MODBUS TCP FOR NORSUB MRUS

This document is a supplement to the NORSUB Configuration Software Manual [1] and explains how to configure the NORSUB MRU to output data on Modbus TCP.

Configuration of Modbus TCP

In the MRU configuration software, go to ports & communication settings to select Modbus TCP.

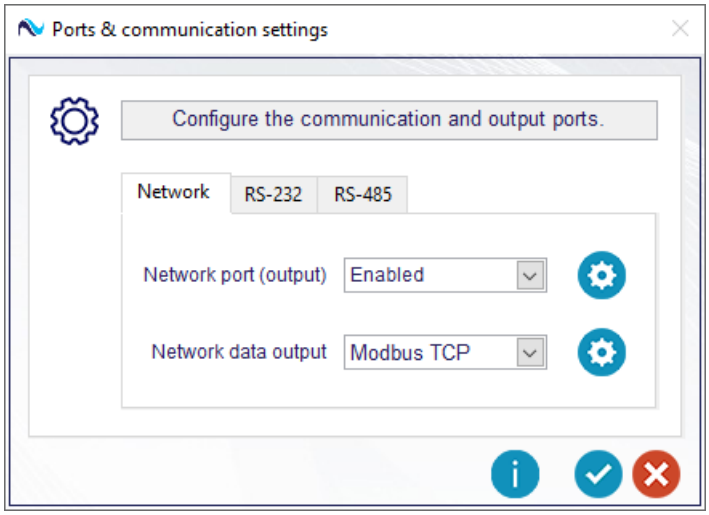

Figure 1: Port & communication settings.

Then select if you want to read from input or holding registers.

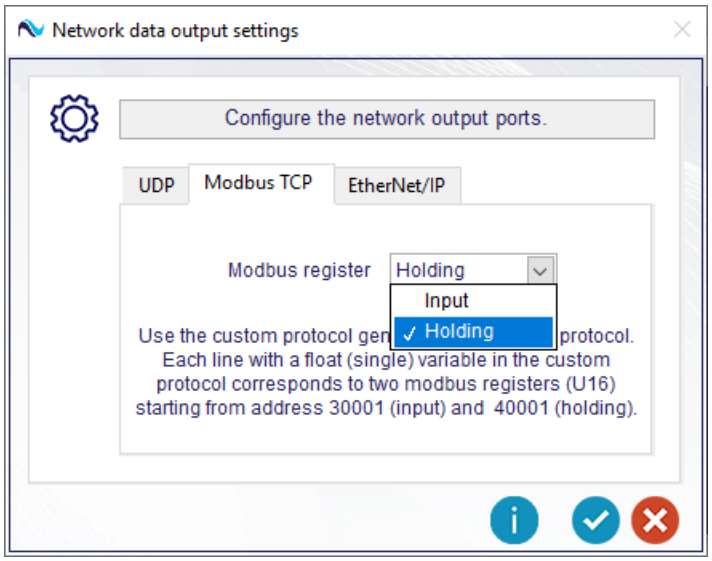

Figure 2: Network data output settings.

If holding registers are selected, then data will be available in the register addresses starting with 40001.

Modbus registers and variables

The data variables in the Modbus registers are configured using the Custom binary protocol. This is accessed from the output settings.

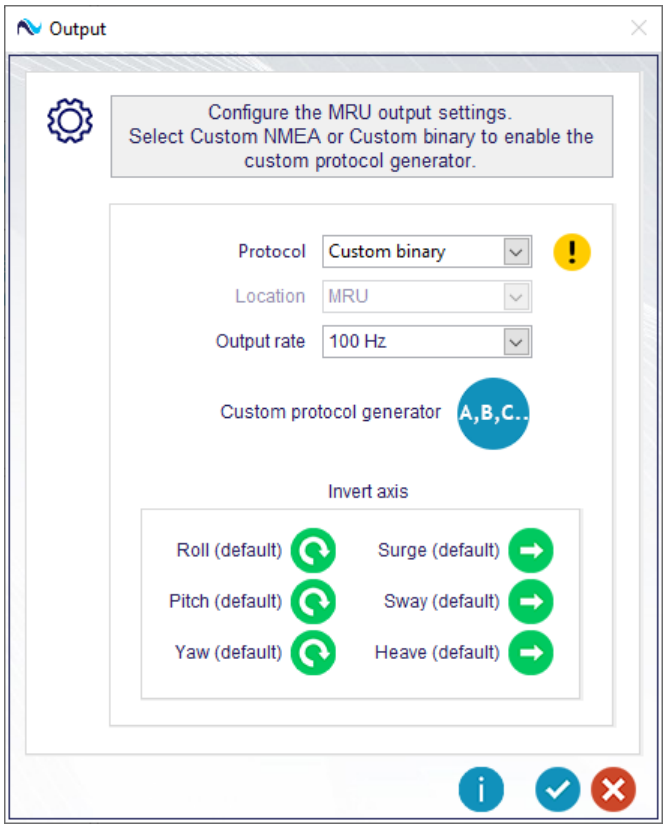

Figure 3: Output: Custom protocol generator.

We recommend using 100 Hz output rate for Modbus TCP as this will be the update frequency of the Modbus registers.

Using the custom protocol generator, you can select the data you want to access and the order they will appear in the Modbus register addresses. E.g. if you select roll, pitch and heave, as seen in Figure 4,

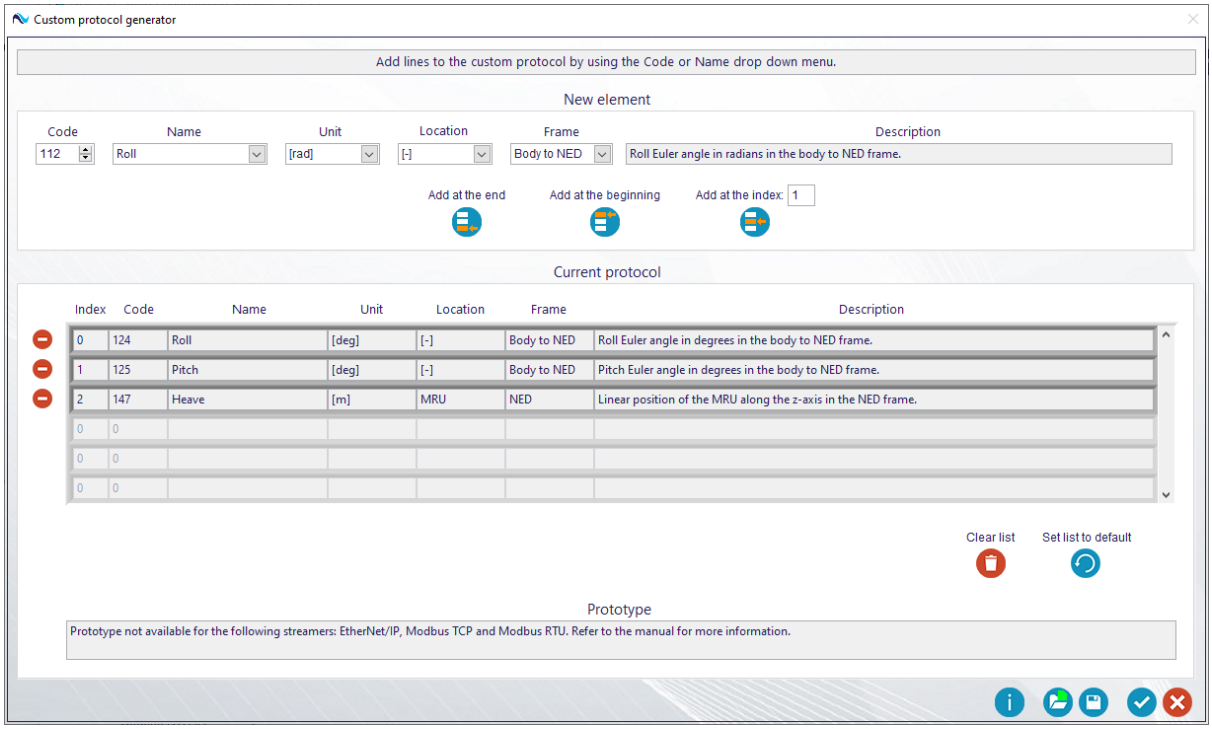

Figure 4: Custom protocol generator.

then roll will be in register addresses 40001 and 40002, pitch in register addresses 40003 and 40004, etc. The table below shows an example of register values and the float value for the selected variables. You can use this table to check the conversion from register values to float.

Parameter	Single precision float (IEEE 754)	Register address	Register value (U16) Decimal
Roll	2.34	40001	16405
		40002	49807
Pitch	-1.47	40003	49084
		40004	10486
Heave	-0.87	40005	48990
		40006	47186

Table 1: Modbus TCP register address example.

Most measurement variables are single precision float (IEEE 754) and will therefore use 2 x U16 registers. Please see the list of all available output variables and their types in the MRU Configuration Software User Manual. An example extract of the output variable list is shown in Table 2.

Let us look at the roll example in Table 1 in more detail and see how to obtain the roll value in degrees from the bytes in the two register addresses 40001 and 40002.

Parameter	Single precision float (IEEE 754) in degrees	Register address	Register value (U16) Decimal	Register value (U16) Binary
Roll	2.34	40001	16405	01000000 00010101
		40002	49807	11000010 10001111

The bytes in each register are then combined to get the U32 word:

01000000 00010101 11000010 10001111

which can be converted to a single floating precision using the IEEE 754 convention. See https://www.h-schmidt.net/FloatConverter/IEEE754.html for an example calculator. This single floating precision representation is the measurement in the unit specified in the protocol generator. E.g. degrees for roll and meters for heave.

Modbus TCP settings

The settings for Modbus TCP are register type and local port. You can use the configuration software or commands via telnet to configure the Modbus TCP settings. See also the Configuration Software User Manual [1] for more info on configuration and the Modbus TCP commands.

SETTING	DESCRIPTION	DEFAULT	VALID RANGE
registertype	register type for Modbus TCP	input	input, holding
localport	Local port for Modbus TCP	502	

Example commands for telnet configuration:

get,modbustcp,registertype<CR><LF>

set,modbustcp,registertype,input<CR><LF>

Note that when using several MRUs they must be configured with unique IP addresses to access data from the specified MRU and to avoid IP conflict.

See also www.modbus.org for more information about the Modbus TCP protocol.

CODE	VARIABLE	M.U.	LOC.	FR.	DESCRIPTION	TYPE
101	Quaternion1	[-]	[-]	MtoN	First element of the quaternion vector. MRU to NED frame.	Single
102	Quaternion2	[-]	[-]	MtoN	Second elem. of the quaternion vector. MRU to NED frame.	Single
103	Quaternion3	[-]	[-]	MtoN	Third element of the quaternion vector. MRU to NED frame.	Single
104	Quaternion4	[-]	[-]	MtoN	Fourth elem. of the quaternion vector. MRU to NED frame.	Single
105	Quaternion1	[-]	[-]	BtoN	First element of the quaternion vector. Body to NED frame.	Single
106	Quaternion2	[-]	[-]	BtoN	Second elem. of the quaternion vector. Body to NED frame.	Single
107	Quaternion3	[-]	[-]	BtoN	Third element of the quaternion vector. Body to NED frame.	Single
108	Quaternion4	[-]	[-]	BtoN	Fourth elem. of the quaternion vector. Body to NED frame.	Single
109	Roll	[rads]	[-]	MtoN	Roll euler angle in radians. MRU to NED frame.	Single
110	Pitch	[rads]	[-]	MtoN	Pitch euler angle in radians. MRU to NED frame.	Single
111	Yaw	[rads]	[-]	MtoN	Yaw euler angle in radians. MRU to NED frame.	Single
112	Roll	[rads]	[-]	BtoN	Roll euler angle in radians. Body to NED frame.	Single
113	Pitch	[rads]	[-]	BtoN	Pitch euler angle in radians. Body to NED frame.	Single
114	Yaw	[rads]	[-]	BtoN	Yaw euler angle in radians. Body to NED frame.	Single
115	RollRate	[rads/s]	[-]	MRU	Angular vel. about the x-axis of the MRU frame in radians/s.	Single
116	PitchRate	[rads/s]	[-]	MRU	Angular vel. about the y-axis of the MRU frame in radians/s.	Single
117	YawRate	[rads/s]	[-]	MRU	Angular vel. about the z-axis of the MRU frame in radians/s.	Single
118	RollRate	[rads/s]	[-]	Body	Angular vel. about the x-axis of the Body frame in radians/s.	Single
119	PitchRate	[rads/s]	[-]	Body	Angular vel. about the y-axis of the Body frame in radians/s.	Single
120	YawRate	[rads/s]	[-]	Body	Angular vel. about the z-axis of the Body frame in radians/s.	Single
121	Roll	[degs]	[-]	MtoN	Roll euler angle in degrees. MRU to NED frame.	Single
122	Pitch	[degs]	[-]	MtoN	Pitch euler angle in degrees. MRU to NED frame.	Single
123	Yaw	[degs]	[-]	MtoN	Yaw euler angle in degrees. MRU to NED frame.	Single
124	Roll	[degs]	[-]	BtoN	Roll euler angle in degrees. Body to NED frame.	Single
125	Pitch	[degs]	[-]	BtoN	Pitch euler angle in degrees. Body to NED frame.	Single
126	Yaw	[degs]	[-]	BtoN	Yaw euler angle in degrees. Body to NED frame.	Single
127	RollRate	[degs/s]	[-]	MRU	Angular vel. about the x-axis of the MRU frame in degrees/s.	Single
128	PitchRate	[degs/s]	[-]	MRU	Angular vel. about the y-axis of the MRU frame in degrees/s.	Single
129	YawRate	[degs/s]	[-]	MRU	Angular vel. about the z-axis of the MRU frame in degrees/s.	Single
130	RollRate	[degs/s]	[-]	Body	Angular vel. about the x-axis of the Body frame in degrees/s.	Single
131	PitchRate	[degs/s]	[-]	Body	Angular vel. about the y-axis of the Body frame in degrees/s.	Single
132	YawRate	[degs/s]	[-]	Body	Angular vel. about the z-axis of the Body frame in degrees/s.	Single
133	Surge	[m]	MRU	MRU	Linear pos. of the MRU along the x-axis in the MRU frame.	Single
134	Sway	[m]	MRU	MRU	Linear pos. of the MRU along the y-axis in the MRU frame.	Single
135	Heave	[m]	MRU	MRU	Linear pos. of the MRU along the z-axis in the MRU frame.	Single

Table 2: MRU output variable list extract.

REFERENCES

Norwegian Subsea. (2021). *Configuration Software User Manual Version 1.3.0.* Norwegian Subsea.