx xxxx xxxx = Switch 18 bits xxxx SSxx xxxx xxxx = Switch 19 bits xxxx xxSS xxxx xxxx = Switch 20 bits xxxx xxxx SSxx xxxx = Switch 21 bits xxxx xxxx xxSS xxxx = Switch 22 bits xxxx xxxx xxxx SSxx = Switch 23 bits xxxx xxxx xxxx xxSS = Switch 24 bits Values as per bit value table above
0x01AA	0426	Switches 25 –28	16 bit field xxxx xxxx SSxx xxxx = Switch 25 bits xxxx xxxx xxSS xxxx = Switch 26 bits xxxx xxxx xxxx SSxx = Switch 27 bits xxxx xxxx xxxx xxSS = Switch 28 bits Values as per bit value table above

Switch Bank Instance 7 Holding Registers

Hex Addr	Dec Addr	Data Field	Data Type, Range and Resolution
0x01AB	0427	Switches 1 – 8	16 bit field SSxx xxxx xxxx xxxx = Switch 1 bits xxSS xxxx xxxx xxxx = Switch 2 bits xxxx SSxx xxxx xxxx = Switch 3 bits xxxx xxSS xxxx xxxx = Switch 4 bits xxxx xxxx SSxx xxxx = Switch 5 bits xxxx xxxx xxSS xxxx = Switch 6 bits xxxx xxxx xxxx SSxx = Switch 7 bits xxxx xxxx xxxx xxSS = Switch 8 bits Values as per bit value table above
0x01AC	0428	Switches 9 –16	16 bit field SSxx xxxx xxxx xxxx = Switch 9 bits xxSS xxxx xxxx xxxx = Switch 10 bits

			xxxx SSxx xxxx xxxx = Switch 11 bits xxxx xxSS xxxx xxxx = Switch 12 bits xxxx xxxx SSxx xxxx = Switch 13 bits xxxx xxxx xxSS xxxx = Switch 14 bits xxxx xxxx xxxx SSxx = Switch 15 bits xxxx xxxx xxxx xxSS = Switch 16 bits Values as per bit value table above
0x01AD	0429	Switches 17 –24	16 bit field SSxx xxxx xxxx xxxx = Switch 17 bits xxSS xxxx xxxx xxxx = Switch 18 bits xxxx SSxx xxxx xxxx = Switch 19 bits xxxx xxSS xxxx xxxx = Switch 20 bits xxxx xxxx SSxx xxxx = Switch 21 bits xxxx xxxx xxSS xxxx = Switch 22 bits xxxx xxxx xxxx SSxx = Switch 23 bits xxxx xxxx xxxx xxSS = Switch 24 bits Values as per bit value table above
0x01AE	0430	Switches 25 –28	16 bit field xxxx xxxx SSxx xxxx = Switch 25 bits xxxx xxxx xxSS xxxx = Switch 26 bits xxxx xxxx xxxx SSxx = Switch 27 bits xxxx xxxx xxxx xxSS = Switch 28 bits Values as per bit value table above

8 Maintenance

- Clean the unit with a soft cloth.
- Do not use chemical cleaners as they may remove paint or markings or may corrode the enclosure or seals.
- Ensure that the unit is mounted securely and cannot be moved relative to the mounting surface. If the unit is loose, tighten the mounting screws.
- Check the security of the cables connected to the NMEA 2000 connector and the RS485 connector, and tighten if necessary.

9 Technical Specification

As Offshore Systems are constantly improving their products ass specifications are subject to change without notice. Offshore System's products are designed to be accurate and reliable however they should only be used as aids to navigation and not as a replacement for traditional navigation aids and techniques.

Certifications

Parameter	Comment
NMEA2000	Level B+
Maritime Nav and RadioComm Equipment	IEC60945
CE and FCC	Electromagnetic Compatibility

Converted NMEA2000 Parameter Group Numbers (PGNs)

Source	Max No	PGN No	PGN Name
Engines	3	127488	Engine Parameters, Rapid Update
		127489	Engine Parameters, Dynamic
Fuel Tanks	8	127505	Fluid Level
Fresh Water Tanks	8		
Grey Water Tanks	8		
Black Water Tanks	8		
Oil Tanks	8		
Generators	3	127504	AC Output Status
Shore Power / AC Busbars	3	127503	AC Input Status
Battery Banks	8	127508	Battery Status
Battery Chargers	4	127507	Charger Status
Switch Banks of 28 switches	8	127501	Switch Bank Status
		127502	Switch Bank Control

Electrical and Mechanical

Parameter	Value	Comment
Operating Voltage	9 to 32 Volts	DC Voltage
Power Consumption	50mA	Average Operating
Load Equivalence Number	1	LEN
Reverse Battery Protection	Yes	Indefinitely
Load Dump Protection	Yes	SAE J1113
Size	120x100x35mm	
Weight	160gm	

Environmental

Parameter	Value
IEC 60954 Classification	Protected
Degree of Protection	IP40
Operating Temperature	-25°C to 50°C
Storage Temperature	-40°C to 70°C
Relative Humidity	93%RH @40° per IEC60945-8.2
Vibration	2-13.2Hz @ ±1mm, 13.2-100Hz @ 7m/s ² per IEC 60945-8.7
Electromagnetic Emission	Conducted and Radiated Emission per IEC 60945-9
Electromagnetic Immunity	Conducted, Radiated, Supply, and ESD per IEC 60945-10
Safety Precautions	Dangerous Voltage, Electromagnetic Radio Frequency per IEC 60945-12

10 Technical Support

If you require technical support for any Offshore Systems products you can reach us by any of the following ways:

- ❖ Tel: +44(0)1425 610022
- ❖ Fax: +44(0)1425 614794
- ❖ Email: support@osukl.com
- ❖ Web: www.osukl.com
- ❖ Post: Offshore Systems UK Ltd
Unit 11 Milton Business Centre
Wick Drive, New Milton, BH25 6RH
United Kingdom

11 Warranty

Offshore Systems warrants this product to be free from defects in materials and workmanship for one year from the date of original purchase. If within the applicable period any such products shall be proved to Offshore Systems satisfaction to fail to meet the above limited warranty, such products shall be repaired or replaced at Offshore Systems option. Purchaser's exclusive remedy and Offshore Systems sole obligation hereunder, provided product is returned pursuant to the return requirements below, shall be limited to the repair or replacement, at Offshore Systems option, of any product not meeting the above limited warranty and which is returned to Offshore Systems; or if Offshore Systems is unable to deliver a replacement that is free from defects in materials or workmanship, Purchaser's payment for such product will be refunded. Offshore Systems assumes no liability whatsoever for expenses of removing any defective product or part or for installing the repaired product or part or a replacement therefore or for any loss or damage to equipment in connection with which Offshore Systems products or parts shall be used. The foregoing warranties shall not apply with respect to products subjected to negligence, misuse, misapplication, accident, damages by circumstances beyond Offshore Systems control, to improper installation, operation, maintenance, or storage, or to other than normal use or service.

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Statements made by any person, including representatives of Offshore Systems, which are inconsistent or in conflict with the terms of this Limited Warranty, shall not be binding upon Offshore Systems unless reduced to writing and approved by an officer of Offshore Systems.

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whether directly, in trade literature, brochures or other documentation shall be construed as warranties of any kind, and any failure to conform with such specifications, samples, descriptions, or illustrations shall not constitute any breach of Offshore Systems limited warranty.

Warranty Return Procedure

To apply for warranty claims, contact Offshore Systems or one of its dealers to describe the problem and determine the appropriate course of action. If a return is necessary, place the product in its original packaging together with proof of purchase and send to an Authorized Offshore Systems Service Location. You are responsible for all shipping and insurance charges. Offshore Systems will return the replaced or repaired product with all shipping and handling prepaid except for requests requiring expedited shipping (i.e. overnight shipments). Failure to follow this warranty return procedure could result in the product's warranty becoming null and void.

Offshore Systems reserves the right to modify or replace, at its sole discretion, without prior notification, the warranty listed above

