nexen.

WEB CONTROL PRODUCTS

User Manual

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MODBUS Communications
RSD200

FORM NO. L-21195-A-0904

In accordance with Nexen's established policy of constant product improvement, the specifications contained in this manual are subject to change without notice. Technical data listed in this manual are based on the latest information available at the time of printing and are also subject to change without notice.

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⚠ **DANGER**

Read this manual carefully before installation and operation.

Follow Nexen's instructions and integrate this unit into your system with care.

This unit should be installed, operated and maintained by qualified personnel ONLY.

Improper installation can damage your system or cause injury or death.

Comply with all applicable codes.

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ISO 9001 Certified

INTRODUCTION

NOTE: This manual assumes the reader is already familiar with the MODBUS RTU over Serial Line protocol. If not, then the reader must read the following documents *MODBUS Application Protocol Specification* and *MODBUS over Serial Line Specification & Implementation Guide* found at http://www.modbus.org. In addition, the reader is assumed to have read the RSD200 User Manual.

Modbus RTU is a master/slave protocol that only allows the RSD200 to send information after it has been requested from the master device, typically a HMI. As a result, messages can arrive at the RSD200 at anytime and interrupt the processing of the control algorithm. After receiving the message, the RSD200 will wait until it is convenient to send a reply. Therefore, the master device must have a response time-out that is greater than 200 milliseconds. Generally speaking baud rates should be high as practical to minimize message transmission time and communication with the RSD200 should be kept to a minimum to minimize interruptions of the control algorithm.

MODBUS RSD200 dancer controllers feature a RS232 line driver/receiver on board and will require an external RS232 to RS485 converter to be able to communicate on a Modbus network that utilizes the MODBUS RTU over Serial Line protocol and a full duplex RS485 physical layer. Communication port values are preset to 19200 baud, 1 start bit, 8 data bits, no parity, 2 stop bits and device address 23. Only function codes 03, Read Holding Registers, 06, Write Single Register, and 16, Write Multiple Registers, and their respective error codes 131, Read Holding Registers, 134, Write Single Register, and 144, Write Multiple Registers, have been implemented. Following the successful transmission of a message from the MODBUS Master the RSD200 will send a response appropriate for the function code per the MODBUS specification.

Table 1 is a summary of the registers used by the RSD200. These 16 bit words are sent as integers with the most significant byte first and are addressed using base 0 protocol addresses. Some Programmable Logic Controllers will use base 1 protocol addresses. The registers are grouped by their function of Setup, Calibration, Tuning, and Control variables and are read with function code 03, and written to using function code 06 or 16.

SETUP REGISTERS

Setup registers are read or written to during the installation and start up of a RSD200 system and seldom change afterwards.

ADDRESS

10: **Restore Default Values** will restore default values to all variables when a 1 is written to this register. This is a write only register reading from it will only return a zero.

11: **Load Communication Parameters** will load previously assigned values for Stop Bits, Device Address, Baud Rate, and Parity into the RSD200 and begin communicating with them when a 1 is written to this register. This is a write only register reading from it will only return a zero.

Note: Changes to registers 12 – 15 will only take effect after a write to register 11 or the RSD200's power is cycled off and on. Reading registers 12 – 15 will indicate the communication values currently in use and not the pending changes. Rotating the RSD200's rotary switch to position "F" and cycling power off and on will load the default values for registers 12 – 15. If registers 12 – 15 are changed, then rotate the rotary switch to any non-"F" position or the default values will be used after the RSD200 is turned on.

12: **Stop Bits** is the number of stop bits sent with each Modbus message byte. It has values of 1 or 2 and is read and written to as an integer. The default value is 2.

13: **Device Address** is the RSD200's address on the Modbus network. It has a range of 1 to 247 and is read and written to as an integer. The default value is 23.

14: **Baud Rate** determines the speed of the message transmissions. The baud rates supported are 9600, 19200, and 38400. Values are read and written as integers. The default baud rate is 19200.

15: **Parity** can be even, odd, or none. Set this register to 0 for none, 1 for odd, and 2 for even. Values are read and written as integers. The default parity is 0.

Note: No Parity requires 2 Stop Bits and even or odd Parity requires 1 Stop Bit per the Modbus standard. If the no parity and one Stop Bit combination is selected, then the RSD200 will communicate using a non-Modbus standard 10 bit packet format. Other combinations of these two parameters are not supported.

16: **Torque Actuator** defines the type of device creating the web tension. It has a value of 1 for a pneumatic brake or clutch or 2 for a motor drive system or magnetic particle brake or clutch. Read and write integer values only. The default value is 1.

17: **Application** defines whether the RSD200 controls tension during unwinding or winding. It has a value of 1 for unwinding or 2 for winding applications. Read and write integer values only. The default value is 1.

18: **Minimum Output** is the minimum output level limit that the RSD200 is allowed to reach. It has a range of 1 to 100 % and is typically set to 1 % and must be set to a value lower than Maximum Output. Read and write integer values only. The default value is 1.

19: **Maximum Output** is the maximum output level limit that the RSD200 is allowed to reach. It has a range of 1 to 100 % and is typically set to 100 % and must be set to a value greater than Minimum Output. Read and write integer values only. The default value is 100.

20: **Stopped Output** is used to limit how high the output can go while the web is stopped and the RSD200 is not in Run mode. This value supersedes the Maximum Output value during stopped conditions. It is used in applications when the machine is stopped and a limited amount of drag tension is desired on the web. It is has a range of 1 to 100 % and is typically set to the same value as Maximum Output. Read and write integer values only. The default value is 100.

CALIBRATION REGISTERS

Calibration registers are read or written to during the installation and start up of a RSD200 system and seldom change afterwards. Registers 21 and 22 tell the RSD200 to determine the position of the dancer arm when the arm is predefined positions for the purpose of calibrating the dancer position sensor. Web Tension registers provide the RSD200P with information to calibrate the dancer arm loading cylinder pressure to the total web tension. It is only used with RSD200P models.

ADDRESS

21: **Read Maximum** Storage Position causes the RSD200 to measure the position of the dancer arm in its maximum web storage position when a 1 is written to this register. This is a write only register and reading from it will only return a zero.

22: **Read Minimum** Storage Position causes the RSD200 to measure the position of the dancer arm in its minimum web storage position when a 1 is written to this register. This is a write only register and reading from it will only return a zero.

23: **Minimum Arm Pressure** is the dancer arm loading cylinder air pressure that corresponds to the minimum operating total web tension. It has a range of 1.0 to 100.0 psi. This value is multiplied by 10 before sending or receiving in order to convert it to an integer. Default value is 1.0.

24: **Minimum Web Tension** is the minimum operating total web tension that corresponds to Minimum Arm Pressure. It has a range of 1.0 to 500.0 lbs. This value is multiplied by 10 before sending or receiving in order to convert it to an integer. Default value is 1.0.

25: **Maximum Arm Pressure** is the dancer arm loading cylinder air pressure that corresponds to the maximum operating total web tension. It has a range of 1.0 to 100.0 psi. This value is multiplied by 10 before sending or receiving in order to convert it to an integer. Default value is 2.0.

26: **Maximum Web Tension** is the maximum operating total web tension that corresponds to Maximum Arm Pressure. It has a range of 1.0 to 500.0 lbs. This value is multiplied by 10 before sending or receiving in order to convert it to an integer. Default value is 2.0.

TUNING REGISTERS

Tuning registers are adjusted during the tuning portion of the RSD200 setup. Please refer to the RSD200 User Manual for the tuning procedure.

ADDRESS

27: **Gain** is one of the primary parameters affecting the response of the RSD200 and must be adjusted before other tuning parameters; see RSD200 User Manual for more information. Gain has a range of .1 to 10.0. This value is multiplied by 10 before sending or receiving in order to convert it to an integer. Default value is 5.0.

28: **New Roll Adaptation** sets the adaptation level for the smallest new roll run on the machine. It has a range of 2 to 100 and must be set less than Maximum Adaptation. This variable is read and written to as an integer. Default value is 20.

29: **Setpoint** is the running position of the dancer. It has a range of 1 % (minimum storage) to 100 % (maximum storage) and is read and written to as an integer. Typically Setpoint is set to 50%. Default value is 50.

30: **Dampening** affects how the controller responds to high frequency disturbances such as out-of-round rolls or vibrations. It has a range of 1 (more responsive) to 7 (less responsive) and is read and written to as an integer. Default value is 2.

31: **Minimum Adaptation** sets the beginning point for the gain adaptation process. It has a range of 2 to 20 and must be set less than Maximum Adaptation. This variable is read and written to as an integer. Default value is 2.

32: **Maximum Adaptation** sets the maximum limit for the gain adaptation process. It has a range of 2 to 100 and is read and written to as an integer. Default value is 100.

33: **Adaptation Rate** affects how fast the RSD200 will adapt to a roll's diameter and inertia. It has a range of 2 (slow) to 50 (fast) and is read and written to as an integer. Default value is 8.

CONTROL REGISTERS

These registers are used to control the RSD200 and provide feedback to the HMI while the machine is running.

ADDRESS

34: **Web Run/Stop** informs the RSD200 when the web is moving or has stopped. It has two values 0 (web stopped, RSD200 goes to stopped mode) and 1 (web moving, RSD200 goes into run mode). The Web Run/Stop register is only set to 1 at the onset of web movement or immediately after the web is moving otherwise controller gains could adapt to undesirable levels. Likewise, the Web Run/Stop register is set to 0 after the web has come to a stop.

35: **Splice** resets the adaptation level to the New Roll Adaptation value and is used during an automatic splicing event or when a new roll is placed on the machine. Momentarily writing a 1 to the Splice register will cause the adaptation level to change immediately to the New Roll Adaptation value. This register will reset itself to 0.

36: **Automatic/Manual** determines the operating mode of the RSD200. When a 1 is written to this register the RSD200 will go into manual mode and the controller's output will no longer automatically change. By writing to the output register, the output

value can be changed manually. When a 2 is written to this register the RSD200 will go into automatic mode and control the dancer arm.

37: **Output** provides the current level of the RSD200's control output and is also used to adjust this level. It has a range of 0 % to 100 % and is read and written to as an integer. Writing to Output will only affect the output when the RSD200 is in manual mode.

38: **Dancer Position** provides the dancer arm position. This is a read only register that returns integer values in the range of 0 % (minimum storage position) to 100 % (maximum storage position). Writing to this register will be ignored by the RSD200.

39: **Adaptation** provides the adaptation level. This is a unit less number and has a range of 0 to 100 that provides a relative value that indicates where on the non-linear adaptation curve the adaptation process is. Higher values mean higher internal gain values. This is a read only register that returns integer values. Writing to this register will be ignored by the RSD200.

RSD200 REGISTER MEMORY MAP

REGISTER ADDRESS	DESCRIPTION	HMI FUNCTION
SETUP		
10	Restore Default Values	Write Only
11	Load Communication Parameters	Write Only
12	Stop Bits: 1, 2	Read & Write
13	Device Address: 1–247	Read & Write
14	Baud Rate: 9600, 19200, 38400	Read & Write
15	Parity: 0–none, 1–odd, 2–even	Read & Write
16	Torque Actuator: 1–brake, 2–drive	Read & Write
17	Application: 1–unwind, 2–wind	Read & Write
18	Minimum Output: 0–100%	Read & Write
19	Maximum Output: 0–100%	Read & Write
20	Stopped Output: 0–100%	Read & Write
CALIBRATION		
DANCER RANGE		
21	Read Maximum Storage Position	Write Only
22	Read Minimum Storage Position	Write Only
WEB TENSION		
23	Minimum Arm Pressure: 1.0–100.0 psi	Read & Write
24	Minimum Web Tension: 1.0–500.0 lbs	Read & Write
25	Maximum Arm Pressure: 1.0–100.0 psi	Read & Write
26	Maximum Web Tension: 1.0–500.0 lbs	Read & Write
TUNING		
27	Gain: 0.1–10.0	Read & Write
28	New Roll Adaptation: 2–100	Read & Write
29	Setpoint: 1–100%	Read & Write
30	Dampening: 1–7	Read & Write
31	Minimum Adaptation: 2–20	Read & Write
32	Maximum Adaptation: 2–100	Read & Write
33	Adaptation Rate: 2–50	Read & Write
CONTROL		
34	Web Run/Stop: 0–stopped, 1–running	Read & Write
35	Splice: 1–splice, reset adaptation	Read & Write
36	Auto/Man: 1–manual, 2–automatic	Read & Write
37	Output: 0–100%	Read & Write
38	Dancer Position: 0–100%	Read Only
39	Adaptation: 0–100	Read Only

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