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SILBUS NETWORK MONITOR
TYPE SILBUS-SNM1

USER MANUAL

120-436-12

04

REVISION CONTROL

04	Table update	2017.09.15	PC	PC	JY
03	Address and Logo Update	2017.04.06	CW	CW	PC
02	Connection Drawing Corrected	2014.11.11	CG	CG	PC
01	Original	2012.09.20	CG	CG	PC
Issue	Details	Date	Written	Designed	Approved

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1 GENERAL DESCRIPTION

The SILBUS Network Monitors is part of a family of explosion protected DIN rail mounting modules that transmit to an Austdac SILBUS field bus network.

There are two variants of the SILBUS-SNM1, the SNM1-ELD (Earth Leakage Detection) and the SILBUS-SNM1-EOL (End of Line);

- The SILBUS-SNM1-ELD is design to be placed at the front end of SILBUS conveyor system to monitor earth leakage between SILBUS signal and SILBUS common to earth. The monitored values are voltage and resistance values. The voltage readings mimic those obtained when the line voltages are measured using an analogue multitester such as the University Multitester CTY-500-MA .

- The SILBUS-SNM1-EOL is design to be placed at end of SILBUS conveyor system to monitor SILBUS voltage, slew rate and reflection on a defined un-used channel.

The SILBUS-SNM1-ELD and SILBUS-SNM1-EOL units can transmit monitored values on one to six independent valid SILBUS channel depending on amount information required to log.

The SILBUS Network Monitor is housed within a DIN rail mounting enclosure measuring 45mm (W) x 75mm (H) x 110mm (D). The front panel is located between the two top of enclosure mounted terminal blocks to provide a clear view of the operation indicating LED. A single LED is provided to show SILBUS network status.

The SILBUS-SNM1 can be quickly and simply configured using a laptop computer running Hyper Terminal and a MEAN1 programming adaptor. The network monitor values can be programmed to any SILBUS channel address.

2 FRONT PANEL LAYOUT

The SILBUS network monitor transmitter front panel is located between the terminal blocks that form part of the enclosure. The front panel is shown in photograph 1 below.

Photograph 1 SILBUS-SNM1 front panel (ELD version shown)

Located in the top right hand corner of the front panel is the STATUS indication LED. The green status LED flashes at different rates to indicate the operational status of the monitor, see table 1 for more details.

FLASH SEQUENCE	NAME	MEANING
NONE – LED ON OR OFF CONTINUOUSLY	NO FLASH	INTERNAL MICROPROCESSOR FAULT OR NO POWER.
QUICK FLASH EVERY 1.36s	FAST FLASH	TRANSMITTER FUNCTIONING – HEALTHY SILBUS CONNECTED TO SILBUS PORT.

Table 1 Status LED flash sequence meanings

The front panel can be snapped out and removed by using a wide flat bladed screw driver to gain access to the configuration (console) port and programming switch. Photograph 2 below shows the front panel removed and the location of the console port and programming switch.

Photograph 2 Access to console port and programming switch

The black four pin console port connector and the red programming switch are located behind the upper left corner of the front panel label.

3 THEORY OF OPERATION

The SILBUS network monitor takes measurements of SILBUS network healthiness and transmits it onto the connected SILBUS network using either the ANALINK or FASTLINK protocols.

3.1 SNM1-ELD MEASUREMENTS

3.1.1 SILBUS Signal Voltages

The SILBUS-SNM1 measures the Signal to Common, Signal to Earth and Common to Earth voltages. In a floating system the signal and common lines should float around the earth line. When a resistance is placed between the signal and earth or common and earth, such as in the case of a damaged cable, this will cause these voltages to be unbalanced. A common method of detecting this fault is to measure the signal to earth and common to earth voltages using a multimeter with a medium impedance such as the University Multitester CTY-500-MA. The SILBUS-SNM1 mimics this and reports the voltages the same as if the readings were taken with a University Multitester CTY-500-MA.

The SILBUS-SNM1 also measures the Signal to Common voltage. This voltage indicates the loading on the Channel Generator or may indicate a resistance across the signal and common.

3.1.2 SILBUS Signal Resistance

As discussed previously the SILBUS-SNM1 measures the voltages between the various lines. These measurements are used to calculate the approximate resistance across the signal and earth and signal to common. This gives a clear indication of the fault resistance.

3.2 SNM1-EOL MEASUREMENTS

3.2.1 SILBUS Signal to Common voltage

The SILBUS-SNM1 measures the Signal to Common voltage. This voltage indicates the loading on Dupline or may indicate a resistance across the signal and common.

3.2.2 SILBUS Signal slew rate

The slew rate indicates the amount of capacitance on the line.

3.2.3 SILBUS Signal reflection

The reflection indicates the amount of mismatch between the line and the termination unit.

4 OPERATING INSTRUCTIONS

The SILBUS network monitor transmitter does not require any operator action to operate once it has been installed and configured correctly.

The console port power source selection switch SW1 must always be in the run position for correct operation of the transmitter. The run position is with the small slide actuator pushed closest to the black four pin console connector X1.

The status LED provides information on the operational status of the transmitter and the connected SILBUS network.

4.1 CONVERTING DATA

The conversion of data can be read directly from the GSW1 or using the simple conversion table below. As there is no offset in any of the calculations the percentage read from the GSW1 either Fastlink or Analink can be simply be convert by multiplying 100% read from the GSW1 by the maximum value i.e. Vsc is 85% then voltage read across Vsc is 85% X 10Volts = 8.5Volts.

Function	Console Command	Maximum
Vsc	SBVOLT SET SC	10Volts (100% = 10Volts)
Vse	SBVOLT SET SE	10Volts (100% = 10Volts)
Vec	SBVOLT SET CE	10Volts (100% = 10Volts)
Rse	SBOHMS SET SE	1000kOhms (100% = 1000kOhms)
Rec	SBOHMS SET CE	1000kOhms (100% = 1000kOhms)
Slew	SBSLEW	% percentage
Reflection	SBREFL	% percentage

Table 2 Conversion of Data

4.2 ANALINK CONVERSION

A full scale Analink value takes 256 Dupline scans to transmit with the channel on for all the scans, a zero scale Analink value takes 256 Dupline scans to transmit with the channel on for one of the scans and off for 255 scans. An Analink channel with all 256 scans off is transmitting a fault signal i.e. a sensor fault with an output below 4mA.

The transmitted value is equal to the proportion of "on" scans minus one in any consecutive group of 256 scans. Therefore the transmitted value = "on scans – 1" / 256.

Thus 255 counts is full scale i.e. 100% and 1 count is 0%. No count means the device is not connected.

4.3 FASTLINK CONVERSION

A full scale Fastlink value of 65535 (0xFFFF) gives 100%, and 0 values gives 0%. For example a count 55704 (0xD998, 85%) give voltage reading of 8.5Volts, 850kOhms or 85% slew.

5 CONFIGURATION

The SILBUS network monitor transmitter has several operational parameters that require configuration prior to use. All of these parameters can be viewed and changed via the console port.

The console port consists of a small four pin connector and a two position slide switch behind the front panel label. Access to the console port can be gained by snapping out the front panel using a wide bladed flat screw driver in one of the slots between the front panel and terminal blocks.

To use the console port an Austdac MEAN1 interface, A to B USB cable and laptop computer running Hyper Terminal are required.

For more detail on the console port, MEAN1 interface and their use refer to Austdac document 53-018-11.

5.1 CONSOLE PORT OPERATION

The console port should be connected to a laptop running a terminal emulation program such as Hyper Terminal via the Austdac interface type MEAN1 and a USB cable as shown in the following photograph.

Photograph 3 Laptop connected to console port via MEAN1 interface

The SILBUS-SNM1 certification places restrictions on what may be connected to the console port, the connection of an interface other than the Austdac MEAN1 to the console port will invalidate the certification of the transmitter.

The terminal emulation program should be configured to 19200 baud, 8 data bits, one stop bit, no parity, no flow control and DEC VT100 terminal emulation.

Once communications have been established with the SILBUS-SNM1, it will display a screen of information that includes software version, software checksum, and a list of commands followed by the console port prompt.

The prompt includes an abbreviation of the transmitter type number. **SNM1::>**

Commands are invoked by entering the command name followed by any optional modifiers, keywords and the "ENTER" key. The enter key is shown in the following examples as a "↵" symbol.

5.2 HELP COMMAND

The HELP command prints a list of all available commands and shows the syntax for each command. Optional command modifiers are shown within [ ] while mandatory modifiers are shown within < >. An example of a screen output follows:

```
----------------------------------------------------------
Software 2V00B 0x9716 Configuration 0xFFDD SN:00000000
Commands:
  ----------------------------------------------------------------------
              ********** Level 1: Standard Menu **********

  HELP     [1..7] Level of Help                 Display help menu
  REPEAT   [LF] [Refresh rate in seconds]       Repeat previous command
  VER                                           Firmware version and checksum
  STACK                                         Display peak stack usage
  SBVOLT   [<SET> <SC|SE|CE> <A1-P8,DISABLE>]   Earth voltage SILBUS chan
  SBOHMS   [<SET> <SE|CE> <A1-P8,DISABLE>]      Earth resistance SILBUS chan
  FSTMRK   [<SET> <A1-P8,DISABLE>]              Set Fastlink marker address
  ANASEL   [<SET> <ANALINK|FSTLINK>]            Analog protocol for params
  DATA                                          Display monitor data
  CFGUP                                         Upload configuration text
  CFGDWN                                        Download configuration text
              ********* Level 2: SPECIAL MENUS ***********

  SERIAL   [YYMM] [SSSS]                        Enter serial number ssss
  SLOAD    <S-Record Hex file>                  Download Srecords for upgrades
  ----------------------------------------------------------------------
```

  SNM1::>

5.3 REPEAT COMMAND

The REPEAT command is used after another command to continuously repeat that command.

5.4 VERSION COMMAND

The VERSION command is used to display the serial number, abbreviated type number, software version, program memory checksum and configuration checksum of the SILBUS-SNM1. The command can be invoked as shown in the following example:

SNM1::>ver

SNM1 Software 2V00B 0x9716 Configuration 0xFFDD SN:00000000

SNM1::>

This command is useful when the user needs to know the software version or serial number. The program memory checksum is useful to confirm that a software update has completed successfully without any programming errors.

5.5 STACK COMMAND

The STACK command is provided to allow the technician to gauge the health of the SILBUS-SNM1 microprocessor and its code by displaying the maximum usage of the program stack. The display is a peak value of the stack usage since the SILBUS-SNM1 was powered up. The command can be invoked as shown in the example below:

SNM1::>stack

Stack usage/size = 294/1024

Percentage Used = 28%

This command would typically only be used when requested by an Austdac software engineer.

5.6 FASTLINK MARKER COMMAND

This command is used to display and configure the FASTLINK marker SILBUS channel address. A valid FASTLINK marker is required whenever the measured parameter is configured to transmit using the FASTLINK protocol. The marker is generated by the GSW1 channel generator and can be any valid SILBUS channel address. Only one marker is required per SILBUS field bus network. The current marker channel address can be displayed by simply entering the command name as shown in the example below:

SNM1::>fstmrk

Fastlink Marker is A1

SNM1::>

The example below shows the format of the command when the marker address is configured. The keyword "SET" is required to invoke a change, followed by the SILBUS channel address of the FASTLINK marker.

SNM1::>fstmrk set a1

Setting Changed

Fastlink Marker is A1

If FASTLINK is not to be used by the SILBUD-SNM1 transmitter then the marker channel should be disabled. The keyword "DISABLE" is used when the marker channel is not required.

5.7 ANALOGUE PROTOCOL SELECT COMMAND

This command is used to display and configure the analogue transmission protocol for the temperature input. The measured parameter input can be configured to either Analink or Fastlink transmission protocol. The current selected transmission protocol can be displayed by simply entering the command name as shown in the example below:

`SNM1::>anasel`

`SILBUS Analog Protocal = Fastlink`

`SNM1::>`

If the command name is entered with additional attributes the analogue transmission protocol can be configured to Fastlink or Analink for the measured parameter input. An example of configuring the protocol is shown below:

`SNM1::>anasel set analink`

`Setting Changed`

`SILBUS Analog Protocal = Analink`

5.8 SILBUS-SNM1-ELD MEASUREMENT PARAMETERS

5.8.1 SBVOLT COMMAND

This command is used to display and configure the SILBUS channel addresses used for the voltage measurements.

There are three voltage measurements, Signal to Common, Signal to Earth and Common to Earth. Each of these measurement values is transmitted either using Analink or Fastlink on a selected channel (see section 5.7).

For example to set the Signal to Common voltage measurement to channel A1 use the following command;

`SNM1::>sbvolt set sc a1`

`Setting Changed`

`SILBUS Addresses are:`

`Vsc = A1`

`Vse = --`

`Vec = --`

5.8.2 SBOHM COMMAND

This command is used to display and configure the SILBUS channel addresses used for the voltage measurements.

There are two ohm measurements, Signal to Earth and Common to Earth. Each of these measurement values is transmitted either using Analink or Fastlink on a selected channel (see section 5.7).

For example to set the Signal to Earth ohm measurement to channel A2 use the following command;

SNM1::>sbohms set se a2

Setting Changed

SILBUS Addresses are:

Rse = A2

Rec = --

5.9 SILBUS-SNM1-EOL MEASUREMENT PARAMETERS

5.9.1 SBVSC COMMAND

This command is used to display and configure the SILBUS channel addresses used for the Signal to Common voltage measurements.

The measurement value is transmitted either using Analink or Fastlink on a selected channel (see section 5.7).

For example to set the Signal to Common voltage measurement to channel A1 use the following command;

SNM1::>sbvsc set a1

Setting Changed

SILBUS Vsc address is = A1

SNM1::>

5.9.2 SBSLEW COMMAND

This command is used to display and configure the SILBUS channel addresses used for the slew rate measurements.

The measurement value is transmitted either using Analink or Fastlink on a selected channel (see section 5.7).

For example to set the slew rate measurement to channel A2 use the following command;

SNM1::>sbslew set a2

Setting Changed

SILBUS slew percentage address is = A2

SNM1::>

5.9.3 SBREFL COMMAND

This command is used to display and configure the SILBUS channel addresses used for the reflection measurements.

The measurement value is transmitted either using Analink or Fastlink on a selected channel (see section 5.7).

For example to set the reflection measurement to channel A3 use the following command;

SNM1::>sbrefl set a3

Setting Changed

SILBUS reflection precentage address is = A3

SNM1::>

5.9.4 UNUSED COMMAND

This command is used to select the SILBUS channel address used for measurements. This should be an unused channel.

For example to set the unused channel to channel A5 use the following command;

SNM1::>unused set a5

Setting Changed

Un-used slew rate channel is A5

SNM1::>

5.10 UPLOAD CONFIGURATION COMMAND

The upload configuration command is used to extract the configuration profile of the SILBUS-SNM1 via the MEAN1 interface and record it in a file on a PC. Having an exact copy of the configuration is useful for record keeping and future cloning of new SILBUS-SNM1 for maintenance or system expansion. The upload is invoked by entering the command name without any attributes as shown in the example below.

SNM1::>cfgup

CFGDWN

S0030000FC

S1130000010000120200 0A0080808080808080 77D6

S11300100000000000008100000100F43E00003314E1

S1130020323F000001000B00E8809289000 08D142B

S113003074850000449 30000AE8500000000FFFFBB

S9030000FC

`SNM1::>`

The configuration is uploaded and displayed on the screen in Motorola S1-S9® HEX format. This data format includes headers and checksums to guard against errors and corruption of the data. The first line of the uploaded configuration is the keyword "CFGDWN" this does not form part of the data but is included to help with the configuration download process, see section 5.11 below for details.

To save the configuration to a file, open Notepad or a similar non-word processing editor, highlight the uploaded configuration as indicated below and copy to Notepad via the clipboard. The Notepad file should then be saved with a meaningful title that reflects the application e.g. SNM1_xxx.CFG. When highlighting the uploaded configuration, ensure that the invisible carriage returns (CR) at the end of all lines are included. Also ensure that the CFGDWN keyword is included.

`SNM1::>cfgup`

`CFGDWN`

`S0030000FC`

`S1130000010000120200 0A008080808080808077D6`

`S11300100000000008100000100F43E00003314E1`

`S1130020323F000001000B00E880928900008D142B`

`S1130030748500004493 0000AE8500000000FFFFBB`

`S9030000FC`

`SNM1::>`

The copy and paste method is used in this manual because it is the most universal method that works with all terminal emulation programs such as HyperTerminal®. Do not use an editor that introduces hidden formatting characters as a future download may not work with these characters in place. Many terminal emulation programs have automatic means to upload the configuration directly into a file; these are not described here as they differ from program to program but there is no restriction on using these features. Austdac is planning to release a complete tool to allow direct upload, download and editing of the configuration profile.

5.11 DOWNLOAD CONFIGURATION COMMAND

The download configuration command is used to take a previously saved configuration from a file and download it to the target SILBUS-SNM1. This method of configuration ensures exact cloning during maintenance and system expansions.

Communications with the target must first be established via the MEAN1 interface and a terminal emulation program such as Hyper Terminal®. The cursor should be left at the SILBUS-SNM1 prompt as follows.

`SNM1::>_`

Open the previously saved configuration file in Notepad or a similar non-word processing editor and highlight the configuration as shown below.

`CFGDWN`

`S0030000FC`

`S1130000010000120200 0A008080808080808077D6`

`S1130010000000000008100000100F43E00003314E1`

`S1130020323F000001000B00E880928900008D142B`

`S1130030748500004493 0000AE8500000000FFFFBB`

`S9030000FC`

Copy and paste the configuration from Notepad to the SNM1::> prompt in Hyper Terminal as shown below. Note CTRL-V does not work in Hyper Terminal.

`SNM1::>CFGDWN`

`S0030000FC`

`S1130000010000120200 0A008080808080808077D6`

`S1130010000000000008100000100F43E00003314E1`

`S1130020323F000001000B00E880928900008D142B`

`S1130030748500004493 0000AE8500000000FFFFBB`

`S9030000FC`

`SNM1::>`

The first line of the configuration contains the keyword "CFGDWN" which instructs the target to accept the data records. This "CFGDWN" keyword should have been copied from a previous upload and saved in the configuration file. Automatic file transmission features of the terminal emulation program may be used to download configuration files.
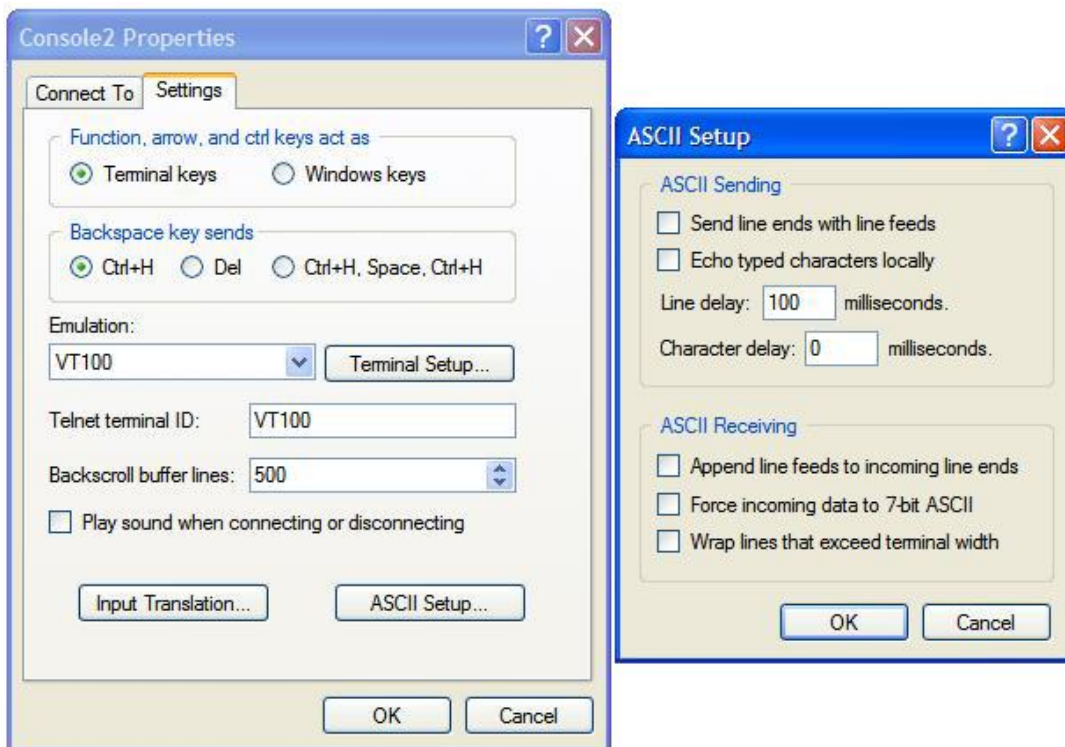
Photograph 4 Hyper Terminal delay setup

The terminal emulation program should be set up to allow a 100mS wait period after the carriage return at the end of each line during a download, this gives the target time to process the incoming data.

6 TERMINATIONS AND CONNECTIONS

All connections to the SILBUS-SNM1 are via cage-clamp terminals, these terminals can accommodate up to 4mm^2 conductors.
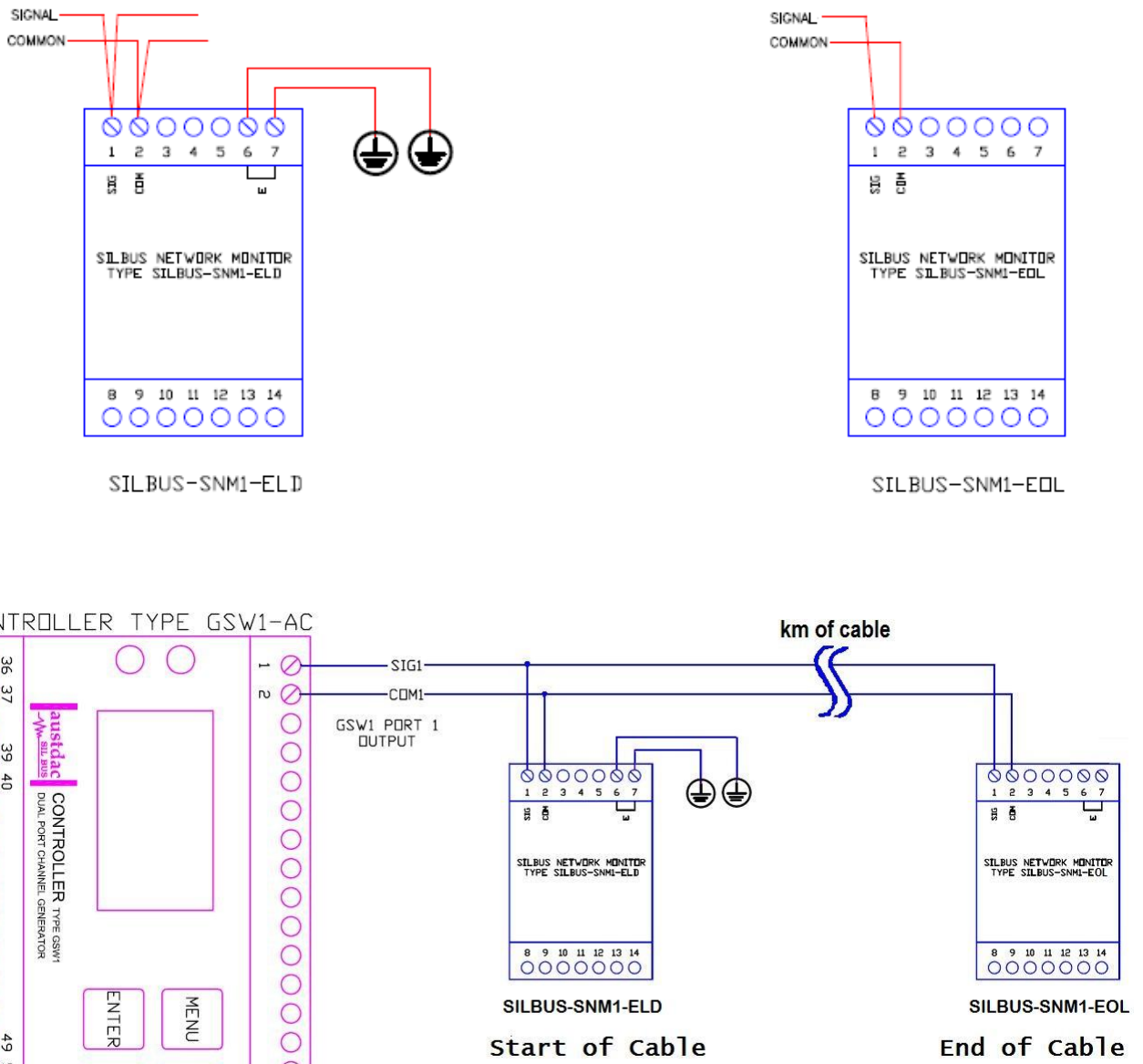
Figure 1 SIBUS-SNM1 Connection diagrams

6.1 SILBUS NETWORK PORT

The SILBUS network port provides a means for the SILBUS-SNM1 to be connected to a SILBUS network. Any connections to a SILBUS field bus network pair should be of a multi-drop nature with spur lengths kept to a minimum. This will minimize any reflections and therefore communications errors in the SILBUS network.

TERMINAL	DESIGNATION	DESCRIPTION
1	SIG	SILBUS NETWORK MONITOR SIGNAL
2	COM	SILBUS NETWORK MONITOR COMMON
6	EARTH	MINE EARTH
7	EARTH	MINE EARTH

Table 3 SILBUS network port termination details

The table above shows the SILBUS network port connections.

7 CERTIFICATION

The network monitor type SNM1 has been awarded IECEx certification under IECEx TSA 07.0002X, Ex ia I, as part of the Dupline / SILBUS system.

The certification requires that the SILBUS-SNM1 be mounted within a host enclosure that provides a minimum ingress protection of IP54 (IP55 for Queensland Australia).

The certificate should be consulted for any special conditions of use when designing the SILBUS-SNM1 into an installation.

8 SOFTWARE REVISION AND DISPLAY

The software version of the network monitor type SNM1 will vary as its functionality is improved at the request of our customers. The software version is given in two parts, the major revision level and the minor revision level and is written in the following format:

`VERSION M.mm` where M represents the major revision level and mm represents the minor revision level. E.g. VER 1.12

The software version can be determined by using the VER command on both console ports. Both ports should give the same firmware version. Refer to the SILBUS-SNM1 software release register (120-443-01) for a history of software / firmware updates.

9 SPECIFICATIONS

Name .... SILBUS Network Monitor Transmitter

Type SILBUS-SNM1

Console port configuration .... 19200 baud, 8 data, 1 stop, No parity

Terminations .... Cage clamp 4mm^2 maximum

Size .... 45mm (W) x 75mm (H) x 110mm (D)

Mass 135g

Fixing .... TS35 DIN rail only

Ingress protection IP20

Enclosure material .... Polycarbonate (30%GV) UL 94 V-1

Enclosure colour .... RAL 7032 Grey

Terminal material .... Polycarbonate UL 94 V-2

Terminal block colour .... Blue

Operating temperature range .... 0ºC to 40ºC

Storage temperature range .... -20ºC to 80ºC

Operating relative humidity range .... 10% to 90% Non condensing

Power supply operating voltage range .... SILBUS network line powered