SCM9B-1000 MODBUS PROTOCOL

USERS MANUAL

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

SCM9B-1000 MODBUS PROTOCOL

USERS MANUAL

September 14, 1998

DATAFORTH CORP.
3331 EAST HEMISPHERE LOOP
TUCSON, AZ 85706

TEL: 520-741-1404

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

WARRANTY

DATAFORTH warrants each SCM9B-1000M series module to be free from defects in materials and workmanship under normal conditions of use and service and will replace any component found to be defective, on its return to DATAFORTH, transportation charges prepaid within one year of its original purchase. DATAFORTH assumes no liability, expressed or implied, beyond its obligation to replace any component involved. Such warranty is in lieu of all other warranties expressed or implied.

WARNING

The circuits and software contained in SCM9B-1000M series modules are proprietary. Purchase of these products does not transfer any rights or grant any license to the circuits or software used in these products. Disassembling or decompiling of the software program is explicitly prohibited. Reproduction of the software program by any means is illegal.

As explained in the setup section, all setups are performed entirely from the outside of the SCM9B-1000M module. There is no need to open the module because there are no user-serviceable parts inside. Removing the cover or tampering with, modifying, or repairing by unauthorized personnel will automatically void the warranty. DATAFORTH is not responsible for any consequential damages.

RETURNS

When returning products for any reason, contact the factory and request a Return Authorization Number and shipping instructions. Write the Return Authorization Number on the outside of the shipping box. DATAFORTH strongly recommends that you insure the product for value prior to shipping. Items should not be returned collect as they will not be accepted.

Shipping Address:
DATAFORTH CORP.
3331 EAST HEMISPHERE LOOP
TUCSON, AZ 85706

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

TABLE OF CONTENTS

MODBUS PROTOCOL OVERVIEW	**1**
GETTING STARTED	**3**
MODBUS FUNCTION CODES	**4**
MODBUS ENABLE/DISABLE	**10**
MODBUS EXCEPTION RESPONSES	**11**
SCM9B-1000M SETUP COMMAND	**12**
CALIBRATION	**18**

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

MODBUS PROTOCOL OVERVIEW

This document describes the Modbus RTU protocol option included in the SCM9B-1000 series of data acquisition modules. This implementation of the Modbus protocol is a subset of the protocol as described in the Modicon Modbus Protocol Reference Guide PI-MBUS-300 Rev F. Only the RTU version of the protocol has been implemented.

Modbus RTU mode communicates in standard NRZ asynchronous format with one start bit, eight data bits, one parity bit, and one stop bit. Even and odd parity is supported. If no parity is specified, the number of stop bits can be user configured for either one or two stop bits.

Baud rates supported at this time are: 300, 600, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600 and 115,200 baud.

Modbus uses the RS-485 electrical specification for multidrop communications. The RS-232 electrical specification is not supported.

Modbus is a registered trademark of AEG Modicon Inc.

The Modbus RTU protocol transmits data in 8-bit binary bytes (not ASCII). To illustrate the data in this document, the 8-bit byte is described as two hexadecimal nibbles. For example, the binary byte value “0101 1101” will be written as 5D.

A typical Modbus RTU command may look like this:

01 04 00 00 00 01 31 CA

Remember, this command string and others throughout this document are actually transmitted to a module as eight 8-bit binary characters.

The actual format of the data is dependent on the type of command desired. The example above is the Modbus ‘Read Input Registers’ function.

The ‘01’ is the address of the slave device (SCM9B-1000 module) being commanded. Each slave device must have its own unique address.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

The ‘04’ specifies the Modbus ‘Read Input Registers’ function. This is equivalent to the ‘Read Data’ command to obtain analog input data.

The next two characters ‘00 00’ specify the starting address of the registers to be read. The first Modicon input register 30001 is addressed as ‘00 00’. Register 30005 is addressed as ‘00 04’, etc.

The next two characters of this command specify the number of registers to be read, including the starting register. In this case the two binary characters ‘00 01’ indicates only one register is to be read.

The final two characters of the command string make up the Cyclical Redundancy Check (CRC), used to check for errors in the message.

There are no prompt or terminating characters in the messages. All messages must be transmitted as continuous strings. Messages are terminated by a ‘silent’ interval of at least 3.5 character times. A ‘silent’ interval of more than 1.5 character times marks the beginning of the next message. Therefore it is mandatory that the RS-485 bus must be biased in the MARK condition during the ‘silent’ interval. This is usually accomplished by pull-up and pull-down resistors on the communications line.

A typical response to this example command could be:

01 04 02 80 00 D8 F0

The ‘01’ and ‘04’ characters echo the slave address and the command function.

For this particular command function, the ‘02’ character indicates the number of data characters to follow, in this case, 2 characters.

The two character string ‘80 00’ is the value read from Modicon input register 30001. Register data is read back as 16 bits.

The remaining two characters, ‘D8 F0’ is the CRC for the response.

The A1000 series of RS-232 to RS-485 protocol converters and repeaters will not operate with the 9-bit data characters used by the Modbus protocol.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Getting Started

The SCM9B-1000M series modules are initialized at the factory to communicate using the SCM9B-1000 ASCII protocol. This allows for all setup and configurations to be easily performed using the SCM9B-1000 setup software or a dumb terminal. After the setup process has been completed the SCM9B-1000M can be placed in Modbus RTU protocol mode using the "MBR" command. Disable the Modbus RTU mode using the Modbus Disable ("MBD") command.

Quick start steps:

1 Connect a power supply to the SCM9B-1000M between +Vs terminal and GND terminal. The supply voltage must be between +10 and +30Vdc.

2. Properly connect the SCM9B-1000M series to a computer using the "quick hook-up" diagrams in chapter #1 of this manual using either an RS-232 or RS-485 serial port.

3. Locate the S1000 Utility software diskette and copy files from the S1000 sub-directory on the computer hard drive and run the 1000.bat file.

4. Configure the main menu "Host" RS-232 Port settings and correct COMx: port baud rate. Note: If the "Default*" pin on SCM9B-1000M is connected to GND then select 300 baud as host computer baud rate and select no parity.

5. Select main menu "Setup" and enter the SCM9B-1000M device address and four digit model number. For example, enter 1112 for a SCM9B-1112M analog input module.

6. At the next configuration screen make alterations to Baud Rate, Parity type and any other required parameters. Press the <F10> function key to transmit the new setup values. Once the values have been transmitted press the <ESC> key back to the program main menu.

7. Select "Misc" followed by "Enable Modbus Mode" to specify the Modbus Slave address. Using the <+><-> keys, or left mouse button,

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

increment the screen address value to desired Modbus Slave address and press <F10> to transmit the value.

8. Remove the connection between "Default*" and GND, which performs internal reset, to enable Modbus RTU mode. If there was no connection between "Default*" and GND then cycle the power on device to force a reset and enable Modbus Mode.

The device is now configured for Modbus RTU mode and can be connected to a RS-485 based Modbus master system.

SCM9B-1000 Modbus Protocol SetUp Notes

SCM9B-1000M do not have local alarm output capability or Events counters. Therefore, the SCM9B-1000 ASCII protocol commands CA, CE, DA, EA, EC, HI, LO, RE, RH and RL are not supported. A COMMAND ERROR will be generated in response to any of these commands.

Each SCM9B-1000M module must contain a unique Modbus device address and the communications settings must be configured properly before installation into a Modbus system..

MODBUS Function Codes

Modbus protocol compatible devices communicate using a master-slave technique similar to that used in ASCII protocol. In a master-slave communications system only one device (the master) can initiate a communications sequence. All others devices (the slaves) respond when requested by the master. Typical master devices can be personal computers or PLCs. Typical slave devices are SCM9B-1000M modules.

The master can address any slave device. Slave devices return a message to any command that was addressed specifically to them. The returned messages are considered response messages.

The Modbus protocol format used by a master consists of a device address, a command function code which defines the operation to be performed, data required with the command, and an error checking value. The slave response message contains any required data and an error checking value. If an error occurs, an exception code will be generated. The supported master function codes are discussed below.

01 - Read Coil Status (Digital Inputs)

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

04 - Read Input Register (Analog Inputs)
05 - Force Single Coil (Digital Output)
06 - Preset Single Register (Return to SCM9B-1000 ASCII protocol)
15 - Force Multiple Coils (Digital Outputs)

Function (01) Read Coil Status (Digital Inputs)

Modbus function (01) Read Coil Status will read the status of both the digital inputs and digital outputs. Digital outputs are read as the state of the data on the microprocessor output port before being buffered by the open-collector transistor. If the coil status of a digital output returns as '1', this means that this particular bit (coil) is turned "on" or sinking current on the corresponding module digital output pin. Depending on the module type, some of the digital outputs may not be implemented.

Modbus relay input coils are considered digital inputs on the SCM9B-1000M series modules. Modbus relay output coils are considered digital outputs on the SCM9B-1000M series modules. This function can be used to read status of the digital inputs or the combined status of both the digital inputs and digital outputs.

SCM9B-1000M digital output bits DO0 to DO7 correspond to Modbus coils 00 00 to 00 07.

SCM9B-1000M digital input bits DI0 to DI7 correspond to Modbus coils 00 08 to 00 0F.

The SCM9B-1000 series digital inputs and outputs are register mapped as two 8-bit bytes (16-bits), one byte for inputs and one byte for outputs. The least-significant byte represent the status of up to 8 digital outputs. The most-significant byte represents the status of up to 8 digital input bits. The register contents can be interrogated as 8-bits of digital input data or together as 16-bits of digital inputs and outputs data.

Exception errors will be generated by the module if attempting to read or write to more than 16 bits.

The following example can be used to read only the digital input status:

Command: 01 01 00 08 00 08 BC 0E
Response: 01 01 01 FF 11 C8

In the command string:
01 is the slave address

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

01 is the Read Coil Status command
00 08 is the starting coil number
00 08 is the number of bits to read
BC 0E is the CRC to this message

In the response string:
01 is the slave address
01 is the Read Coil Status command
01 is the number of data bytes returned
FF is the Digital Inputs status data
11 C8 is the CRC for this message

The following example can be used to read the status of both the digital inputs and outputs:

Command: 01 01 00 00 00 10 3D C6
Response: 01 01 02 09 FF FF EC

In the command string:
01 is the slave address
01 is the Read Coil Status command
00 00 is the starting coil address
00 10 is the number digital bits to read
3D C6 is the CRC to this message

In the response string:
01 is the slave address
01 is the Read Coil Status command
02 is the number of data bytes returned
09 is the Digital Output status
FF is the Digital Inputs status
FF EC is the CRC for this message

Function (04) - Read Input Register (Analog Inputs)
Read Input Register function (04) is the primary command to acquire analog input data. This command function supports reading of up to 16 input registers starting from Modbus slave register 30001. The registers are addressed starting from zero meaning registers 1-16 are addressed as 0-15.

The response data for each channel is returned as two bytes that represent a 16-bit binary value. The 16-bit value is scaled as a

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

percentage of the full scale input range. The first byte contains the high order bits and the second contains the low order bits. The binary analog values for each channel can range from 0000-FFFF (hexadecimal).

Only the register values for channel one are valid as each module contains a single analog input. The remaining data values for channels 2-16 will always return as 0000 (hexadecimal).

A typical command and response to read the analog input value from Modbus device address 01 is:

Command: 01 04 00 00 00 01 31 CA
Response: 01 04 02 14 57 F7 CE

In the command string:
01 is the slave address
04 is the Read Input Registers command
00 00 is the starting register to be read (Modbus address 30001)
00 01 specifies the number of registers to be read, in this case, one register.
31 CA is the CRC for this message

In the response string:
01 is the slave address
04 is the command
02 indicated the number of data bytes in the message, in this case, two bytes
14 57 is the analog data
F7 CE is the CRC for this message

This sample command reads two registers:

Command: 01 04 00 00 00 02 71 CB
Response: 01 04 04 14 58 00 00 7F A7

The analog data from Modbus register 30001 is 14 58.
The data from Modbus register 30002 is set to 00 00.

The analog data is scaled so that 00 01 represents the Negative Full Scale value programmed into the module. FF FE represents the Positive Full Scale value programmed into the module.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

For example, for a ±10 volt input module:
00 01 corresponds to -10 volts
80 00 corresponds to 0 volts
FF FE corresponds to +10 volts

A negative overload where the analog input exceeds minus full scale value is represented by 00 00 (hexadecimal).

A positive overload where the analog input exceeds the positive full scale value is represented by FF FF (hexadecimal).

Function (05) - Force Single Coil (Digital Output)
The Force Single Coil function (05) is used to set or clear a single Modbus output relay coil. Each output relay coil is considered a digital output on the SCM9B-1000 series modules. Modbus Coil #1 equals SCM9B-1000 series digital output bit DO0 and Coil #8 equals digital output bit DO7 (when available).

The following example can be used to turn on digital output bit DO0:

Command: 01 05 00 00 FF 00 8C 3A
Response: 01 05 00 00 FF 00 8C 3A

In the command string:
01 is the slave address
05 is the Force Single Coil command
00 00 is the address of the digital output bit, 00 07 would equal DO7
FF 00 indicates that the desired bit will be set or turned on
8C 3A is the CRC for this message

The valid address range of digital output bits is 00 00 to 00 07. Any other address will produce an exception (error) response.

To clear or turn off digital output bit D03, replace the FF 00 string with 00 00. For example:

Command: 01 05 00 03 00 00 3D CA
Response: 01 05 00 03 00 00 3D CA

Command values other than FF 00 or 00 00 will result in an exception (error) response.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Function (06) - Preset Single Register (Return to SCM9B-1000 ASCII Protocol)
The Preset Single Register function (06) can be used to temporarily suspend the Modbus RTU protocol and force the module into SCM9B-1000 ASCII protocol. Write a value of 0000 to Modbus register 40001 to temporarily suspend Modbus RTU mode. The module will then communicate using the SCM9B-1000 ASCII protocol only.

The SCM9B-1000 ASCII protocol can be used to alter or check setup information and/or for troubleshooting purposes. The module will continue to communicate using the ASCII protocol until either a Remote Reset (RR) command (RR) is received or the power is cycled. At which time, the module will return to the Modbus RTU protocol mode.

Refer to the SCM9B-1000 ASCII Modbus Disable command (MBD) for more information on disabling the Modbus protocol.

Command: 01 06 00 00 00 00 89 CA
Response: 01 06 00 00 00 00 89 CA

Function (15) - Force Multiple Coils (Digital Outputs)
The Force Multiple Coils function (15) is used to force multiple Modbus output relay coils to a desired ON or OFF state. This function is similar in operation to the SCM9B-1000 ASCII digital output command (DO) in that it updates the status of all available output coils at once. The state of each output coil is set ON or OFF according to the digital data value received with the function.

Any SCM9B-1000M series module that contains one or more digital output bits can use Modbus Function 15. The digital output bits are referred to as "output relay coils" in the Modbus protocol. The SCM9B-1000M series digital output bit DO0 equals Modbus output relay Coil#1 and digital output bit DO7 equals output relay Coil#8. SCM9B-1000M series modules with less than eight digital outputs also equate output bit DO0 with output relay Coil#1 and count up by one for each additional output bit.

The following example can be used to turn on two digital output bits on a SCM9B-1132M module.

Command: 01 0F 00 00 00 02 00 03 9F 06
Response: 01 0F 00 00 00 02 D4 0A

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

In the command string:
01 is the slave address
05 is the Force Single Coil command
00 00 is the starting address of the digital output bits to be changed, 00 07 would equal DO7
00 02 specifies the number of output relay coils to be changed
00 03 specifies the digital output data value in HI byte LO byte format. Note: The HI byte will always be zero as SCM9B-1000M series modules contain up to eight digital outputs
9F 06 is the CRC for this message

The valid address range of digital output bits is 00 00 to 00 07. Any other address will produce an exception (error) response.

To clear or turn off the digital output bits, replace the 00 03 string with 00 00. For example:

Command: 01 0F 00 00 00 02 00 00 DF 07
Response: 01 0F 00 00 00 02 D4 0A

Modbus RTU Enable (MBR)
To place any SCM9B-1000M module in Modbus protocol mode use the Modbus RTU (MBR) command. The MBR command must be used to specify the Modbus device address and enable the Modbus protocol mode. The device address consists of a two character hexadecimal value and is stored in EEPROM. The two byte address specified is translated to a one byte, 8 bit address required by the Modbus protocol. The example below can be used to specify a Modbus device address of "01".

Command: $1MBR01
Response: *

Command: #1MBR01
Response: *1MBR019D

After the Modbus address is specified, a reset is necessary to activate the Modbus protocol mode. The reset may be accomplished in one of three ways:

1) Removing power for about 10 seconds to perform a power-up reset.

2) Momentarily grounding the Default* pin.

3) Issue a Write Enable (WE) command followed by a Remote Reset (RR) command.

After a reset is performed, the module is in Modbus protocol mode.

Modbus Disable (MBD)
The Modbus Disable (MBD) command is used to disable the Modbus protocol. Any SCM9B-1000M series module in Modbus mode can be returned to SCM9B-1000 ASCII protocol mode by connecting a jumper wire between module pins GND and Default* pin. This places the module in Default Mode, where the module will only communicate at 300 baud, no parity, SCM9B-1000 ASCII protocol, and answer to any address. While in Default mode, transmit an MBD command to internally disable the Modbus protocol.

Following the MBD command a device reset must occur. The reset is necessary to activate the SCM9B-1000 ASCII protocol. A reset can occur by removing the Default* jumper, performing a power-up reset or by transmitting a Write Enable (WE) and Remote Reset (RR) command sequence.

After a reset is performed, the module is in SCM9B-1000 ASCII protocol mode.

Command: **$1MBD**
Response: *****

Command: **#1MBD**
Response: ***1MBD2E**

Modbus Exception Responses
The following standard Modbus exception codes (error messages) are supported:

01 **Illegal Function**
This exception code is generated when the function code is not recognized by the module.

02 **Illegal Data Address**

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

This code is generated when the specified data address in the command is not supported by the module.

03 Illegal Data Value

This exception code is returned if the command data is out of range for the function.

06 Slave Device Busy

After the module is reset by power-up, a 'RR' command, or return from Default Mode, the module performs an initial self-calibration for a period of about 3 seconds. During this time any command sent to the module will result in a 'busy' exception response.

SetUp (SU)

For convenience, ASCII-based SCM9B-1000 commands are used to specify all setup values. The SetUp (SU) command is used to select the desired baud rate and parity for both the SCM9B-1000 ASCII protocol as well as the Modbus protocol. It is also used to select the SCM9B-1000 ASCII protocol address which may not be the same as the Modbus protocol address. The SU command should be used to establish these communications values before enabling the Modbus protocol. Use MBR command to specify the Modbus protocol device address and enable the Modbus protocol.

The following information details the module setup and hardware differences between the standard SCM9B-1000 series modules and those that are Modbus compatible.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Byte 1
The first setup byte specifies the ASCII channel address. This address value is ONLY used while the module is configured for the SCM9B-1000 ASCII protocol. The Modbus address is completely different and specified with the Modbus RTU (MBR) command.

Table 5.1 Byte 1 ASCII Printable Characters.

HEX	ASCII	HEX	ASCII	HEX	ASCII	HEX	ASCII
21	!	3A	:	51	Q	68	h
22	“	3B	;	52	R	69	i
25	%	3C	<	53	S	6A	j
26	&	3D	=	54	T	6B	k
27	‘	3E	>	55	U	6C	l
28	(	3F	?	56	V	6D	m
29	)	40	@	57	W	6E	n
2A	*	41	A	58	X	6F	o
2B	+	42	B	59	Y	70	p
2C	,	43	C	5A	Z	71	q
2D	-	44	D	5B	[	72	r
2E	.	45	E	5C	\	73	s
2F	/	46	F	5D	]	74	t
30	0	47	G	5E	^	75	u
31	1	48	H	5F	_	76	v
32	2	49	I	60	‘	77	w
33	3	4A	J	61	a	78	x
34	4	4B	K	62	b	79	y
35	5	4C	L	63	c	7A	z
36	6	4D	M	64	d	7B	{
37	7	4E	N	65	e	7C	|
38	8	4F	O	66	f	7D	}
39	9	50	P	67	g	7E	~

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

SU Byte #2

Table 5.2 Byte 2: Linefeed, Parity and Baud Rate.

FUNCTION	DATA BIT							
	7	6	5	4	3	2	1	0
LINEFEED	1							
NO LINEFEED	0							
NO PARITY		0	0					
NO PARITY		1	0					
EVEN PARITY	0	1						
ODD PARITY	1	1						
115200 BAUD			X	1	0	0	0	
57600 BAUD				1	0	0	1	
38400 BAUD				0	0	0	0	
19200 BAUD				0	0	0	1	
9600 BAUD					0	0	1	0
4800 BAUD					0	0	1	1
2400 BAUD					0	1	0	0
1200 BAUD					0	1	0	1
600 BAUD					0	1	1	0
300 BAUD					0	1	1	1

Linefeeds

The 'Linefeeds Enable' setup bit is active during SCM9B-1000 ASCII protocol mode and ignored by the Modbus protocol.

Parity Type

The 'Parity Type' setup bits specify parity for both SCM9B-1000 ASCII and Modbus protocols. The Modbus parity type must be specified using the SCM9B-1000 ASCII SetUp (SU) command and is defined in byte #2 of the setup message. The following parity type definitions should be used to define the required parity type in Modbus mode. The four possible Modbus parity settings are.

FUNCTION	DATA BIT	
	6	5
NO Parity, 1 Stop	0	0
NO Parity, 2 Stop	1	0
EVEN, 1 Stop	0	1
ODD, 1 Stop	1	1

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Note: The UART is ALWAYS set for 1 start bit, 7 data bits, 1 parity bit, and 1 stop bit in SCM9B-1000 ASCII mode. The parity settings in the SCM9B-1000 Users Manual Table 5.2 should be used to configure SCM9B-1000 ASCII protocol parity type.

Baud Rate

The SCM9B-1000M series Modbus compatible modules have been upgraded to include two new baud rates, 57,600 and 115,200. This new upgrade has not been included in the existing SCM9B-1000 modules or manuals. The baud rate is selected with the four least significant bits of the second setup byte. The following settings replace those listed in table 5.2 of the SCM9B-1000 Users Manual. The new baud rate selection bit settings are:

	DATA BIT			
	3	**2**	**1**	**0**
300 baud	0	1	1	1
600 baud	0	1	1	0
1200 baud	0	1	0	1
2400 baud	0	1	0	0
4800 baud	0	0	1	1
9600 baud	0	0	1	0
19,200 baud	0	0	0	1
38,400 baud	0	0	0	0
57,600 baud	1	0	0	1
115,200 baud	1	0	0	0

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

SU Byte #3

Table 5.3 Byte 3 Options.

FUNCTION DATA BIT	7	6	5	4	3	2	1	0
NOT USED	X							
NOT USED		X						
NOT USED			X					
CJC (SCM9B-1300'S)				0				
NO CJC (SCM9B-1300'S)				1				
3 WIRE (SCM9B-1400'S)				0				
4 WIRE (SCM9B-1400'S)				1				
- STARTING EDGE (SCM9B-1600'S)				0				
+ STARTING EDGE (SCM9B-1600'S)				1				
NOT USED					X			
NOT USED						X		
NO DELAYS							0	0
2 BYTE TIME DELAYS							0	1
4 BYTE TIME DELAYS							1	0
6 BYTE TIME DELAYS							1	1

Byte Time Delays
The 'Byte Time Delays' setup bits are active during SCM9B-1000 ASCII protocol and ignored by Modbus protocol.

SU Byte #4

Displayed Digits
The Displayed Digits setup bits are active during SCM9B-1000 ASCII protocol and ignored by Modbus protocol.

Large and Small Signal Filters
The Large and Small Signal Filters are active during both SCM9B-1000 ASCII and Modbus protocols.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Table 5.4 Byte 4 Displayed Digits and Filter Time Constants.

BYTE 4 FUNCTION	DATA BIT 7	6	5	4	3	2	1	0
+XXXX0.00 DISPLAYED DIGITS	0	0						
+XXXXX.00 DISPLAYED DIGITS	0	1						
+XXXXX.X0 DISPLAYED DIGITS	1	0						
+XXXXX.XX DISPLAYED DIGITS	1	1						
NO LARGE SIGNAL FILTERING			0	0	0			
0.25 SECOND TIME CONSTANT			0	0	1			
0.5 SECOND TIME CONSTANT			0	1	0			
1.0 SECOND TIME CONSTANT			0	1	1			
2.0 SECOND TIME CONSTANT			1	0	0			
4.0 SECOND TIME CONSTANT			1	0	1			
8.0 SECOND TIME CONSTANT			1	1	0			
16.0 SECOND TIME CONSTANT			1	1	1			
NO SMALL SIGNAL FILTERING						0	0	0
0.25 SECOND TIME CONSTANT						0	0	1
0.5 SECOND TIME CONSTANT						0	1	0
1.0 SECOND TIME CONSTANT						0	1	1
2.0 SECOND TIME CONSTANT						1	0	0
4.0 SECOND TIME CONSTANT						1	0	1
8.0 SECOND TIME CONSTANT						1	1	0
16.0 SECOND TIME CONSTANT						1	1	1

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Calibration

The module may be calibrated in SCM9B-1000 ASCII mode using the Trim Span (TS) and Trim Zero (TZ) commands as described in the SCM9B-1000 Series Users manual. The calibrated scaling will be reflected accurately in the Modbus data as a percentage of Full Scale.

One note concerning the Trim Zero (TZ) command. The zero is trimmed digitally in the module after the analog to digital conversion is performed. In SCM9B-1000 ASCII mode it is possible for the output data to exceed the designed full scale limits of the module. For example, on a +/-5 volt module the normal output range is -05000.00 to +05000.00. If a zero offset of +01000.00 is programmed into the module, the resulting output range will be -04000.00 to +06000.00.

However, in Modbus format, by definition, the span range is -5 volts to +5 volts. The lowest Modbus output value in this case would be 2000 hex, representing 4 volts. There will be a gap in output codes between the defined negative overload value of 0000 and the first valid output of 2000. In addition, readings above +5 volts will be truncated to the positive overload of FFFF hex.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000