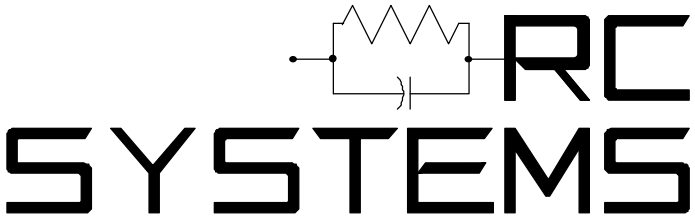

INSTRUCTION MANUAL

R.C. SYSTEMS CO. INC.

MODEL ST-60A ANALOG INPUT RS-485 SERIAL INTERFACE WITH MODBUS®

(REVISION 1.1)

Modbus is a registered trademark of Modicon Corp.

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SECTION 1

1.1 ST-60A MODBUS® TRANSMITTER:

The ST-60A Modbus RS-485 serial interface allows analog signals such as 4-20mA to be interfaced to a Modbus master device. As many as 128 ST-60A's may be connected to an RS-485 Modbus master device using either a 2 or 4 wire cable. It requires a Modbus *master* to interrogate and retrieve information made available in specific register locations. Modbus master devices are typically PLC's or PC's running MMI or GUI software equipped with a Modbus driver. The RS-485 electrical standard allows cable lengths up to 4000 feet between Modbus master and slave.

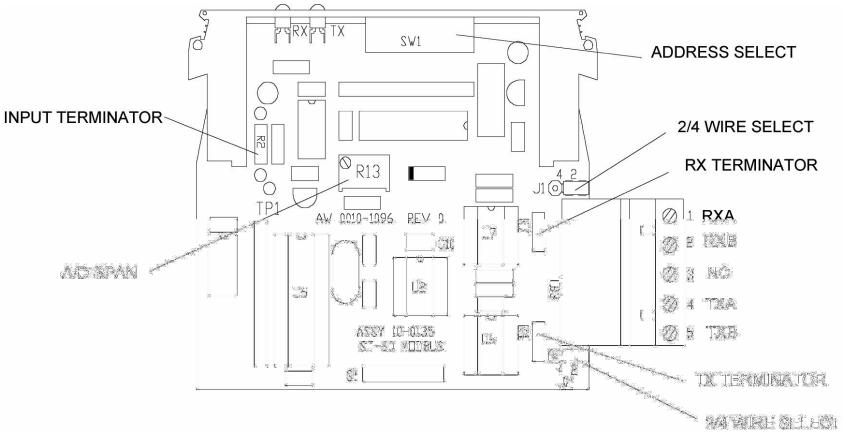

FIGURE 1.1 MODBUS RS-485 PCB

1.1.1 INPUT TERMINATOR:

The socketed Input Terminator resistor (R2) converts current input signals to voltage for the A to D converter. A 100 ohm .1% resistor is shipped with the ST-60A for converting 4-20mA inputs into .4 to 2 volts. Other resistor values may be used as long as the voltage across the resistor does not exceed 5 volts.

1.1.2 A/D SPAN:

The A/D Span adjustment (R13) allows the A/D reference to be adjusted to match the full scale voltage of the input. It may be set by matching the voltage at TP1 and power supply common to the full scale input across R2. Another way is to use the Configuration software and monitor the value over Modbus and adjust R13 to the desired reading.

1.1.3 RTU ADDRESS:

The 8 position DIP (SW1) switch allows a different RTU address be assigned to each ST-60A. The 8 DIP switches represent an 8 bit binary number with 1 = LSB and 8 = MSB. For example, OFF, ON, ON, OFF, ON, OFF, OFF, OFF = 0110 1000 = RTU address 104. A unique RTU address must be assigned each ST-60A communicating on the same RS-485 port.

1.1.4 2/4 WIRE SELECT:

The 2/4 Wire Select jumpers (J1 and J2) allow the RX and TX A and B terminals to be shorted together for 2-wire operation or isolated for 4-wire operation. In either case both J1 and J2 must be set the same. In 2-wire mode, the communications cables may be landed on either the TX or RX terminals and the unused terminals may be used to connect to the next unit.

1.1.5 RX/TX TERMINATOR RESISTORS:

The RX and TX Terminator sockets (R4 and R7) allow end of line terminator resistors to be installed at the unit furthest from the master station. A 120 ohm resistor is typical and should be installed in RX in the 4-wire mode or in either RX or TX in the 2-wire mode.

SECTION 2

2.1 MODBUS DATA REGISTERS AND FUNCTION CODES:

The following table identifies the ST-60A Modbus register locations and function codes available:

MODBUS REGISTER SUMMARY

VARIABLE	ALIAS	READ FUNCTION CODE	WRITE FUNCTION CODE
FAULT BIT	**12000**	**2**	**NA**
0 = OK			
1 = Fault			
ALARMS	**12008**	**2**	**NA**

Returned as 8 discrete bits packed in the low byte of the response data.

12008:bit 0 = Fault (tracks 12000)

12008:bit 1 = Alarm1

12008:bit 2 = Alarm2

12008:bit 3 = Not Used

12008:bit 4 = Not Used

12008:bit 5 = Not Used

12008:bit 6 = Alarm2 Acknowledgeable

12008:bit 7 = Not Used

A2D Raw	**33000**	**3&4**	**NA**

10 bit value representing the A2D value of 0 to 1023 for -20 to 103 %FS (197=0% & 1003=100%).

A2D ASCII	**31010 (6 bytes)**	**3&4**	**NA**

6 bytes of data representing the scaled span value including the decimal point. The first 5 bytes contain the value with the last byte being a space. They are arranged with the first byte as the MSD with leading zero spacing. For example, with a span value of 1234 with 1 decimal point, the correct value of 123.4 is returned for 100% of full scale as follows:

Byte	0	1	2	3	4	5	6	7	8	9	10
Response	[address]	[04]	[06]	[31]	[32]	[33]	[2E]	[34]	[20]	[Crcl]	[Crch]
ASCII Char	[address]	[?	????	????	?????	?????	??????????	???sp]		[Crcl]	[Crch]

With the same settings a 50% of full scale reading of 617 would be:

Byte	0	1	2	3	4	5	6	7	8	9	10
Response	[address]	[04]	[06]	[20]	[36]	[31]	[2E]	[37]	[20]	[Crcl]	[Crch]
ASCII Char	[address]	[?	????	???sp	????	?????	??????????	???sp]		[Crcl]	[Crch]

EUNITS	**40319-40324**	**3**	**6**

6 ASCII characters assigned to the engineering units read as bytes.

Measurement Name	**40325-40340**	**3**	**6**

16 ASCII characters assigned to the unit identifier read as bytes.

Span	**40343**	**3**	**6**

An integer from 1 to 9999 used to scale the A2D ASCII value.

Alm1Setpoint	**40345**	**3**	**6**
Alm2Setpoint	**40347**	**3**	**6**

Integer compared to the A2D Raw value to determine alarm 1 or 2 status. The 0 to 100% set point must be scaled from 197 to 1003. This is done by using (Alarm% * 806) + Offset .

Example: A 40% set point would be computed as (.4 * 806) + 197

D.P.Position	**40349**	**3**	**6**

Determines how many decimal positions return with the A2D ASCII value. Valid range is 0 to 3.

Alm1Trip	**40351**	**3**	**6**
Alm2Trip	**40359**	**3**	**6**

Set to 255 alarms on high, set to 0 alarm on low.

Alm1Latch	**40353**	**3**	**6**
Alm2Latch	**40355**	**3**	**6**

Set to 0 causes alarm 1 or 2 to auto reset, set to 255 causes alarms 1 or 2 to latch.

AlmZoneWord	**40357**	**3**	**6**

16 bit value which may be used as a zone alarm mask for the master.

AlarmReset	**2000**	**NA**	**5**

Setting to 255 causes any latched or acknowledgeable alarms to reset.

InitRtu	**2010**	**NA**	**5**

Setting to 255 causes a re-start which applies updated configuration variables.

SECTION 3

3.1 MODBUS CONFIGURATION SOFTWARE:

All of the register values described in 2.1 above must be configured via the serial port. This is a *one time only* requirement unless changes within the application necessitate adjustments after the initial installation. This functionality may be built into the users Modbus Master, or , may easily be performed with a portable computer running a simple software application available from our website at: www.rcsystemsco.com. This application consists of the 2 recipe screens shown in Figure 3.1. Masters with zone relays may use the AlmZoneWord register 40357 to track certain transmitters to their respective zone relays. This register may be configured by the second screen in Figure 3.1.

```
07:52:55          RC Systems ST-46/47 MODBUS Configurator          Ver 1.02

                          STATION ID 1

                        33.6      EUNITS
                      Measurement Name


  <1> Span =  1000                          OFF Fault Bit
  <2> Decimal Point  1                      ON  Alarm 1 Bit
  <3> Alarm1 %FS =  20 % Non-Latching       OFF Alarm 2 Bit
  <4> Alarm1 Type = High                    OFF Acknowledge Bit
  <5> Alarm2 %FS =  40 % Non-Latching       <R> Send Alarm Reset
  <6> Alarm2 Type = High                    <I> Re-Initialize RTU
  <E> Change EUNITS                         <Z> Alarm Zone bits
  <M> Change Measurement Name               A2D Counts =  468
  <S> Change STATION ID


 <Esc>QUIT          <U>Upload          <D>Download        <H>HELP
```

```
08:05:45          RC Systems ST-46/47 MODBUS Configurator          Ver 1.02

      When connected to an ST-75, the zone alarm bits determine
      which zone relays activate during an alarm for this RTU.

      1 = ACTIVE, 0 = INACTIVE.

      To change the bit status press the key which corresponds
      with the bit.



            lsb            ZONE ALARM BITS              msb
             ¦                                           ¦
        BIT: 0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
     STATUS: 1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0



 <Esc>QUIT
```

FIGURE 3.1 MODBUS CONFIGURATION SOFTWARE SCREENS

SECTION 4

4.1 FIELD WIRING:

Below is a typical field wiring installation diagram:

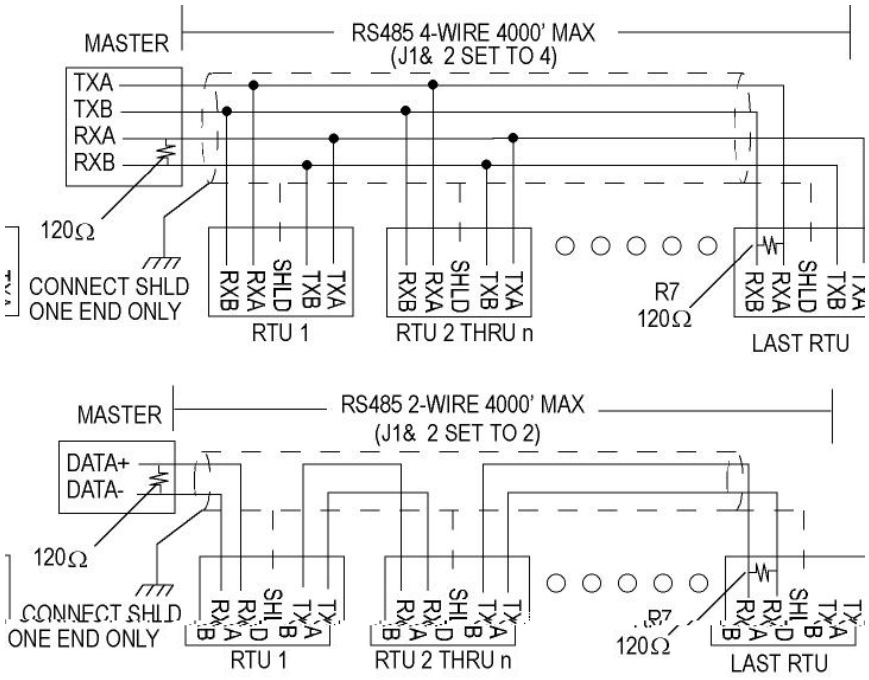

FIGURE 4.1 TYPICAL RS-485 WIRING