MS1-SCAN Protocol Converter

User Manual

ISI

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Introduction

The MS1-SCAN protocol converter can take readings from 1 or more ModBus registers on a single ModBus instrument using an RS232 or RS485 interface, and make that data available on a SDI12 network. It is preconfigured to read the device status register and the first seven parameter data registers on the S::CAN spectrometer probes.

For special situations, the unit can be reconfigured via the text-based user interface using most any terminal software.

Getting Started

All wiring connections are made inside the weatherproof enclosure, with the wires passing through the waterproof fitting on the rear panel of the enclosure.

Remove the rear panel by removing the 4 retaining screws and slide the circuit board out to gain access to the connectors (see Figure 1). The DB9P connector labeled "RS-232" is used for connecting to RS-232 devices, as well as for configuring the protocol converter via the text-based user interface. Permanent installations using the RS-232 interface should use screw terminals 4-6 labeled "GND", "232 TX", and "232 RX", respectively. SDI12 and RS-485 connections are made on terminals 1 & 2, and 7 & 8, respectively. See Tables 1 & 2 for more information on making electrical connections. When configuring the MS1-SCAN, a null-modem serial cable (included) and terminal program such as Hyperterm is required. When configuring the MS1-SCAN, any other RS-232 devices must be disconnected from the converter. The MS1-SCAN is preconfigured to operate with the S::CAN spectrometer probe, and configuration is not normally required.

The converter has 2 multi-color LED indicators on the front panel for indicating SDI12 and Modbus data activity. The indicators light up green when the converter is receiving data on the associated interface, and red when the converter is sending data on the interface. These can be used to help diagnose communication problems.

Figure 1

Table 1 - DB9P Connections

Pin	
Pin 1	No connection
Pin 2	Receive data – RS232 input
Pin 3	Transmit data – RS232 output
Pin 4	DTR – internally tied to pin 6 for flow control loopback
Pin 5	Signal ground
Pin 6	DSR – internally tied to pin 4 for flow control loopback
Pin 7	RTS – internally tied to pin 8 for flow control loopback
Pin 8	CTS – internally tied to pin 7 for flow control loopback
Pin 9	No connection

Table 2 – Terminal Connections

| #	
#1	SDI12 data line
#2	SDI12 ground
#3	+12VDC input
#4	Ground
#5	Transmit data – RS232 output
#6	Receive data – RS232 input
#7	RS485 line A
#8	RS485 line B

Table 3 – Jumper J6

Jumper installed on 1 & 2	Enable RS-232 operation
Jumper installed on 2 & 3	Enable RS-485 operation

Default Configuration

To view the current configuration or configure the MS1-SCAN, it is first necessary to move the jumper on header J6 (which is located immediately behind the screw-terminal block) from its normal 2-3 position to position 1-2. This jumper must be returned to position 2-3 for the ModBus interface to work. Please refer to Table 3 above and the highlighted portion in Figure 1, where the jumper is shown in position 2-3.

Next, plug one end of a null-modem cable into the DB9P connector on the converter, and the other end into an available serial port on a PC. Terminal software should be set for 9600 baud, 8 data bits, no parity, and no flow control.

To enter configuration mode, quickly type 3 question-mark characters. The MS1-SCAN should respond with the following screen:
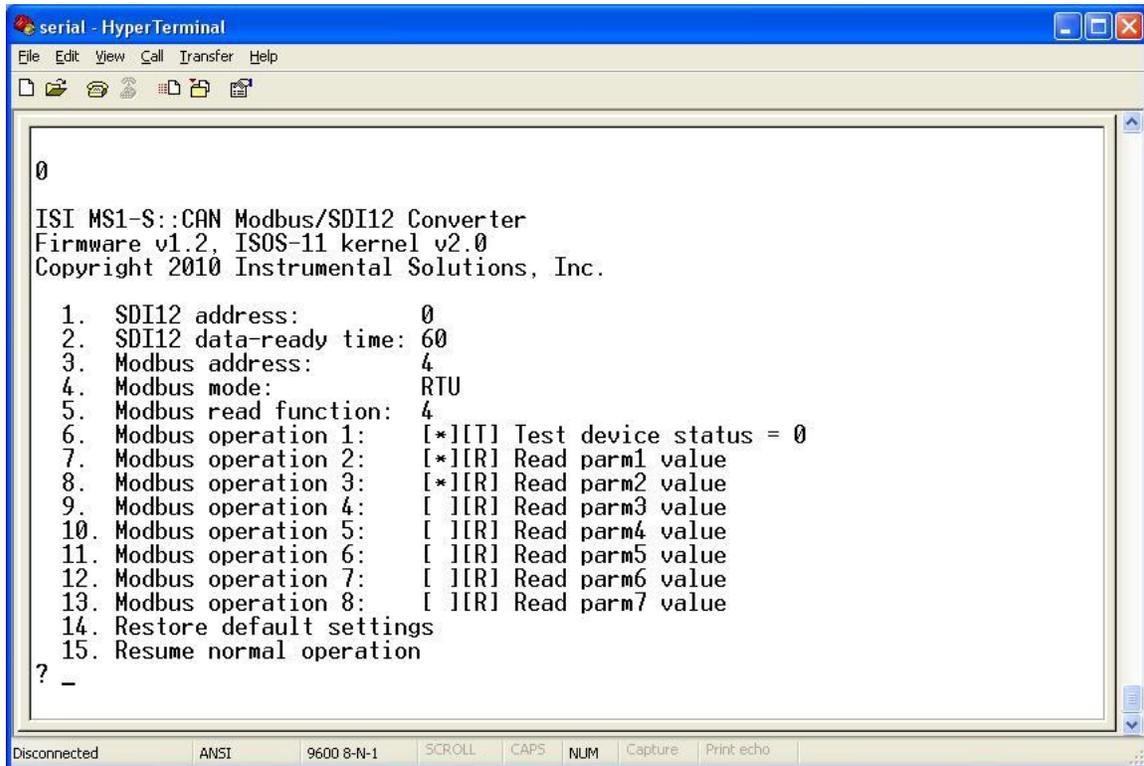
```
serial - HyperTerminal
File  Edit  View  Call  Transfer  Help

0

ISI MS1-S::CAN Modbus/SDI12 Converter
Firmware v1.2, ISOS-11 kernel v2.0
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  1.  SDI12 address:          0
  2.  SDI12 data-ready time: 60
  3.  Modbus address:         4
  4.  Modbus mode:            RTU
  5.  Modbus read function:   4
  6.  Modbus operation 1:    [*][T] Test device status = 0
  7.  Modbus operation 2:    [*][R] Read parm1 value
  8.  Modbus operation 3:    [*][R] Read parm2 value
  9.  Modbus operation 4:    [ ][R] Read parm3 value
 10.  Modbus operation 5:    [ ][R] Read parm4 value
 11.  Modbus operation 6:    [ ][R] Read parm5 value
 12.  Modbus operation 7:    [ ][R] Read parm6 value
 13.  Modbus operation 8:    [ ][R] Read parm7 value
 14.  Restore default settings
 15.  Resume normal operation
?  _

Disconnected        ANSI        9600 8-N-1     SCROLL   CAPS   NUM   Capture   Print echo
```

NOTE: If the converter fails to respond, try again, typing as quickly as you can. If still no response, remove and re-apply power to the converter while watching the front panel LEDs. Both LEDs should immediately light up red, then turn green after about half a second, then go out after another half-second. If this doesn't happen, check the power wiring for proper voltage and polarity. The MS1-SCAN operates on 9-14 volts DC.

If the LEDs don't light when power is applied, there is a problem with the converter. If the LEDs light but there is still no response after typing question marks, make sure that you are using a null-modem serial cable, which crosses pins 2 & 3 between ends. If the unit fails to respond, there may be a problem with the converter.

The default configuration returns fields to the SDI12 master in the following order:
Parameter 1, Parameter 2.

To change a configuration setting, type the number of the setting followed by the Enter key. The configuration mode has an inactivity timeout of 1 minute. If at any point during configuration the user goes 1 minute without typing anything, the converter automatically returns to normal online operation. Setting changes are saved as they are entered, so any changes completed during the configuration session will not be lost if a inactivity timeout occurs.

The following section describes each setting in detail.

1. SDI12 address
This is the address that the MS1-SCAN will answer to on the SDI12 network. The default value is 0. This value must match the address that the SDI12 master uses when attempting to communicate with the MS1-SCAN. If the SDI12 master has the ability to scan the network for sensors, this is the address that will be associated with MS1-SCAN on the SDI12 master.

2. SDI12 data-ready time
This is the maximum length of time in seconds that the Modbus device should take to have data available after a measurement request. The default value is 60. The MS1-SCAN reports this value back to the SDI12 master in response to a measurement request. The SDI12 master must wait this length of time before requesting data from the MS1-SCAN. However, if the SDI12 master issues a non-concurrent measurement request (recommended), the MS1-SCAN will issue a Service Request to the SDI12 master as soon as data is available from the Modbus device. This causes the SDI12 master to immediately issue a data retrieval request, even if the data-ready time has not been reached. This can significantly speed up the data retrieval cycle.
For more information concerning the SDI12 protocol, see http://www.sdi-12.org.

3. Modbus address

This is the address that the MS1-SCAN will send Modbus requests to on the RS232 and RS-485 interface. The default value is 4, which matches the default address of the S::CAN probe.

4. Modbus mode

This sets the Modbus operating mode. The choices are ASCII and RTU. Modbus RTU is the default, which matches the default setting of the S::CAN probe.

5. Modbus read function

This sets the function code that will be sent to the Modbus device to read the data registers on the Modbus device. This must be set to 4 for the S::CAN probe.

6. Modbus operations 1-8

Upon receiving a measurement request from the SDI12 master, the MS1-SCAN executes a series of Modbus operations, as defined by these settings. An operation can be 1 of 3 types: a Read type (which reads a Modbus register on the attached sensor), a Write type (which writes a Modbus register on the attached sensor), or a Test type (which repeatedly reads a Modbus register on the attached sensor until the value read matches a "test" value specified in the operation).

For example, before reading the data registers on the S::CAN probe, it's a good idea to read the device status held in input register 121, and wait until it returns a value of 0. Operation #1 accomplishes this:

```
6.   Modbus operation 1:    [*][T] Test device status = 0
```

The [*] indicates that this particular operation is enabled. A disabled operation appears as [ ].
The [T] indicates that this is a Test operation.
"Test device status = 0" is a free-form text description of what the operation does.
To view or modify the details of a Modbus operation, type its menu-selection number and hit Enter. For example, to view/modify operation #1 (menu selection 6), type 6 and hit Enter. You will be led through the following dialog:

```
  6.  Modbus operation 1:
Enabled: Yes  (Spacebar to change, Enter to accept)
```

The spacebar will toggle this setting between Yes and No. Press the ENTER key to accept the setting and take you to the next step:

```
Modbus register:
Current setting: 121
    New setting:
```

Enter a new value for the Modbus register, or hit Enter with no entry to keep the current setting. In this case, we are operating on register 121, which is the device status register in the S::CAN probe.

```
Data type: 16-bit unsigned integer  (Spacebar to change, Enter to
accept)
```

The spacebar steps through all of the data types supported by the MS1-SCAN. This setting must agree with the data type of the Modbus register being referenced. In this case, register number 121 in the S::CAN probe has a data type of bitmask, which translates just fine to a 16-bit unsigned integer. Press the ENTER key to accept the setting and take you to the next step:

```
Number of registers:
Current setting: 1
    New setting:
```

Enter a new value for the number of Modbus registers that this operation is to operate on, or hit Enter with no entry to keep the current setting. In this case, we want to operate on a single register.

```
Type of operation: Test   (Spacebar to change, Enter to accept)
```

The spacebar steps through the available types for this operation. In this case, we want to Test to the specified register on the S::CAN probe.

```
Operation data:
Current setting: 0
    New setting:
```

Enter the data value to compare the probe value to, which in this case will be 0. This means that the MS1-SCAN will continuously read the probe until the returned value is equal to 0 or until it times-out waiting for the probe to return 0. The timeout value is approximately 2 minutes.

```
Operation name:
Current setting: Test device status = 0
    New setting:
```

This is a free-form text description of what the operation does. Hit Enter with no entry to keep the current setting.

After the Test operation finishes (whether due to the test condition becoming true or a timeout occurring), the converter continues with Operations 2 – 3, which are Read-type operations. These operations are what get each data field from the S::CAN probe, making it available via SDI12.
The remaining operations, 4 – 8, are not enabled by default, but they are preconfigured to read parameters 3 – 7 in the S::CAN probe. They can be enabled or modified as required.

14. Restore default settings
This selection resets all configuration parameters to the factory-default settings.

15. Resume normal operation
This selection exits configuration mode and returns the converter to online operation. Configuration mode has an inactivity timeout of 1 minute; if at any time after entering configuration mode no characters are typed for 1 minute, the converter will automatically return to normal online operation. If this occurs in the middle of configuring a Modbus operation, no changes will be made to the configuration. Modbus operation changes are not saved until the user has stepped through all of the settings for the operation.

Specifications

SDI-12 interface:	SDI-12 v1.3 compliant
Modbus interface:	Modbus ASCII, 9600 baud, 8-bit, no parity
Text interface:	9600 baud, 8-bit, no parity, no handshake
Operating system:	Instrumental Solutions ISOS-11
Indicators:	2 bicolor LEDs for transmit/receive indication
Connections:	Internal screw terminals, DB9 male (DTE)
Temperature range:	-40°C to +85°C
Power requirements:	12VDC 35ma idle, 35 ma avg, 55ma max
Enclosure:	Extruded aluminum, IP65 rated
External dimensions:	7.52" (19.1cm) L, 3.48" (8.84cm) W, 1.85" (4.7cm) H
Weight:	15 ounces